Table 1 Some physical and chemical properties of the used experimental soils (Dar El-Ramad and Demo farms) through season 2007 and 2008

Soil properties	**Demo**				**Dar El- Ramad**	
	2007	2008	2007`	2008	2007	2008
Physical properties						
Coarse sand %	28.69	22.73	30.2	31.05	5.14	6.37
Fine sand %	37.19	31.66	42.33	40.38	21.55	19.4
Silt %	22.16	31.84	15.72	16.04	24.43	27.48
Clay %	11.96	13.77	11.75	12.53	48.88	46.75
Texture class	Sandy loam	Sandy loam	Loamy sand	Loamy sand	Clay	Clay
Chmical properties						
Organic matter %	0.48	0.38	0.41	0.4	1.69	1.43
CaCO3 %	8.61	7.83	7.42	7.69	5.82	5.12
pH (soil paste)	7.82	7.75	7.76	7.81	7.89	7.55
ECe (paste extract), ds/m	3.12	3.64	7.51	7.26	1.58	2.1
Soluble anions, meq/L*						
CO3--	….	….	….	….		
HCO3-	5.4	4.83	4.37	4.96	….	….
Cl-	12.35	15.42	38.93	35.43	2.24	3.83
SO4--	13.45	16.15	31.8	32.21	7.12	10.29
					6.44	6.88
Soluble cations, meq/L*						
Ca++						
Mg++	8.67	10.25	30.75	30.24		
Na+	6.89	7.32	17.41	14.39	6.15	7.43
K+	15.03	18.11	26.15	27.32	6.8	8.92
	0.61	0.72	0.79	0.65	2.13	3.8
Available nutrients, ppm**					0.72	0.85
N						
P	3.54	3.8	4.44	4.96		
K	6.87	6.59	6.42	6.42	21.02	22.16

	54	42	36	24	12.27	12.27

Table 2 Phosphorus and potassium fertilizers were applied during soil preparation

Application of mineral fertilization	**N**	**P**	**K**
	Ammonium sulfate (20.6% N)	**Calcium superphosphate (15% P2O5)**	**Potassium sulfate (48% K2O)**
100%	500 kg/fed	150 kg/fed	50 kg/fed
50%	250 kg/fed	75 kg/fed	25 kg/fed
25%	125 kg/fed	37.5 kg/fed	12.5 kg/fed

Table 3 Effect of bio and mineral fertilization as well as ascorbic acid and their interactions on N% in roselle herb under clay, sandy loam and saline loamy sand soils during the two successive seasons 2007 and 2008

Soil type	**Ascorbic acid**	**N% in roselle herb Fertilizer treatments Season (2007)**						**Season (2008)**						
		Non fertilizer	**Biofertilizers**	**100% NPK**	**Bio + 25% NPK**	**Bio + 50% NPK**	**Bio + 100% NPK**	**Mean**	**Non fertilizer**	**Biofertilizers**	**100% NPK**	**Bio + 25% NPK**	**Bio + 50% NPK**	**Bio + 100% NPK**	**Mean**
Clay	Zero	1.02	1.14	1.77	1.27	1.48	1.8	1.41	1.01	1.13	1.71	1.19	1.38	1.79	1.37
	400 ppm	1.05	1.19	1.84	1.29	1.68	1.98	1.51	1.08	1.2	1.83	1.3	1.68	1.84	1.49
mean		1.03	1.17	1.81	1.28	1.58	1.89	1.46	1.04	1.17	1.77	1.24	1.53	1.81	1.43
Sandy loam	Zero	0.95	1.1	1.7	1.26	1.42	1.71	1.36	0.93	1.06	1.62	1.22	1.38	1.67	1.31
	400 ppm	0.94	1.18	1.72	1.24	1.63	1.73	1.41	0.94	1.2	1.72	1.29	1.71	1.72	1.43
mean		0.94	1.14	1.71	1.25	1.53	1.72	1.38	0.94	1.13	1.67	1.26	1.54	1.69	1.37
Saline loamy sand	Zero	0.83	0.98	1.65	1.19	1.31	1.28	1.21	0.83	0.96	1.57	1.14	1.29	1.34	1.19
	400 ppm	0.93	1.18	1.72	1.24	1.62	1.68	1.39	0.96	1.18	1.7	1.24	1.63	1.63	1.39

mean		0.88	1.08	1.68	1.21	1.47	1.48	1.3	0.9	1.07	1.63	1.19	1.46	1.49	1.29
Mean of ascorbic acid	Zero	0.93	1.07	1.71	1.24	1.41	1.6	1.33	0.92	1.05	1.64	1.19	1.35	1.6	1.29
	400 ppm	0.97	1.18	1.76	1.26	1.65	1.8	1.44	0.99	1.2	1.75	1.28	1.67	1.73	1.44
G.MEAN		0.95	1.13	1.73	1.25	1.53	1.7	1.38	0.96	1.12	1.69	1.23	1.51	1.66	1.36
		S	F	A	S.F	S.A	F.A	S.F.A	S	F	A	S.F	S.A	F.A	S.F.A
LSD at															
5%		N. S.	0.07	N. S.	0.04	0.01	0.07	0.03	0.06	0.04	0.06	0.02	0.01	0.03	0.01
1%		N. S.	0.09	N. S.	0.05	0.02	0.1	0.04	0.1	0.05	N. S.	0.03	0.01	0.04	0.02

S= Soil F= Fertilizer A= Ascorbic acid

100% NPK (500 kg/fed ammonium sulfate + 150 kg/fed calcium super phosphate + 50 kg/fed potassium sulfate) and biofertilizers (Azotobacterine + phosphorein)

Table 4 Effect of bio and mineral fertilization as well as ascorbic acid and their interactions on P% in roselle herb under clay, sandy loam and saline loamy sand soils during the two successive seasons 2007 and 2008

Soil type	**Ascorbic acid**	**P% in roselle herb Fertilizer treatments Season (2007)**							**Season (2008)**						
		Non fertilizer	**Biofertilizers**	**100% NPK**	**Bio + 25% NPK**	**Bio + 50% NPK**	**Bio + 100% NPK**	**Mean**	**Non fertilizer**	**Biofertilizers**	**100% NