4-RESULTS AND DISCUSSION

4.1: Effects on N uptake at flowering stage (Table2).

4.1.1: Main effect of irrigation system.

Results in Table 2 show that N uptake (NU) at flowering stage under sprinkler irrigation system significantly surpassed that under drip irrigation system. Average values of NU amounted to 3454.0 and 3333.4(mg/plant) under sprinkler and drip irrigation systems respectively, with an increase about 3.6% for sprinkler over drip irrigation. Thus sprinkler is a more efficient application of irrigation water by comparative to drip irrigation. Such results are in harmony with **Power et_al. (2000)** who, reported that sprinkler irrigation system allows for a uniform and efficient application of irrigation water which minimizes water and nitrate losses through deep percolation.

4.1.2: Main effect of inoculation.

Data in Table 2 show that microbical inoculation considerably increased NU at flowering stage. Obtained values of NU show averages of (2045, 3610 and 4527) mg plant^{-1} for non-inoculation as compared with inoculation with *Paenibacillus polymyxa* and *Bacillus megaterium,* respectively. Thus *P.polymyxa* increased NU by 76.5% while *B. megaterium* increased NU by 121.4%. This result agrees with the findings of. **Shotokhina and Khristenko. (1996)** who found that inoculation with phosphate dissolving bacteria increased NU by maize plants. **El-Etr (2006**) reported that the inoculation with *Bacillus megaterium* increased N-uptake by both shoots and roots, at flowering stage.

4.1.3: Main effect of nitrogen source.

Results indicate that NU averages under the N sources, ammonium sulphate and FYM were 3390.0 and 3414.0 mg plant $^{-1}$, respectively; with FYM surpassed ammonium sulfate by 0.71%. Such results agree with those of **Bolt and Bruggenwert, (1978)** who reported that inorganic fertilizers represent a readily available source of nutrient for plant fertilizer. Readily soluble forms of N are easily utilized by growing plants.

4.1.4: Main effect of P source.

Data show that applied P sources of rock phosphate "RP" and super phosphate "SP" gave average NU values of 3263 and 3525 mg plant $^{-1}$ respectively with SP surpassing RP by 8.0%.**Abd el-Aziz et al.(1991)** reported that rock phosphates have alkaline pH values their effect is less positive than soluble phosphorus .

4.1.5: Interaction effect of N sources and inoculation.

Results in Table 1 show values of NU at flowering stage under inorganic source of ammonium sulphate (AS). Obtained values of NU show the follwing order; *B. megaterium*> *P.polymyxa* > no-inoculation with values of4488, 3687and1995 mg N plant $^{-1}$, respectively. The increase in (NU) under *P. polymyxa* and *B. megaterium* over that under the non-inoculation amounted to 84.8 and 125%, respectively. Under conditions of organic FYM, values of the inoculation treatments are 2095, 3530 and 4566 mg/plant for the non-inoculation, *P.polymyxa* and *B.megaterium* respectively; showing increases for *P.polymyxa* and *B.megaterium* of 68 and 118% over than no-inoculation respectively. Inoculation under FYM yielded slightly higher NU as compared with under source .Thus organic N fertilization may be recommended for treatments of bio fertilization. Such results are in agreement with **Shatokhina and Khristenko, (1996)** who reported that inoculation of maize with N_2-fixing bacteria combined with P-dissolving bacteria enhanced uptake of nutrients, and decreased mineral fertilizer application rate by 50%.**EL-sayed (1998)** showed that combined inoculation of Rhizobia and *P.polymyxa* increased the uptake of nutrients.

4.1.6 .Interaction effect of P sources and inoculation.

Data show dramatic increase in NU at flowering stage under rock phosphate (RP) application. Values of NU were 1918, 3590 and 4280 under (RP+ no inoculation), (RP+*P.polymyxa*) and (RP+ *B.megaterium*), respectively. It can be seen that the under application of RP, the increase over the non-inoculated were 87% and 123% due to inoculation with *P.polymyxa* and inoculation with *B.megaterium*, respectively. Under conditions of super phosphate (SP) application, corresponding NU uptake values were 2172, 3628 and 4774, showing increases of 67% and 120% due to inoculation with *P.polymyxa* and *B.megaterium*, respectively. It can be concluded that *Bacillus megaterium* inoculation showed more positive response than *P.polymyxa* inoculation in presence of RP than in presence of SP. **Shatokhina and Khristenko (1996)** showed that inoculation of maize seeds with associative N_2-fixing bacteria in combination with phosphate dissolving bacteria increased nutrients uptake by plant.

Table (2): N-uptake by maize (mg $plant^{-1}$) at flowering stage under the tested treatments

Irrigation system(A)	Nitrogen sources&rate(C)	Phosphorus Forms(D)	Inoculation(B)			mean
			Non	*P.poly*	*B.mega*	
Drip irrigation	**Inorganic (AS1)**	RP1	1603	3476	4065	3048
	(AS1)	SP1	2220	2980	3969	3056
	(AS2)	RP2	2545	4488	4833	3955
	(AS2)	SP2	2358	3215	4074	3216
	Mean		2181	3540	4235	3319
	Organic(FYM1)	RP1	1976	2506	2963	2482
	(FYM1)	SP1	1705	2152	3153	2337
	(FYM2)	RP2	2596	3477	3965	3346
	(FYM2)	SP2	3096	5632	6956	5228
	Mean		2343	3442	4259	3348
	Mean		2262	3491	4247	3333
Sprinkler irrigation	**Inorganic (AS1)**	RP1	1479	3764	4061	3101
	(AS1)	SP1	1634	3200	4133	2989
	(AS2)	RP2	2015	4315	5221	3850
	(AS2)	SP2	2108	4064	5548	3907
	Mean		1808.9	3836	4741	3462
	Organic(FYM1)	RP1	1456.7	2778	4265	2833
	(FYM1)	SP1	1999.2	3190	4062	3084
	(FYM2)	RP2	1675.9	3913	4867	3486
	(FYM2)	SP2	2256.1	4594	6298	4383
	Mean		1847	3619	4873	3446
	Mean		1828	3727	4807	3454
	Grand Mean		2046	3609	4527	3394

(Continued next page)

RESULTS AND DISCUSSION

Table (2) cont.

	Mean of(AS)	RP1 SP1 RP2 SP2	1541 1928 2280 2233	3620 3090 4402 3640	4063 4051 5027 4811	3075 3023 3903 3561
	Mean		1996	3688	4488	3390
	Mean of(FYM)	RP1 SP1 RP2 SP2	1716 1852 2136 2676	2642 2671 3896 5113	3614 3608 4416 6625	2657 2710 3482 4805
	Mean		2095	3581	4566	3414
	Mean of (P)	RP SP	1918 2172	3590 3629	4280 4774	3263 3525
	Mean		2045	3609	4527	3394
	Mean of Drip	RP1 SP1 RP2 SP2	1789 1962 2570 2727	2991 2566 3983 4424	3514 3561 4399 5515	2765 2697 3651 4222
	Mean		2262	3491	4247	3333
	Mean of **Sprinkler**	RP1 SP1 RP2 SP2	1468 1817 1845 2182	3271 3195 4114 4329	4163 4098 5044 5923	2967 3036 3668 4145
	Mean		1828	3727	4807	3454

L.S.D (0.05)
Irrigation(A)=78.89
Inoculation(B)=459.1
Nitrogen(C)=n.s
Phosphorus(D) =242.2

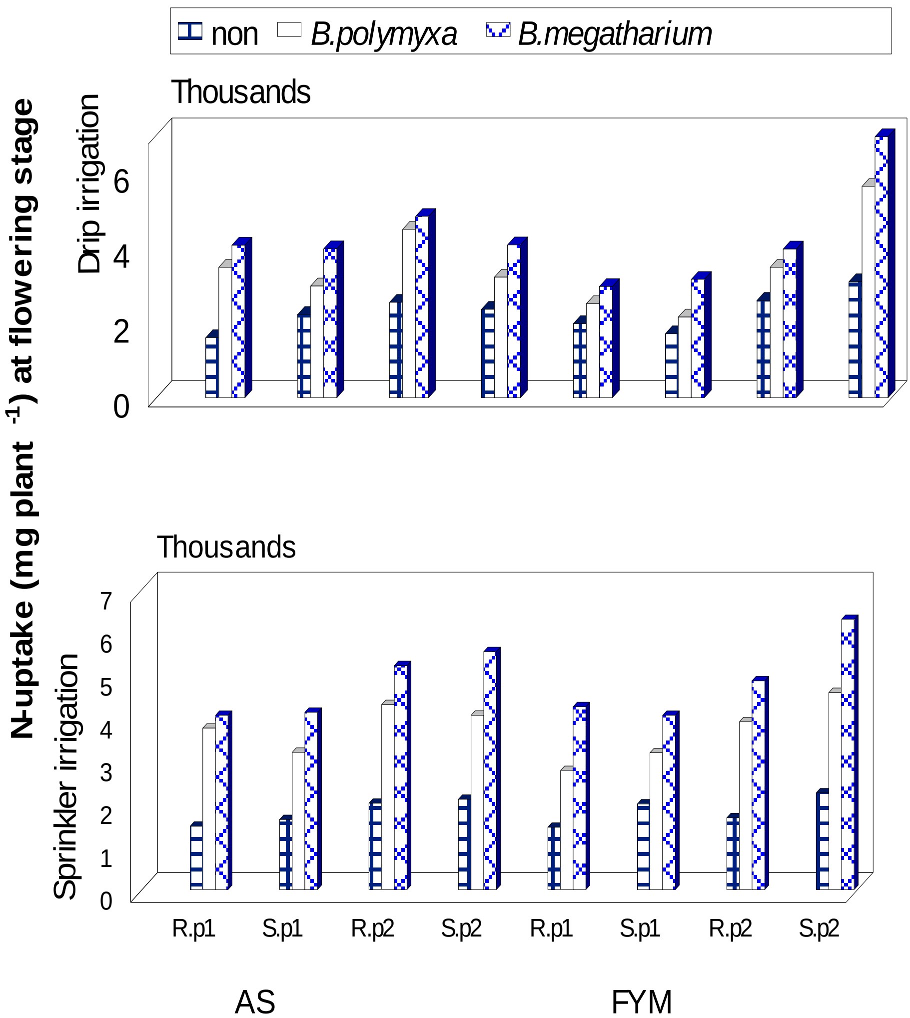
AB=649.3
AC =n.s
BC=n.s
AD=n.s
BD=419.4

CD=342.5
ABC=419.4
ABD=593.2
ACD=484.3
BCD=593.2

ABCD=838.9

RESULTS AND DISCUSSION

R.P=rockphosphate SP=super phosphate AS= ammonium sulphat
FYM= farmyard manure



Fig(1) :Effect of micropial inoculation, N and P fertilization and farmyard application on N-uptake at flowering stage under drip and sprinkler irrigation.

RESULTS AND DISCUSSION

4.2. Effect on P-uptake at flowering stage (Table 3).

4.2.1: Main effect of irrigation system.

Data in Table 3 show that values of the main effect on P uptake (PU) at flowering stage indicate that sprinkler irrigation was slightly superior to drip irrigation by about 7.7% on average.

4.2.2: Main effect of inoculation.

Data of microbical inoculation show increases in PU at flowering stage .Average values were 730, 1227.6 and1534.9 mg/plant under no inoculation, inoculation with *P.polymyxa* and *B.megaterium*, respectively. Thus the increase due to treatment with *P.polymyxa* and *B.megaterium* were 68% and 110% over the control, respectively. These findings are similar to the findings reported by. **Yadav and Singh (1990)** who observed an increase in yield of sugar cane and its P uptake by inoculation with *B.megaterium* under conditions of alluvial soils. **El sayed (1998)** showed that inoculation with bacteria, *B.Polymyxa* increased the P-uptake in lentil plants. **Shotokhina and khristenko (1994)** reported that inoculation of maize with N_2-fixing bacteria in combination with phosphate solubilizing bacteria enhanced the biological potential of soil and increased nutrient uptake.

4.2.3: Main effect of N source.

Results in Table 3 indicate that the main effect of application of mineral N (Ammonium sulfate AS) and organic N source of farmyard manure (FYM) show superiority of the FYM organic source. Average values were 1129.9 and 1198.7 mg plant $^{-1}$ under AS and FYM, respectively. The increase in PU under FYM reflects the effect of organic acids and other compounds resulted from decomposition of FYM. **Holanda et al. (1984)** observed that with increasing the rate of applied farmyard manure up to about 60 metric tons ha $^{-1}$ to the soil positively affected the availability of soil P and consequently P uptake by soybean plants.

4.2.4: Main effect of P sources.

Data of PU indicate that the main effect of super phosphate application to the soil under maize plant show an increase of about 15% over that of rock phosphate, due to the greater soluble in super phosphate than in rock phosphate. **Abd El-Aziz et al. (1991)** reported that rock phosphate is not an efficient source of phosphorus in soils having high pH.

4. 2.5: Interaction effect of N sources and inoculation.

Results in Table 3 show that values of PU at flowering stage under inorganic sources (AS) are 696, 1204 and 1490 under no inoculation, inoculation with *P.polymyxa* and inoculation with *B.megaterium*, respectively. It can be seen from such data that under (AS), PU was increased by 72.8% and 113.9% due to inoculation with *P.polymyxa* and *B.megaterium*, respectively. Under conditions of the organic source FYM the obtained values of PU were 764,1252 and 1580 mg plant $^{-1}$ due to no-inoculation, inoculation with *P .Polymyxa* and inoculation with *B.megaterium* respectively; giving increases of 63.8% and 106.8% due to *P.polymyxa* and *B.megaterium* ,respectively. Thus *P. polymyxa* inoculation showed a considerable increase *B.megaterium* inoculation gave a further marked increase. Although the main effect of N-source showed significant difference between FYM over AS; the interaction effect caused by inoculation show a superiority of FYM over the mineral source of AS was considerable under conditions of *B. megaterium* in particular. This superiority of the organic source which was particularly significant under conditions of inoculation with *B.megaterium* indicates that Farmyard manure can be used with *B.megaterium*. **Gaind and Gaur (1991**) found that phosphate-dissolving bacteria utilize organic compounds as sources for carbon and energy and produce organic acids, which solubilize insoluble phosphates. **Wu et al (2004)** showed that inoculation with phosphorus-dissolving micro-organisms had an effect similar to adding organic fertilizer P.

4.2.6: Interaction effect of P sources and inoculation.

Data show the increase in PU at flowering stage due to inoculation under rock phosphate RP application .Values of PU under RP conditions are 644.7,1167 and 1430 mg/plant due to no- inoculation, inoculation with *P.polymyxa*) and inoculation with *B.megaterium* respectively. It can be seen that the increases over non-inoculated treatment are 81.0%and 121.7%due to *P.polymyxa* and *B.megaterium*, respectively. Comparable data under super phosphate (SP) application, show average values of 816, 1288 and 1640 mg/plant, with average increases as a result of inoculation averaging 73 and 114%due to *P.polymyxa* and *B.megaterium* inoculation, respectively. It may be concluded that *B.megaterium* inoculation showed a higher positive effect over *P.polymyxa* inoculation either in presence of RP or SP. Application of super phosphate combined with *B.megaterium* was of more positive effect than (RP) combined with *P.polymyxa* inoculation.

Table (3): P-uptake by maize (mg plant^{-1}) at flowering stage under the tested treatments

Irrigation system(A)	Nitrogen sources&rate(C)	Phosphorus Forms(D)	Inoculation(B)			mean
			Non	*P.poly*	*B.mega*	
Drip irrigation	**Inorganic (AS1)**	RP1	480	1048	1292	940
	(AS1)	SP1	767	1083	1329	1060
	(AS2)	RP2	541	1263	1338	1571
	(AS2)	SP2	827	1143	1407	1126
	Mean		654	1134	1341	1174
	Organic(FYM1)	RP1	645	884	1132	887
	(FYM1)	SP1	723	1066	1332	1040
	(FYM2)	RP2	741	1315	1561	1206
	(FYM2)	SP2	942	1354	1885	1394
	Mean		763	1155	1477	1132
	Mean		708	1145	1409	1153
Sprinkler irrigation	**Inorganic (AS1)**	RP1	558	1084	1350	997
	(AS1)	SP1	703	1096	1709	1169
	(AS2)	RP2	743	1263	1716	1241
	(AS2)	SP2	952	1649	1777	1459
	Mean		739	1273	1638	1217
	Organic(FYM1)	RP1	669	1131	1410	1070
	(FYM1)	SP1	697	1204	1488	1130
	(FYM2)	RP2	781	1352	1640	1258
	(FYM2)	SP2	916	1706	2194	1606
	Mean		766	1348	1683	1266
	Mean		752	1311	1661	1241
	Grand Mean		730	1228	1535	1197

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<u>RESULTS AND DISCUSSION</u>

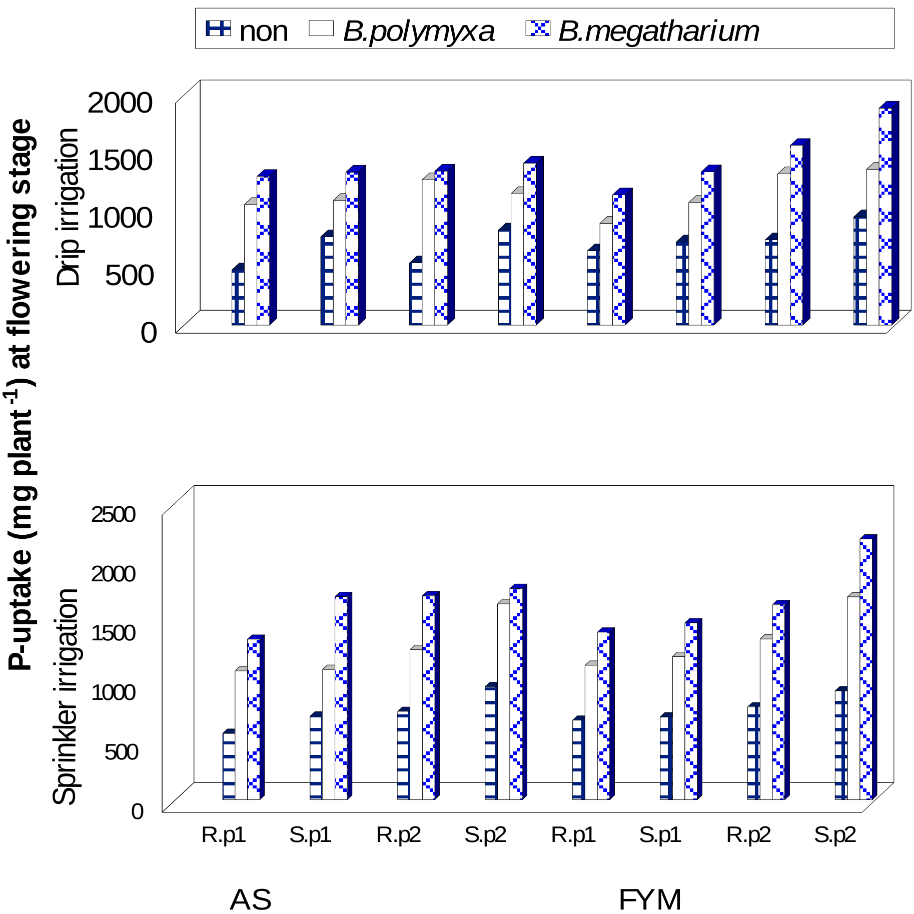
Table (3) cont

	Mean of(AS)	RP1 SP1 RP2 SP2	519 735 642 890	1066 1090 1263 1396	1321 1519 1527 1592	969 1055 1144 1293
	Mean		696	1204	1490	1130
	Mean of(FYM)	RP1 SP1 RP2 SP2	657 710 761 929	1008 1135 1334 1530	1271 1410 1600 2040	978 1085 1232 1500
	Mean		764	1252	1580	1199
	Mean of (P)	RP SP	645 816	1168 1288	1430 1640	1081 1248
	Mean		730	1228	1535	1164
	Mean of Drip	RP1 SP1 RP2 SP2	563 745 641 885	966 1075 1289 1249	1212 1330 1450 1646	913 1050 1127 1260
	Mean		708	1252	1409	1087
	Mean Of **Sprinkler**	RP1 SP1 RP2 SP2	613 700 762 934	1107 1150 1307 1678	1380 1599 1678 1985	1034 1150 1249 1532
	Mean		752	1311	1661	1241

L.S.D (0.05)	AB=310.4	ABC=132.8
Irrigation(A)=n.s	AC=76.66	ABD=187.8
Inoculation(B)=219.5	BC=93.89	ACD=153.3
Nitrogen(C)=53.43	AD=108.4	BCD=187.8
Phosphorus(D) =76.66	BD=132.8	ABCD=265.6

RESULTS AND DISCUSSION

R.P=rockphosphate SP=super phosphate As ammonium sulphat
FYM= farmyard manure



Fig(2): Effect of micropial inoculation, N and P fertilization and farmyard application on P-uptake at flowering stage under drip and sprinkler irrigation.

<u>RESULTS AND DISCUSSION</u>

4.3: Effect on K-uptake at flowering (Table 4).

4.3.1: Main effect of the irrigation system.

Results in Table 4 show that K uptake (KU) at flowering stage under sprinkler irrigation system significantly surpassed that under drip irrigation system. The mean values of KU amounted to 3878 and 2927 mg plant $^{-1}$ under sprinkler and drip irrigation system, respectively. Such effect could be due to greater amounts of available water for plant utilization under the sprinkler system companied with the drip one.

4.3.2: Main effect of inoculation.

Data show a considerable increase in KU due to microbial inoculation. Mean values for inoculation (2238, 3560 and 4409 mg plant $^{-1}$ occurred) under no inoculation, inoculation with *P.polymyxa* and inoculation with *B.megaterium,* respectively. It can be seen from the data that *P.polymyxa* increased KU by 59% but *B.megaterium* increased the KU by 97%.Such results agree with those of **Saber et al. (1981)** who found that K-uptake increased by P-dissolving microorganisms inoculation for Pea plants. **Shatokina and Khristenko (1996)** reported that inoculation of maize with associative N_2-fixing bacteria in combination with phosphate dissolving bacteria enhanced the biological potential of soil and increased nutrient uptake.

4.3.3: Main effect of N-source.

Results show that differences due to application of N sources AS and FYM gave rather similar effect. The mean values of KU are 3419 and 3402 mg/plant for AS and FYM respectively.

4.3.4: Main effect of P sources.

These results show that SP application gave more KU than RP. Mean values for were 3529 and 3276 mg/plant for SP and RP, respectively, where SP source was superior by 7.7% over the RP source.

4.3.5. Interaction effect of N sources and inoculation on K-uptake.

Results of KU by maize at flowering stage showed interaction between N-source and inoculation. Although the main effect show similarity between the two N sources, the interaction effect caused by inoculation show that (1) under conditions of no inoculation, FYM was superior to AS. ; (2) under conditions of inoculation, the reverse occurred where AS was superior to FYM. Inoculation was effective under both N sources. **Saber, et al (1981)** reported that the percent of K-uptake increase from control were persistently higher in the inoculated treatments with phosphate dissolving bacteria.

4.3.6. Interaction effect of P-source and inoculation on K-uptake.

Inoculation under RP application gave values of 2152, 3385 and 4291 mg/plant for no-inoculation, inoculation with *P.polymyxa* and inoculation with *B.megaterium*, respectively ; the increases over the no-inoculation were 57 and 99% due to *p. polymyxa* and *B.megaterium var.phosphaticum*, respectively .Inoculation under SP application, gave values of 2325,3735 and

4528 mg/plant for the no-inoculation, inoculation with *P.polymyxa*, and *B.megaterium* respectively with increases of 60.6 and 94.8% .Thus, superiority of SP over RP was more pronounced under *P.polymyxa* inoculation, but was little under no-inoculation . Under no inoculation, SP was superior to RP by 8.0%; under *P.polymyxa* inoculation the superiority was slightly higher (10.4%). **Heggo and Barakah (1993)** found that inoculation of maize grain with phosphate dissolving bacteria increased K-uptake.

Table (4): K-uptake by maize (mg plant^{-1}) at flowering stage under the tested treatments

Irrigation system(A)	Nitrogen sources&rate(C)	Phosphorus Forms(D)	Inoculation(B)			mean
			Non	*P.poly*	*B.mega*	
Drip irrigation	**Inorganic (AS1)**	RP1	1624	2594	3114	2444
	(AS1)	SP1	1756	2659	3189	2535
	(AS2)	RP2	1779	2747	3673	2733
	(AS2)	SP2	1981	2871	3905	2919
	Mean		1785	2718	3470	2658
	Organic(FYM1)	RP1	2295	2601	3240	2712
	(FYM1)	SP1	2322	2804	3668	2931
	(FYM2)	RP2	2579	3636	4369	3528
	(FYM2)	SP2	2776	3644	4434	3618
	Mean		2493	3171	3928	3197
	Mean		2139	2944	3699	2927
Sprinkler irrigation	**Inorganic (AS1)**	RP1	1948	3334	5151	3477
	(AS1)	SP1	1954	3993	5235	3727
	(AS2)	RP2	2322	4856	6035	4404
	(AS2)	SP2	2370	6299	6299	4989
	Mean		2148	4620	5680	4150
	Organic(FYM1)	RP1	1730	3544	3989	3088
	(FYM1)	SP1	2464	3643	4713	3607
	(FYM2)	RP2	2939	3772	4755	3822
	(FYM2)	SP2	2977	3969	4780	3909
	Mean		2527	3732	4559	3606
	Mean		2338	4176	5120	3878
	Grand Mean		2238	3560	4409	3403

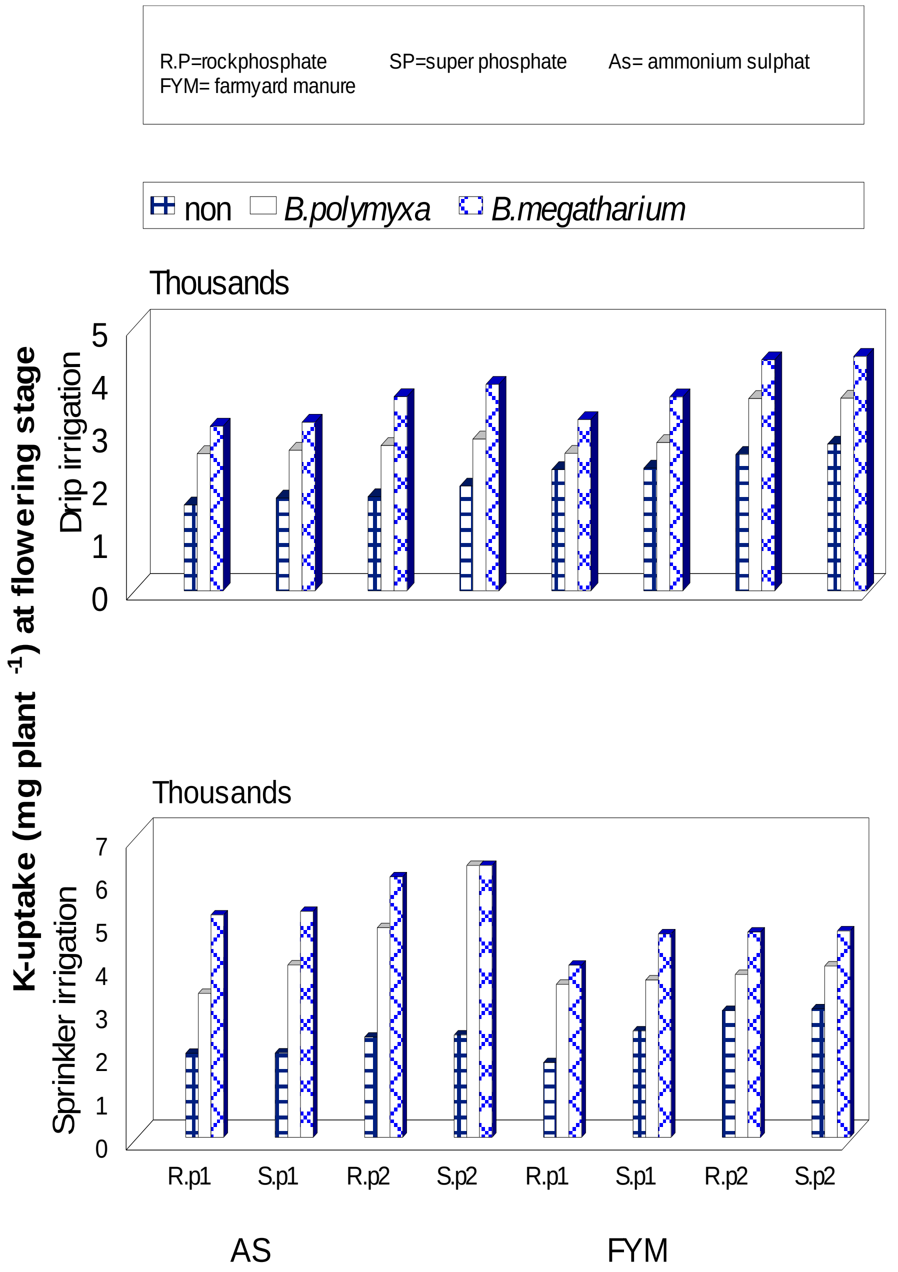
(Continued next page)

RESULTS AND DISCUSSION

Table (4) cont.

	Mean of(AS)	RP1 SP1 RP2 SP2	1786 2039 2050 2175	2964 3326 3801 4585	4132 4212 4853 5102	2961 3193 3568 3954
	Mean		2013	3669	4575	3419
	Mean of(FYM)	RP1 SP1 RP2 SP2	2012 2393 2759 2876	3073 3223 3704 3807	3614 4191 4562 4607	2900 3269 3675 3763
	Mean		2510	3452	4243	3402
	Mean of (P)	RP SP	2152 2325	3385 3735	4291 4528	3276 3529
	Mean		2238	3560	4410	3403
	Mean of Drip	RP1 SP1 RP2 SP2	1959 2039 2179 2378	2598 2731 3191 3258	3177 3429 4021 4170	2578 2733 3130 3269
	Mean		2139	2944	3699.0	2927
	Mean of **Sprinkler**	RP1 SP1 RP2 SP2	1839 2209 2630 2673	3439 3818 4314 5134	4570 4974 5395 5539	3283 3667 4113 4449
	Mean		2338	4176	5120	3878
L.S.D (0.05) Irrigation(A)=502.49 Inoculation(B)=287.9 Nitrogen(C)=n.s Phosphorus(D) =209.0		AB=407.2 AC=209.0 BC=256.0 AD=295.6 BD=362.0	CD=295.6 ABC=362.0 ABD=512.0 ACD=418.0 BCD=512.0		ABCD=724.1	

<u>RESULTS AND DISCUSSION</u>



Fig(3) : Effect of micropial inoculation, N and P fertilization and farmyard application on K-uptake at flowering stage under drip and sprinkler irrigation.

RESULTS AND DISCUSSION

4.4: Effect on N-uptake at harvest (Table 5).

4.4.1: Main effect of irrigation system.

Results in Table 5 show that total N uptake(NU)(straw+ grain) by maize plants at harvest showed the same trend as that at flowering stage .Uptake under sprinkler irrigation system significantly surpassed about 18.5% that under the drip irrigation system, with values of to 5287 and 4463 mg N plant $^{-1}$ under sprinkler and drip systems, respectively.

4.4.2: Main effect of inoculation on N-uptake.

Data in Table 5 show a marked increase in NU due to inoculation. Main values of NU amounted to 3288, 5133 and 6210 mg N plant $^{-1}$ under no inoculation, inoculation with *P.polymyxa* and inoculation with *B.megaterium*, respectively ; giving increases of 56.1, 88.4% due to *P.polymyxa* and *B.megaterium* ,respectively.

4.4.3: Main effect of N source on N-uptake.

Results in Table (5) indicate that the main effect of (FYM) significantly surpassed that of (AS) by about 4.6%. Such trends agree with **Sakr (1985)** who showed that farmyard manure was of a positive effect on both sandy calcareous soils.

4.4.4: Main effect of P-source on N uptake.

Data in Table (5) show a significant difference between SP and RP where. SP effect slightly surpassed that of RP (by 3.0%).

4.4.5: Effect of N source and inoculation interaction on N-uptake.

There was a significant interaction caused by inoculation affecting the pattern of response to N-source FYM was superior to AS only where inoculation was done; with no-inoculation, both FYM and AS were rather

Similar in effect. On the other hand the interaction worked in another way; the N-source affected the pattern of response to inoculation. Inoculation was more pronounced where FYM was present, reflecting 65% and 92% increase due to *P.polymyxa* and *B.megaterium*, respectively. The corresponding increases under AS addition were 48% and 87% respectively.

4.4.6: Interaction effect of P source and inoculation on N-uptake.

Superiority of SP over RP occurred only where no-inoculation was done, or where *B.megaterium* inoculation was done. Under condition of inoculation with *P.polymyxa*, it was RP which surpassed SP. On the other hand inoculation in general surpassed no inoculation by a greater percentage under conditions of applying RP; giving 67.4% and 91.3% increases due to *P.polymyxa* and *B.megaterium* respectively. Corresponding increases under applying SP were 44.7% and 86.4% respectively.

Table (5): N-uptake by maize (mg plant^{-1}) at harvesting stage under the tested treatments.

Irrigation system(A)	Nitrogen sources&rate(C)	Phosphorus Forms(D)	Inoculation(B) Non	*P.poly*	*B.mega*	mean
Drip irrigation	**Inorganic (AS1)**	RP1	3309	4630	5792	4577
	(AS1)	SP1	3115	4731	5081	6463
	(AS2)	RP2	3596	4921	5988	4835
	(AS2)	SP2	3459	5256	5947	4887
	Mean		3370	4884	5702	4652
	Organic(FYM1)	RP1	2352	4924	4187	3821
	(FYM1)	SP1	2896	4096	3408	3467
	(FYM2)	RP2	2783	6071	5643	4832
	(FYM2)	SP2	3537	5557	5924	5006
	Mean		2892	5162	4791	4273
	Mean		3131	5023	5246	4463
Sprinkler irrigation	**Inorganic (AS1)**	RP1	2456	4228	4417	3700
	(AS1)	SP1	3275	4473	5727	4492
	(AS2)	RP2	3287	5762	6852	5300
	(AS2)	SP2	3935	4939	9301	6059
	Mean		3238	4850	6574	4888
	Organic(FYM1)	RP1	3609	4445	7283	5112
	(FYM1)	SP1	2985	5285	6958	5076
	(FYM2)	RP2	3679	7298	7816	6264
	(FYM2)	SP2	4333	5503	9037	6291
	Mean		3651	5633	7774	5686
	Mean		3445	5242	7174	5287
	Grand Mean		3288	5133	6210	4875

(Continued next page)

RESULTS AND DISCUSSION

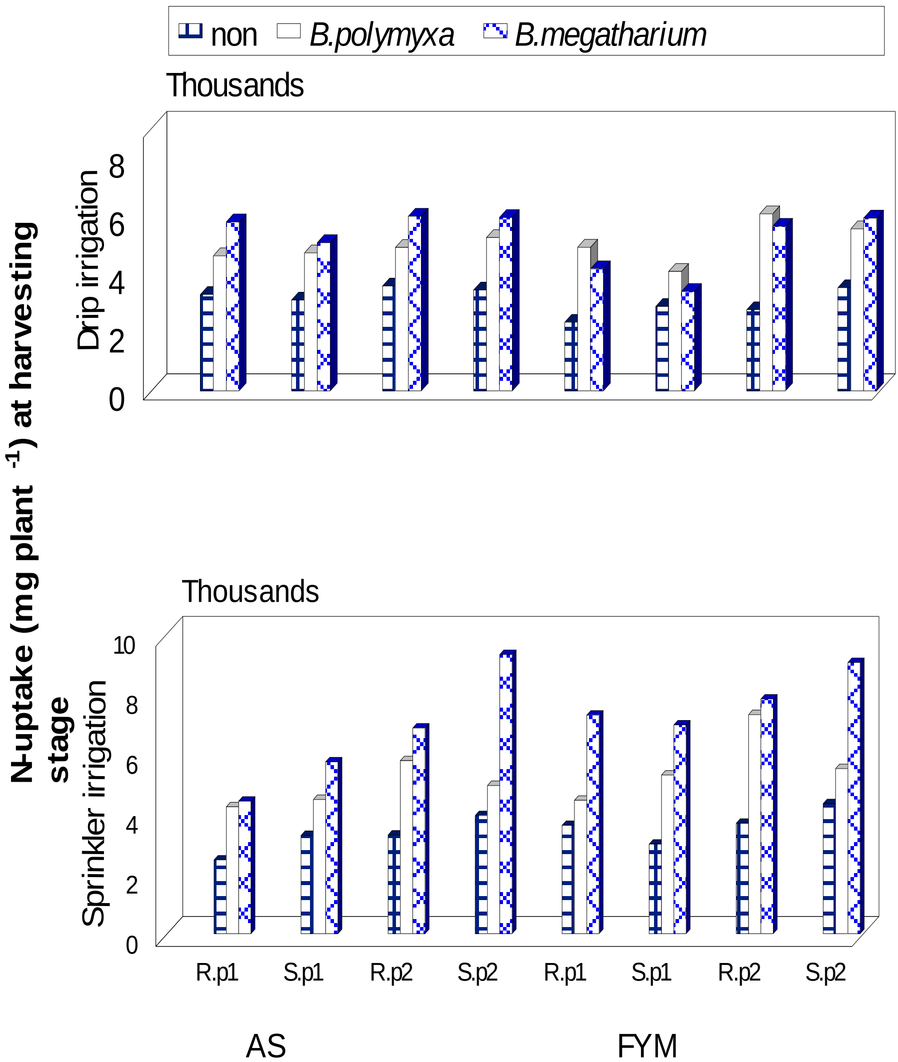
Table (5) cont.

	Mean of(AS)	RP1 SP1 RP2 SP2	2883 3195 3442 3622	4429 4602 5342 5098	5104 5404 6420 7624	4139 4400 5068 5448
	Mean		3285	4897	6138	4764
	Mean of(FYM)	RP1 SP1 RP2 SP2	2981 2941 3231 3935	4685 4691 6684 5530	5735 5183 6730 7480	4467 4271 5548 5649
	Mean		3272	5398	6282.	4984
	Mean of (P)	RP SP	3134 3442	5285 4980	5997 6423	4805 4948
	Mean		3288	5132	6210	4877
	Mean of Drip	RP1 SP1 RP2 SP2	2830 3005 3189 3498	4777 4413 5496 5406	4990 4245 5815 5936	4199 3888 4834 4947
	Mean		3131	5023	5246	4467
	Mean of **Sprinkler**	RP1 SP1 RP2 SP2	3033 3130 3483 4134	4336 4879 6530 5221	5850 7382 7334 8130	4406 5130 5782 5828
	Mean		3445	5242	7174	5287

L.S.D (0.05)	AB=156.9	CD=126.5	ABCD=309.8
Irrigation(A)=264.90	AC=89.44	ABC=154.9	
Inoculation(B)=110.9	BC=109.5	ABD=219.1	
Nitrogen(C)=62.33	AD=126.5	ACD=178.9	
Phosphorus(D) =89.44	BD=154.9	BCD=219.1	

RESULTS AND DISCUSSION

R.P=rockphosphate SP=super phosphate As= ammonium sulphat
FYM= farmyard manure



Fig(4) :Effect of micropial inoculation, N and P fertilization and farmyard application on N-uptakeat harvesting under drip and sprinkler irrigation.

RESULTS AND DISCUSSION

4.5: Effect on P-uptake at harvest (Table 6).

4.5.1: Main effect of irrigation system.

Data in (Table 6) show the values of P uptake PU in (straw+ grains) by maize plants at harvesting stage. Results show (like with PU at the flowering stage) no significant differences between the sprinkler and drip irrigation systems on PU. However sprinkler irrigation was superior to drip irrigation in treatments inoculated with *B. megaterium*.

4.5. 2: Main effect of inoculation.

Data in Table (6) show a considerable significant increase in PU values of maize plants (like at the flowering stage) as a result of inoculation. Mean values amounted to 13.96, 2309 and 3004 mg N plant $^{-1}$ under no inoculation, inoculation with *P.polymyxa* and inoculation with *B.megaterium var. phosphaticum*, respectively. Such effect reflects the capability of these types of bacteria in solubilize insoluble phosphate in soil. The increases due to inoculation averaged 65 and 115% for *P. polymyxa* and *B.megaterium*, respectively.

4.5.3: Main effect of N source.

Results in Table(6) show the main effect of mineral N source ammonium sulphate (AS) and organic N source (FYM).The average (mean) values of PU were 1934 and 2538 mg P / plant under As and FYM, respectively, showing an increase of 31.2% for FYM over AS which elucidates the considerable effect of organic manures in enhancing soil P availability. Farmyard manure would enhance solubility of P via two principal ways (1), firstly, the P-content in the manure; and (2) secondly the indirect solubilizing effects of the manure due to different organic acids and growth inducing compounds release during decomposition of the manure. Such results are in agree with those of **Holanda and Bezerra (1984)** who observed that with increasing the rate of applied FYM there was an increased availability of P and P uptake by Soya bean plants.

4.5.4: Main effect of P sources on (PU).

Data of PU indicate that the main effect of super phosphate and in comparison with that of rock phosphate application gave rather similar responseand there is no significant difference between the two sources. **Singh and Amberger (1991)** showed that application of rock phosphate in combination with organic manure increased both yield and uptake of phosphorus by crops which were mainly attributed to an increase in P availability induced by organic matter decomposition.

4.5.5: Interaction effect of N sources and inoculation.

Results in Table (6) show the values of PU at harvest stage due to the inorganic sources of AS and the organic source of (FYM) under each of the following conditions: no inoculation, inoculation with *P.polymyxa* and *B.megaterium*. The superiority of FYM over AS was highest under conditions of *P.polymyxa*. On the other hand results also show the response to inoculation under the following conditions: applying (FYM) and AS. The *B.megaterium* effect surpassed that of *P. polymyxa* by a higher percentage (35.9%) in presence of AS, but a lower percentage (26.0%) in presence of FYM. **Laheurte and Berthelin (1988)** asserted the potential efficiency of P-solubilizing microorganisms as inoculants to increase P-availability to plants.

4.5.6: Interaction effect of P source and inoculation.

Results in Table 6 show the values of PU at the harvesting stage due to rock phosphate (RP) and super phosphate (SP) under inoculation or no-inoculation. Although the results showed that the main effects of SP and RP were similar, the interaction caused by inoculation treatments no inoculation, SP was significantly superior to RP ; (1), under inoculation, RP was slightly and non significantly superior to SP(2). This shows that RP would be effective when combined under inoculation with phosphate dissolving microorganisms, this superiority was more induced in presence of (FYM) than presence of (AS).

Table (6): P-uptake by maize (mg plant^{-1}) at harvesting stage under the tested treatments.

Irrigation system(A)	Nitrogen sources&rate(C)	Phosphorus Forms(D)	Inoculation(B)			mean
			Non	*P.poly*	*B.mega*	
Drip irrigation	**Inorganic (AS1)**	RP1	949	2029	2630	1869
	(AS1)	SP1	1270	1907	2498	1892
	(AS2)	RP2	1213	2108	2978	2099
	(AS2)	SP2	1365	2055	2578	1999
	Mean		1199	2025	2671	1965
	Organic(FYM1)	RP1	1401	2017	2424	1948
	(FYM1)	SP1	1526	2002	2244	1924
	(FYM2)	RP2	1641	3292	3131	2688
	(FYM2)	SP2	1761	2510	2591	2287
	Mean		1582	2455	2598	2212
	Mean		1391	2240	2634	2088
Sprinkler irrigation	**Inorganic (AS1)**	RP1	890	1417	1702	1336
	(AS1)	SP1	1217	1792	2660	1890
	(AS2)	RP2	1118	2239	2901	2086
	(AS2)	SP2	1643	2036	3218	2299
	Mean		1217	1871	2620	1903
	Organic(FYM1)	RP1	1206	2924	4015	2715
	(FYM1)	SP1	1554	2589	3425	2523
	(FYM2)	RP2	1536	3087	4466	3030
	(FYM2)	SP2	2043	2931	4605	3193
	Mean		1585	2883	4128	2865
	Mean		1401	2377	3374	2384
	Grand Mean		1396	2309	3004	2236

(Continued next page)

RESULTS AND DISCUSSION

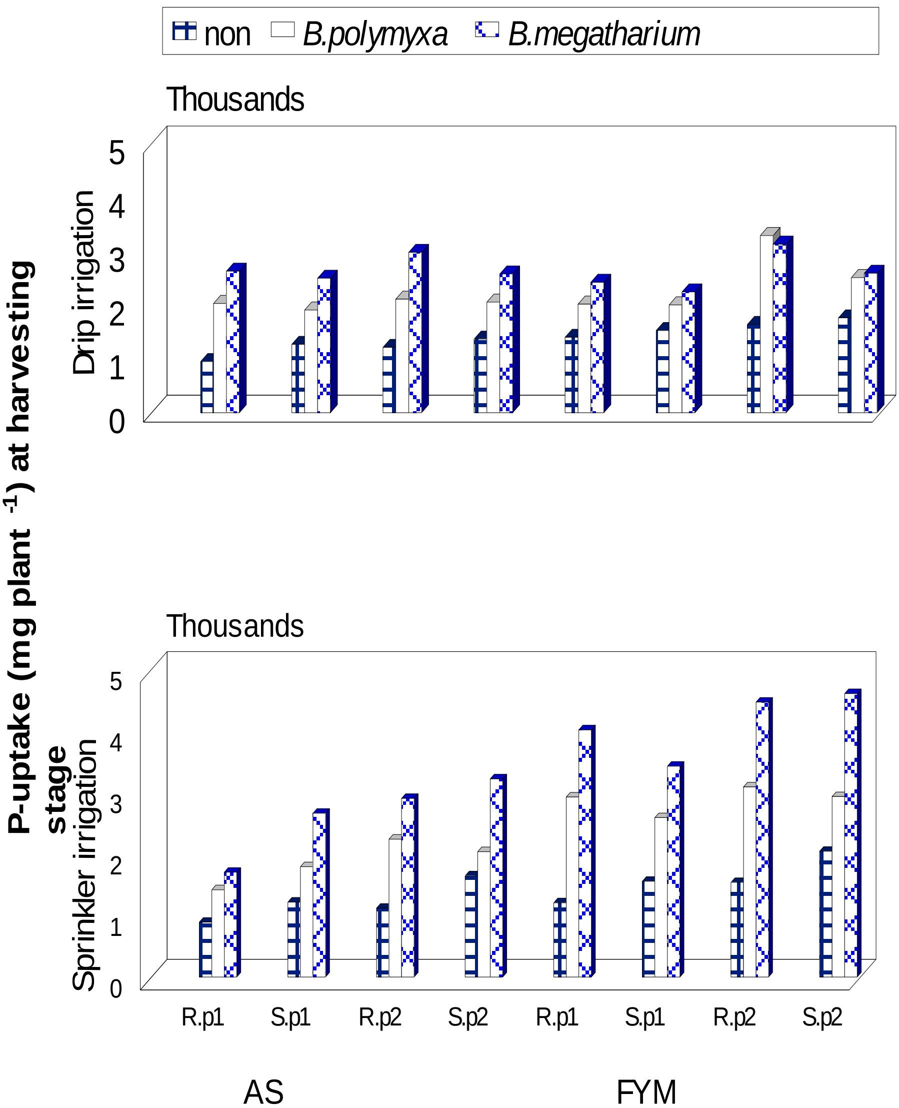
Table (6) cont.

	Mean of(AS)	RP1 SP1 RP2 SP2	919 1244 1165 1504	1723 1850 2174 2045	2166 2579 2940 2898	1603 1891 2093 2150
	Mean		1208	1948	2646	1934
	Mean of(FYM)	RP1 SP1 RP2 SP2	1303 1540 1589 1902	2471 2295 3190 2720	3220 2835 3798 3598	2331 2223 2859 2740
	Mean		1584	2669	3363	2538
	Mean of (P)	RP SP	1244 1548	2389 2228	3031 2978	2221 2251
	Mean		1396	2309	3004	2236
	Mean of Drip	RP1 SP1 RP2 SP2	1175 1398 1427 1563	2023 1954 2700 2282	2527 2371 3054 2585	1908 1908 2394 2143
	Mean		1391	2240	2634	2088
	Mean of **Sprinkler**	RP1 SP1 RP2 SP2	1048 1386 1327 1843	2171 2191 2663 2484	2858 3633 3683 3322	2026 2403 2558 2550
	Mean		1401	2377	3374	2384

L.S.D (0.05)	AB=570.0	CD=190.8	ABCD=467.4
Irrigation(A)=n.s	AC=134.9	ABC=233.7	
Inoculation(B)=403.0	BC=165.2	ABD=330.5	
Nitrogen(C)=94.03	AD=190.8	ACD=269.8	
Phosphorus(D) =n.s	BD=233.7	BCD=330.5	

RESULTS AND DISCUSSION

R.P=rockphosphate SP=super phosphate As= ammonium sulphat
FYM= farmyard manure



Fig(5) : Effect of micropial inoculation,N and P fertilization and farmyard application on P-uptake at harvesting stage under drip and sprinkler irrigation.

RESULTS AND DISCUSSION

4.6: Effect on K uptake at harvest.

4.6.1: Main effect of irrigation system.

Results in Table 7 show that K uptake KU in (straw+ grains) at harvesting stage under drip irrigation system was rather similar to that sprinkler irrigation.

4.6.2: Main effect of inoculation.

Microbical inoculation considerably increased KU at harvesting stage. Mean values of KU were 4915, 7452 and 8651 mg K plant $^{-1}$ under no inoculation, *P.polymyxa* and *B.megaterium* treatments, respectively. It can be seen from the data that *P.polymyxa* increased KU by 52% but *B.megaterium* increased it by 76%, respectively over the no inoculation treatment.

4.6.3: Main effect of nitrogen source.

Results show significant differences in KU values between the N sources of FYM and AS with FYM surpassing AS by 22%.

4.6.4: Main Effect of phosphorus source.

Data in Table 7 show that according to the main effect, there was no significant difference between applications either P source (RP or SP).

4.6.5: Interaction effect of N source and inoculation.

Superiority of (FYM) over AS was highest (33%) under *P.polymyxa* inoculation, and lowest (12%) under conditions of no-inoculation. On the other hand the effectiveness of inoculation was much greater under FYM (57% and 81%) due to

P.polymyxa and *B.megaterium* respectively, than where AS was present (32.6% and 70.4%) for *P.polymyxa* and *B.megaterium*, respectively.

4.6.6: Interaction effect of interaction between P sources and inoculation.

Although the main effect indicates rather similarity between SP and RP, the interaction effect caused by inoculation shows .That SP was superior to RP under inoculation particularly under conditions of *P.polymyxa*. Under conditions of no inoculation a slight, and non-significant, superiority was given by RP. **Saber et al., (1983)** found that increased K-uptake when phosphate dissolving bacteria was mixed with super phosphate.

Table (7): K-uptake by maize (mg plant^{-1}) at harvesting stage under the tested treatments.

Irrigation system(A)	Nitrogen sources&rate(C)	Phosphorus Forms(D)	Inoculation(B)			mean
			Non	*P.poly*	*B.mega*	
Drip irrigation	**Inorganic (AS1)**	RP1	5231	5902	6389	5841
	(AS1)	SP1	4386	5826	5826	5346
	(AS2)	RP2	7223	9389	10195	8936
	(AS2)	SP2	5253	7069	6961	6428
	Mean		5523	7046	733	6638
	Organic(FYM1)	RP1	4948	5986	8937	6624
	(FYM1)	SP1	4554	8257	7409	6740
	(FYM2)	RP2	4986	10915	12054	7822
	(FYM2)	SP2	6115	8318	9108	7847
	Mean		5151	8367.0	9377	6962
	Mean		5337	7707	8360	6800
Sprinkler irrigation	**Inorganic (AS1)**	RP1	2691	5269	5555	4505
	(AS1)	SP1	3475	7256	8522	6418
	(AS2)	RP2	3752	5517	7686	5652
	(AS2)	SP2	5013	7617	11956	8195
	Mean		3733	6415	8430	6193
	Organic(FYM1)	RP1	5860	9147	8696	7363
	(FYM1)	SP1	3684	6261	9103	6349
	(FYM2)	RP2	5641	7752	8849	7952
	(FYM2)	SP2	5822	8763	11176	8587
	Mean		5252	7981	9456	7563
	Mean		4492	7198	8943	6878
	Grand Mean		4915	7452	8651	6819

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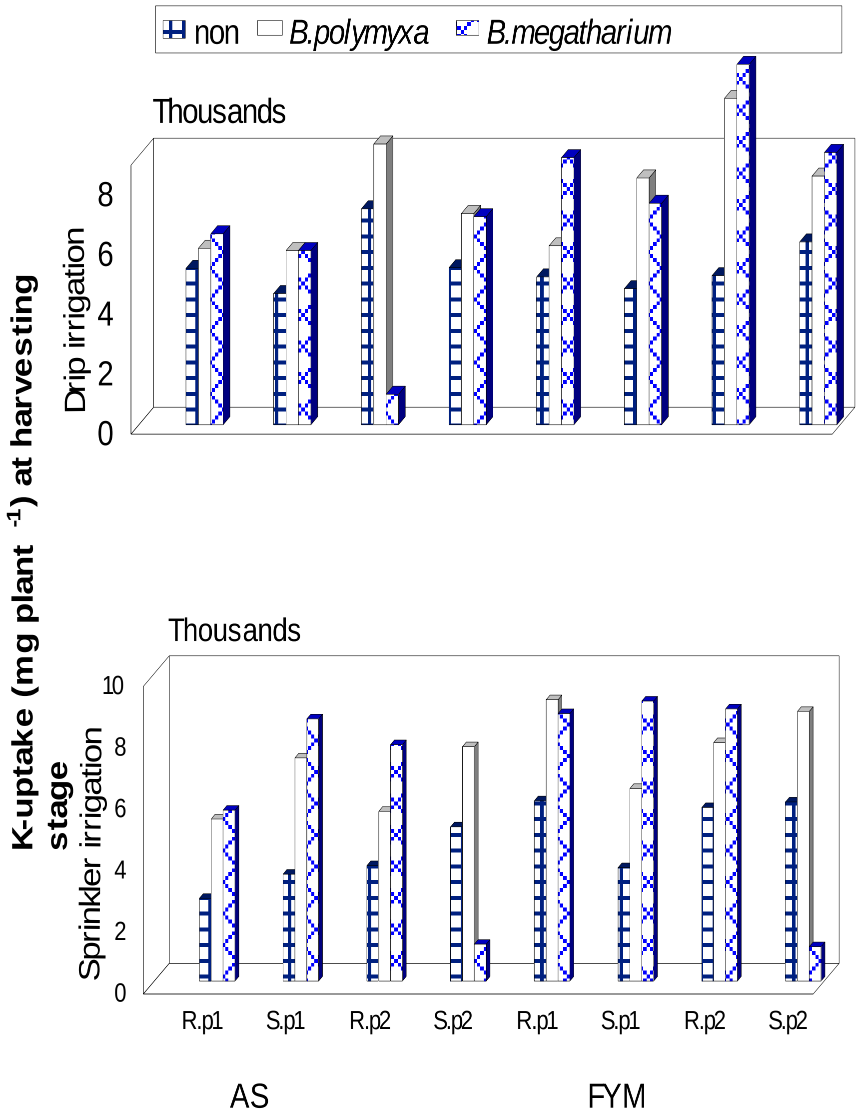
Table (7) cont.

	Mean of(AS)	RP1 SP1 RP2 SP2	3961 3930 5487 5133	5710 6722 4958 7163	5972 7174 8941 9458	5214 5942 6462 7251
	Mean		4628	6138	7886	6217
	Mean of(FYM)	RP1 SP1 RP2 SP2	5404 4119 5313 5969	10031 7259 6869 8541	10375 8256 8893 10142	8603 6545 7025 8217
	Mean		5201	8175	9416	7597.5
	Mean of (P)	RP SP	5042 4788	6257 7421	8545 8758	6614 6582
	Mean		4915	6838.8	8651	6598
	Mean of Drip	RP1 SP1 RP2 SP2	5090 4470 6104 5684	5944 7042 1015 7694	7663 6618 11125 8034	6232 6043 7786 7137
	Mean		5337	7708	8360	6800
	Mean of **Sprinkler**	RP1 SP1 RP2 SP2	4276 3579 4697 5418	7332 6939 6511 8010	7126 8812 8267 11566	5934 6383 6802 8391
	Mean		4992	7198	8943	6878

L.S.D (0.05)	AB=381.8	CD=372.4	ABCD=912.2
Irrigation(A)=n.s	AC=263.3	ABC=456.1	
Inoculation(B)=270.0	BC=322.5	ABD=645.0	
Nitrogen(C)=183.526	AD=372.4	ACD=526.7	
Phosphorus(D) =n.s	BD=456.1	BCD=645.0	

<u>RESULTS AND DISCUSSION</u>

R.P=rockphosphate SP=super phosphate As= ammonium sulphat
FYM= farmyard manure



Fig(6): Effect of micropial inoculation, N and P fertilization and farmyard application on K-uptake at harvesting stage under drip and sprinkler irrigation.

RESULTS AND DISCUSSION

4.7: Effect on available N in soil at 60 and 120 day periods of plant growth.

Data in Table (8) show contents of available N at flowering stage (60 days growth) and at harvest (120 days growth).

4.7.1: Main effect of irrigation system.

Results show that main contents of available nitrogen in soil under sprinkler and drip irrigation .Such reveal suggest that soil N content under drip irrigation after 60 days growth, 5.3% surpassed that under sprinkler irrigation; while under the sprinkler irrigation system, the soil available N content at 120 days growth 5.9% surpassed that under drip irrigation. Accordingly one may suggests that under the experimental conditions, the soil under sprinkler irrigation contained slightly higher available N at the harvest time if compared with that under drip irrigation system. Such results agree at least porbly with **Hergert (1978)** who reported that N loss via leaching losses could be considerable under sprinkler irrigation although such a system could be more efficient than surface irrigation **(Hanks et al, (1976) and Singh and Kavia(1978)**

4.7.2: Main effect of inoculation.

Results indicate that available soil nitrogen content under at flowering by inoculation giving average increases of 11.1 and 11.1% due *P.polymyxa* and *B.megaterium* respectively. Respective increases at harvest were 5.9 and 11.8 %. Such results agree with **Barea et al. (2005),** concluded that the presence of phosphate dissolving bacteria is responsible for increased nodulation and N_2-fixation in soil / plant systems.

4.7.3: Main effect of nitrogen source.

Results reveal that the available nitrogen content in soil did not differ significantly, on average when compared with AS at flowering as well as at harvest.

4.7.4: Main effect of phosphorus source.

Results reveal that, on average and as the main effect shows that at flowering, the nitrogen content in soil under SP was not significantly different from that under RP. At harvest, the SP soil contained more available N.

4.7.5: Interaction effect of N-sources and inoculation.

Although the main effect shows no significant difference between FYM and AS, the interaction effect caused by inoculation shows significant differences depending on the status of inoculation as follows: (1) under no-inoculation, FYM surpassed AS at flowing but was inferior to AS at harvest.(2) under *B.megaterium* FYM was inferior to As at flowering but both were similar at harvest. Under *P.polymyxa* both FYM and AS were of similar effect at both stages. Superiority of FYM over the soluble AS reflects the slow-release nature of organic fertilizers **(Bott and Bruggen 1978)** the availability and the different nutrients present in them in available forms **(El-Ghozoli 1998)**. Application of organic fertilizers was reported to increase the soil content of available nitrogen **(Mahmoud1994).**

4.7.6: Interaction effect of P-source and inoculation.

The similarity of SP and RP (shown by the main effect) was in all inoculation treatments at flowering. At harvest, SP surpassed RP under *B.megaterium*, under no inoculation or under inoculation with *P.polymyxa* no difference occurred between SP and RP. This shows an interaction caused by inoculation status, affecting the response to P source.

RESULTS AND DISCUSSION

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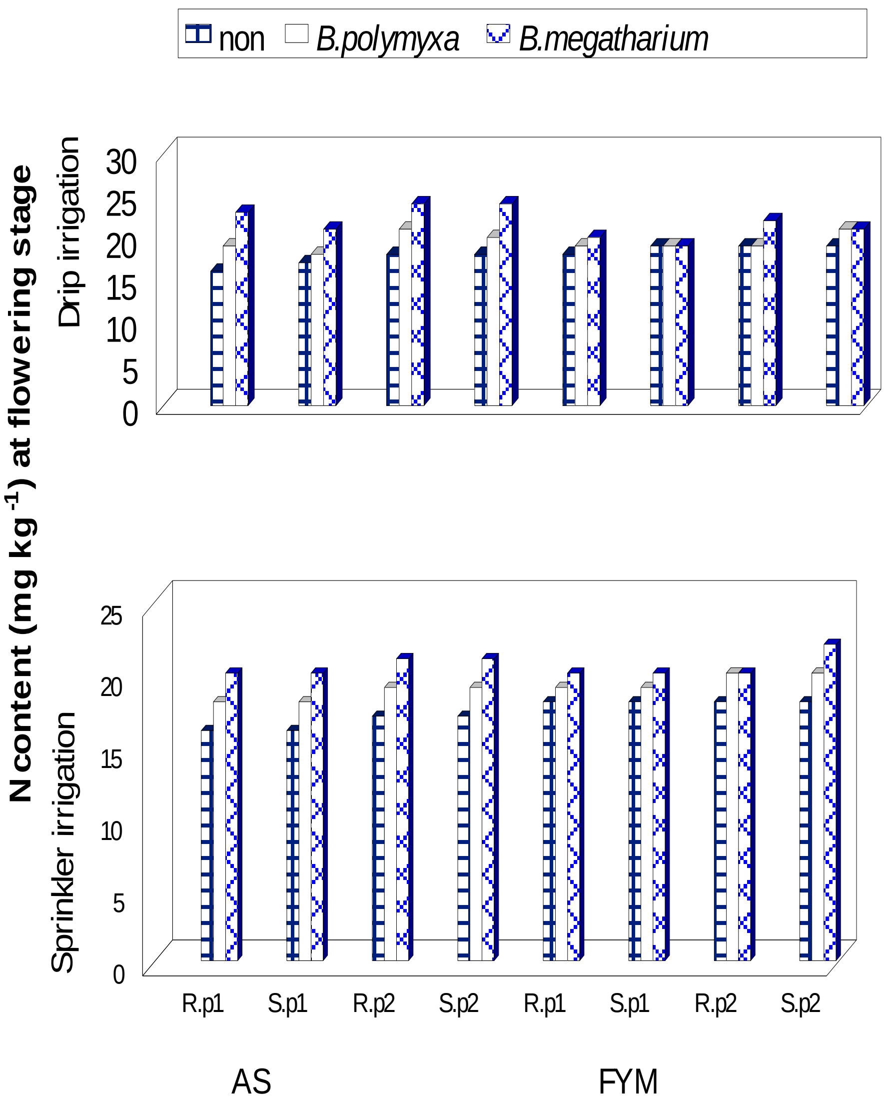
R.P=rockphosphate SP=super phosphate As ammonium sulphat
FYM= farmyard manure



Fig(7);Effect of micropial inoculation, N and P fertilization and famyard application on N content of soil at flowering stage under drip and sprinkler irrigation.

<u>RESULTS AND DISCUSSION</u>

R.P=rockphosphate SP=super phosphate As ammonium sulphat
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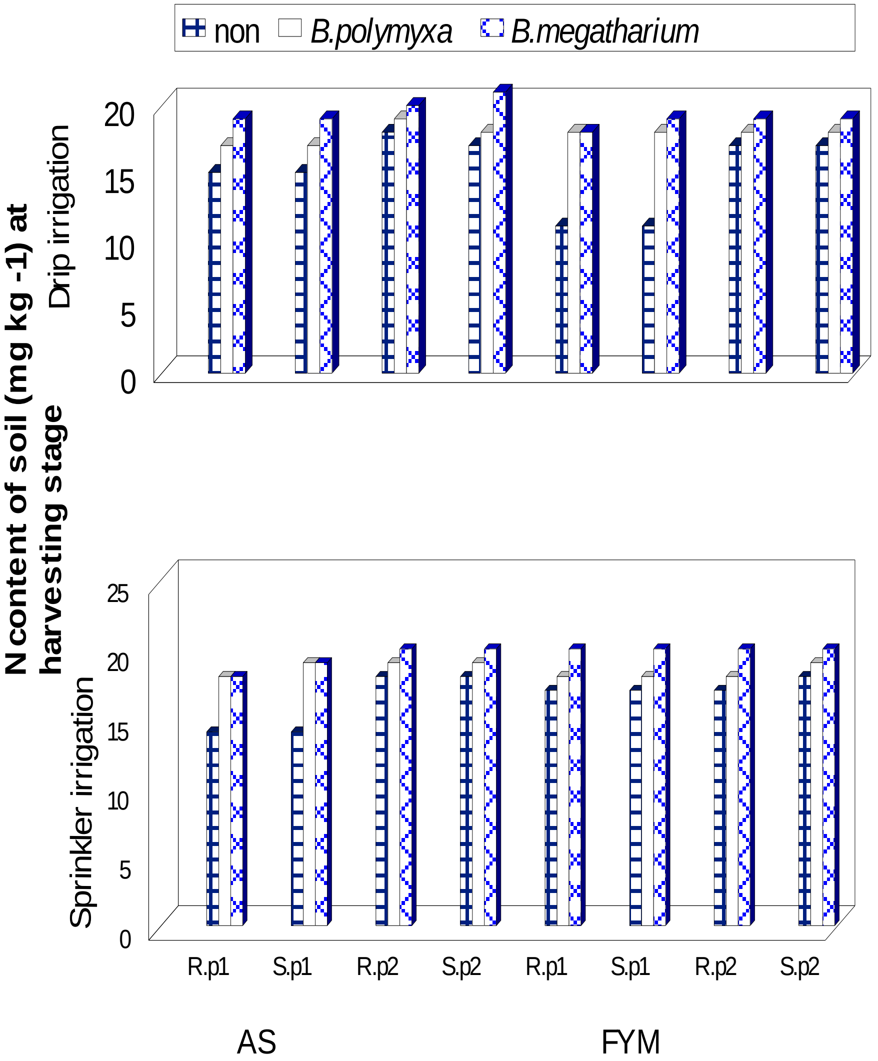

Fig(8);Effect of micropial inoculation, N and P fertilization and farmyard application on N content of soil at harvesting stage under drip and sprinkler irrigation.

RESULTS AND DISCUSSION

4.8: Effect on available P content.

Data in Table (9) show the effect of inoculation and applied AS, FYM, SP and RP under drip and sprinkler irrigation system on available P in soil.

4.8.1: Main effect of irrigation system.

Results indicate that the average values of available P in soil at both flowering and harvesting stages no significant increase between drip and sprinkler irrigation.

4.8.2: Main effect of inoculation.

Results indicate that available soil phosphorus content at 60 days increased by 72.9, and 85.6 **%,** on average, as a result of inoculating with *P. Polymyxa* and *B. megaterium*, respectively. At 120 day the corresponding percentages were 66.2% and 139%, respectively **.El-Sayed (1998)** used the P-solubilizing bacteria, of *Pseudomonas striata* and *Paenibacillus polymyxa* in inoculating lentil and obtained an increase in available phosphorus in soil **.Sundara et al., (2002)** using *Bacillus megaterium var.phosphaticum* found that soil available P was increased.

4.8.3: Main effect of nitrogen source.

The main effect of N-sources shown at 60 day timing was greater by 7.5% with FYM as compared with AS, at 120-day no significant difference was defected between for FYM and AS. Such results may suggest that under FYM application, soil was more fertile at 60 day. Under FYM the decompositions of this organic manure decomposed and released organic acids which must have decreased soil pH, leading to more P solubility. **Holanda et al., (1984)** found an increase in available P in the sandy soil with increasing rates of farm yard manure up to about 60 metric tons /ha. **Fagbami et al., (1985)** showed that the availability of soil macronutrients increased with application of organic manure.

4.8.4: Main effect of phosphorus source.

Results reveal that values of soil available P under SP were **greater** than that under RP by 4.4% at 60 day; and by 23.8% at 120 day. This reflects the higher P solubility under SP than RP**. Abd El- Aziz et al., (1991)** showed that rock phosphate is not an efficient source of phosphorus in soils of high pH.

4.8.5: Interaction of N-source and inoculation.

Results indicate that soil inoculation induced its available P content. At 60-day, the superiority of FYM over AS was obvious, where no inoculation or where inoculations was by *P.polymyxa* under AS and FYM. At 120-day time, very little difference occurred between the two N-sources. **Kucey, et al (1989)** showed that many rhizobacteria and rhizofungi are able to solubilizing sparingly soluble phosphates, usually by releasing chelating organic acids,

4.8.6: Interaction effect of P source and inoculation.

At 60-120 day time, the superiority of SP over RP was most prominent under no inoculation, or with B. Polymyxa; with *B. megaterium* both RP and SP were similar in effect. Thus with *B.megaterium*, solubilization of RP seemed more efficient than *P.polymyxa*. **Laheurte and Berthelin (1988)** reported high efficiency of *B.megaterium* for P-solubilizing in presence of rock phosphate to increase P availability to growing plants.

RESULTS AND DISCUSSION

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R.P=rockphosphate SP=super phosphate As ammonium sulphat
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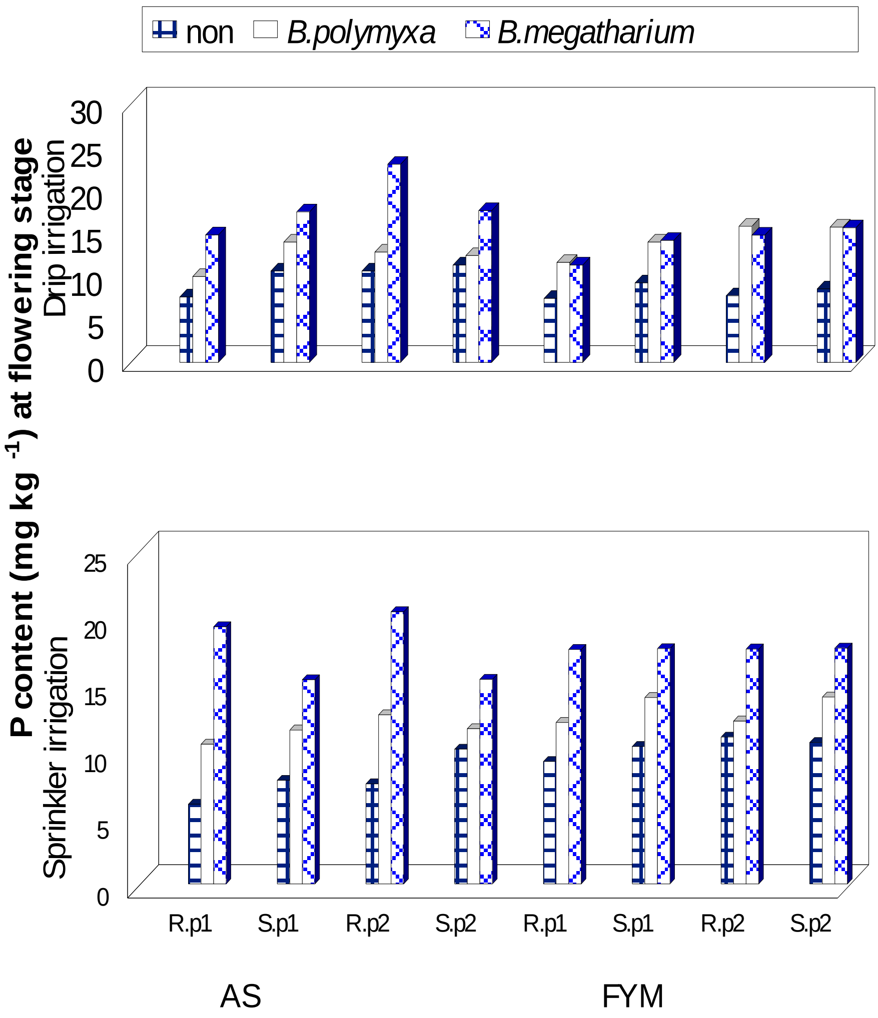

Fig(9);;Effect of micropial inoculation, N and P fertilization and farmyard application on P content of soil at flowering stage under drip and sprinkler irrigation.

RESULTS AND DISCUSSION

R.P=rockphosphate SP=super phosphate As ammonium sulphat
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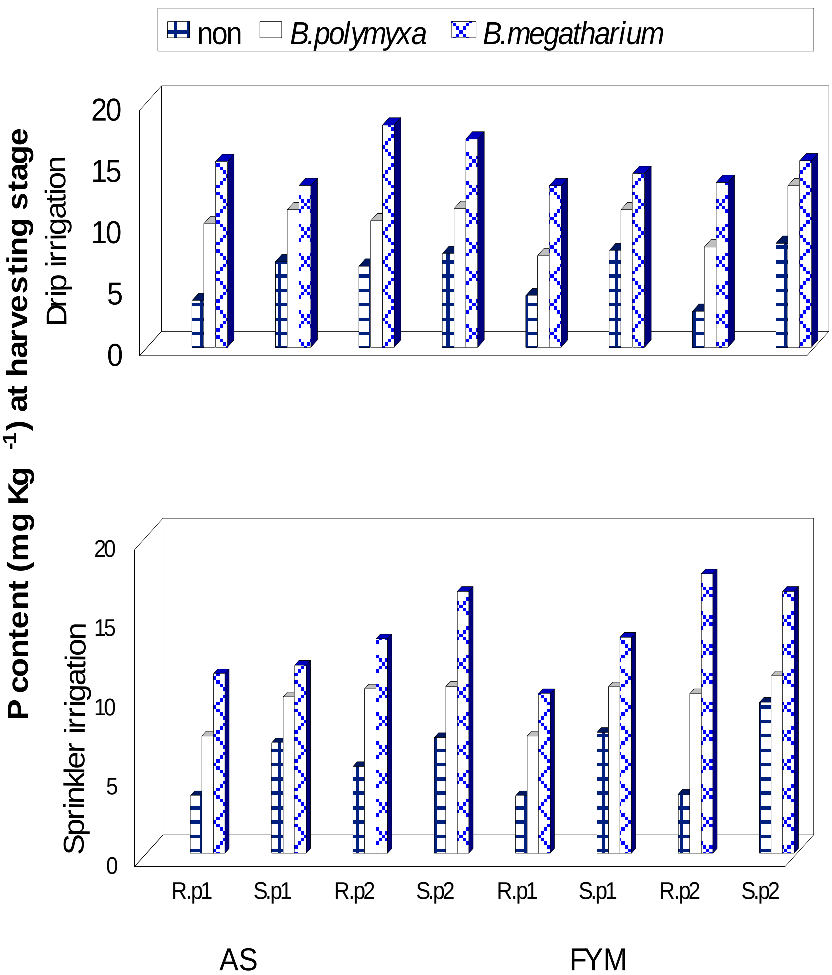


Fig(10);;Effect of micropial inoculation, N and P fertilization and farmyard application on P content of soil at harvesting stage under drip and sprinkler irrigation.

RESULTS AND DISCUSSION

4.9: Effect on available K in soil.

Data in Table (10) show the effect on available K.

4.9.1: Main effect of irrigation system.

Results reveal that average available potassium values in soil under sprinkler irrigation were significantly greater than under drip irrigation by an average of 9.1%.

4.9.2: Main effect of inoculation.

Results indicate that soil inoculation gave greater contents of available K. The increase in available K due to inoculation with *P.polymyxa* and *B.megaterium* averaged 20.0 and 44.2% at flowering respectively and 20.0% and 42.5% at harvest **Heggo and Barakah (1993)** found that maize inoculation with phosphate dissolving bacteria increased available K in soil .

4.9.3: Main effect of nitrogen source.

Results reveal that **the** main effect of N-source show different patterns, according to the growth stage. Regarding flowering stage, AS surpassed FY M significantly (by 3.1%). At harvest, FYM also, surpassed AS by significantly (by 4.9%). It may be concluded that by time, at harvest increasing available K under FYM occurred due to the K-contents in FYM and increasing the decomposition of FYM which release more K to the soil solution **Montaser (1987), Prasad et al (1982) and Fagbmi et al., (1985).**

4.9.4: Main effect of phosphorus source.

Results reveal that the values of soil available potassium under SP application significantly greater than under RP by an average of 8.3%. Under RP, there was a relatively lower K at harvest than at flowering.

4.9.5: Interaction effect of N-source and inoculation.

The superiority of FYM effect over that of AS in giving more available K (during harvest time) was particularly evident *B. megaterium* inoculation. Under *P.polymyxa* or no inoculation, no significant difference was shown between FYM and AS at harvest.

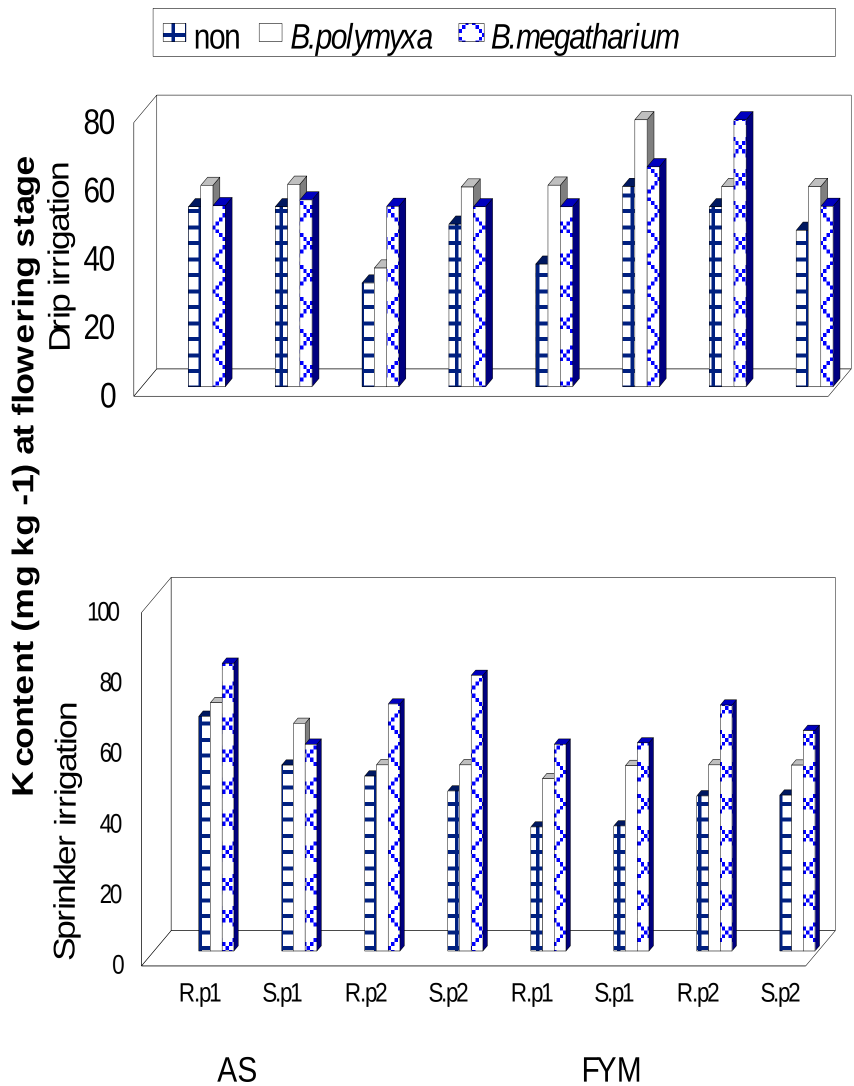
4.9.6: Interaction effect of P source and inoculation.

Although the main effects indicates that SP was superior to RP in the two stages (flowering and harvest), there was a significant interaction between to P sources, and inoculation, follows: Regarding flowering stage, and under conditions of no inoculation both RP and SP were rather similar, but it was RP which surpassed SP under conditions of *B.megaterium* inoculation. The only case where SP surpassed RP (during the same flowering stage) is where *P.polymyxa* was used. Such are the cases where inoculation status affected the way available K responded to P-source. A combination of FYM addition and *B.megaterium* inoculation enhanced RP treatment to cause increased availability of K during the flowering stage.

RESULTS AND DISCUSSION

RESULTS AND DISCUSSION

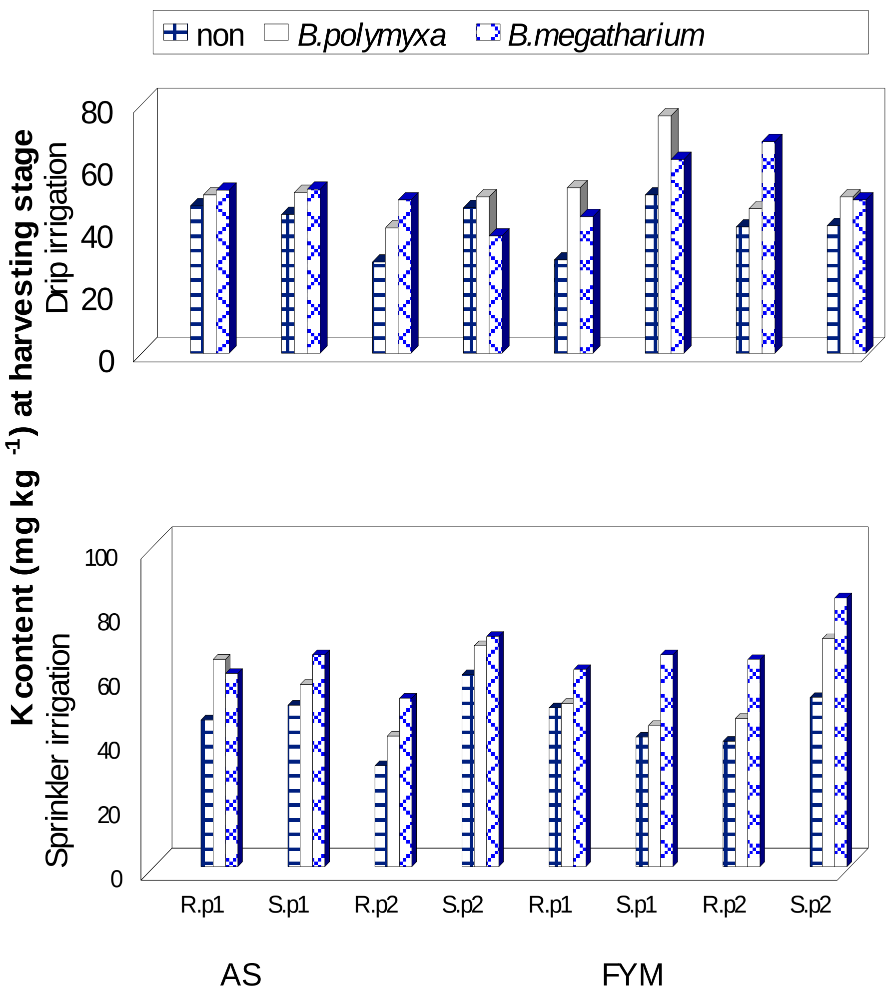
R.P=rockphosphate SP=super phosphate As ammonium sulphat
FYM= farmyard manure



Fig(11); ;Effect of micropial inoculation, N and P fertilization and farmyard application on K content of soil at flowering stage under drip and sprinkler irrigation.

RESULTS AND DISCUSSION

R.P=rockphosphate SP=super phosphate As ammonium sulphat
FYM= farmyard manure



Fig(12);;Effect of micropial inoculation, N and P fertilization and farmyard application on K content of soil at harvesting stage under drip and sprinkler irrigation.

RESULTS AND DISCUSSION

4.10: Effect on 100-grain weight and yield of maize grains.

4.10.1: Main effect of irrigation system.

Data in Table (11) and Fig (1) reveal that the average weight of 100-grain of maize under drip irrigation was 25.5 gm as compared with 24.9gm under sprinkler and showing a slight, but significant superiority of the drip over the sprinkler irrigation system. However the sprinkler system was much superior to the drip system giving a yield more than twice the yield given by the drip system. Yield given by the sprinkler averaged 6.18 metric tons / fed as compared with 2.68 metric tons / fed given by the drip system . This shows that the sprinkler system is more efficient to field crops such as maize **Prakashi et al. (1990), Ruzyczka and Gadek (1991)** reported that grain crops gave optimum yields under sprinkler irrigation systems.

4.10.2: Main effect of inoculation.

Results indicate that the 100-grain weight was increased by inoculation. The increase averaged 1.6 and 9.1 % due to *P. polymyxa* and *B.megaterium*, respectively. The grain yield also showed significant increase by inoculation. Averaging 40.4 and 52.9% due to *P.polymyxa* and *B.megaterium*, respectively. **Alagawadi and Gawr (1998)** examined the inoculation of sorghum using the N-fixing *Azospirillum bresilense* and the phosphate dissolving, *Pseudomonas strata* and *P.polymyxa* and their influence on yield of sorghum. They obtained an increase in the yield with more than one species in comparison with single species inoculation, indicating a positive enhancement due to combined inoculation. **El- Sayed (1998)** examined the influence of *Rhizobium* species and phosphate dissolving bacteria on nutrient uptake and yield of lentil in a newly reclaimed desert soils and found that inoculation of *R.leguminosarum* increased nodulation as well as nitrogenase activity. The same researcher used P-dissolving *Pseudomonas Striata* as well as *P. polymyxa* and obtained an increase in available phosphorus in soil. The combined inoculation increased plant growth, seed yield, and nitrogen and phosphorus uptake.

4.10.3: Main effect of nitrogen source.

Results indicate that both the weight of 100-maize grain and the grain yield under AS was significantly higher (by 9.7% higher) than under FYM. This shows that the inorganic source which is readily soluble supplies available N for plant utilization while the FYM acts as slow release source with regard to yield, results show that AS gave about 40.5% greater yield) than by FYM.**Bolt and Bruggen (1978)** showed that inorganic fertilizer represents a readily available source of nutrients for plant.

4.10.4: Main of phosphorus source.

Results indicate that the average weight of 100-maize grain amounted to 25.6 g and 24.8 g under SP and RP, respectively. There fore SP significantly surpassed RP effect, (by about 3.2 %). Regarding to yield of grains, SP gave very slight increase (insignificant) over RP effect.

4.10.5: Interaction between N-source and inoculation.

The superiority of AS over FYM in giving more (weight of 100-grain and yield) was particularly evident with *B. megaterium* inoculation. Treatments of *P. polymyxa* surpassed that of no inoculation under FYM and AS. **Kumaraswamy., et al (1992)** showed an increase in cane yield by the combined application of phosphate dissolving bacteria and FYM. **Grubiger (1992)** reported that soil organic matter and associated microbical activity have major role in the nutrient cycling process in soil through which nutrients availability and plant biomass production per unit cropped area increased mean while the loss in soil organic matter is reduced.

4.10.6: Interaction effect of P-source and inoculation.

Although the main effect indicates that SP surpassed RP by a bout 3.2% only , for this superiority was reduced more yield of a grains, However, there was a significant interaction for response to P sources, under inoculation. Under conditions of *B.megaterium* inoculation. SP effect surpassed RP (that of respect to weight of 100-grain and yield). Whereas under of *P.polymyxa* inoculation RP effect surpassed that of SP on grain yield **.Dubey and Billore (1992)** reported that the addition of rock phosphate combined and inoculation with phosphate solubilizing microorganisms increased yields of legumes and other field crops. **El-sayed (1995)** reported that seed or soil inoculation with phosphate solubilizing bacteria and simultaneous application of rock phosphate to soil have proved the reliability of RP to substitute for SP apparently without any reduction in crop yield.

RESULTS AND DISCUSSION

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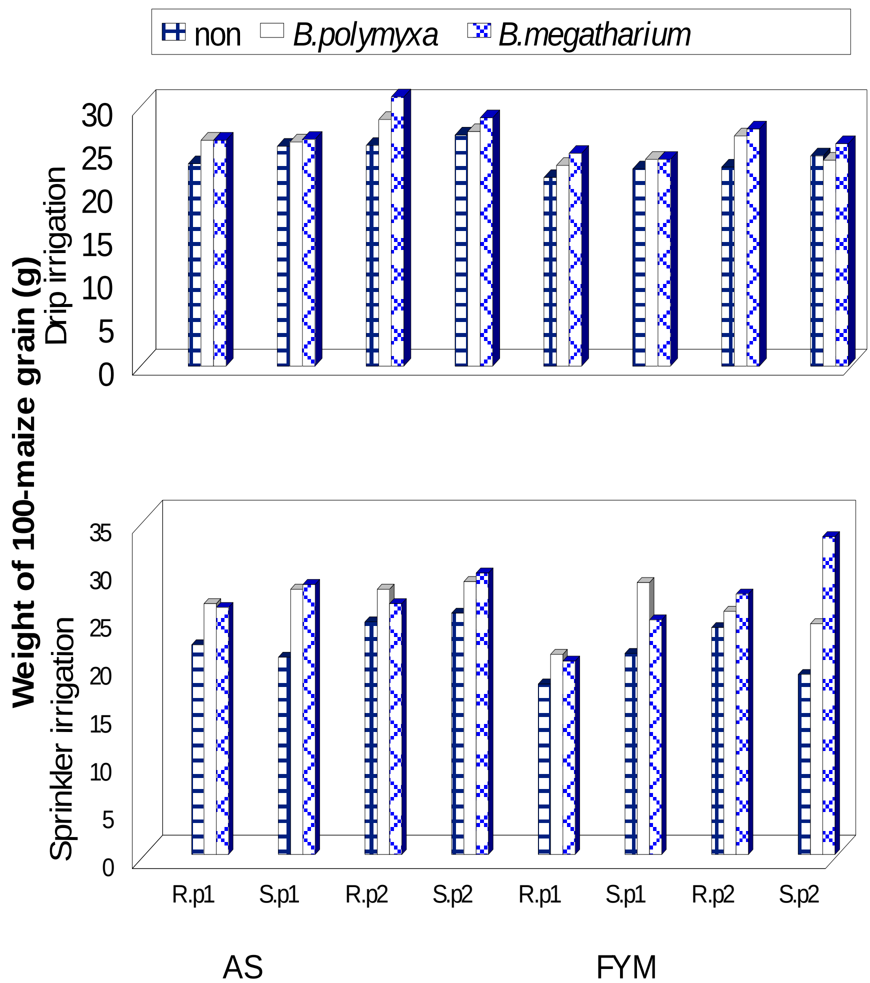
R.P=rockphosphate SP=super phosphate As ammonium sulphat
FYM= farmyard manure



Fig(13); ;Effect of micropial inoculation, N and P fertilization and farmyard application on weight of 100-maize grain under drip and sprinkler irrigation.

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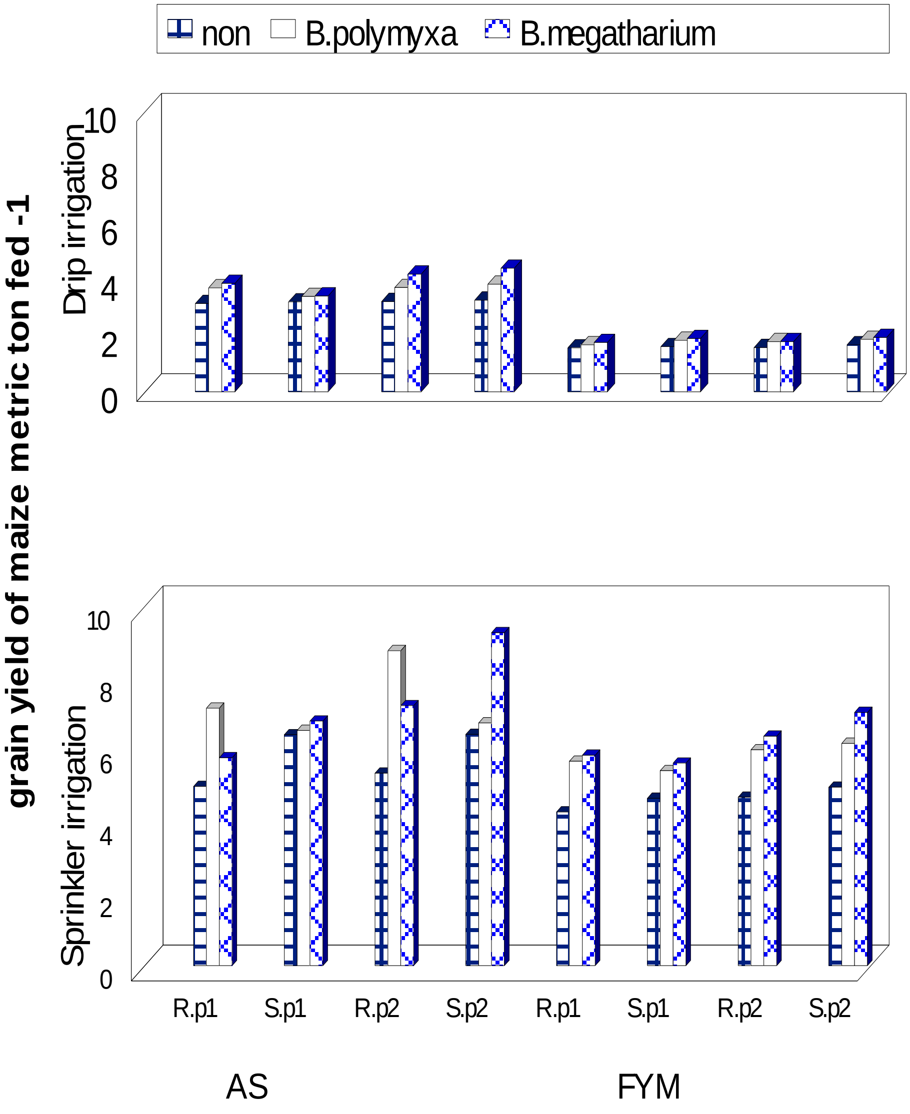

Fig(14);;Effect of micropial inoculation, N and P fertilization and famyard application on the grain yield under drip and sprinkler irrigation.

<u>RESULTS AND DISCUSSION</u>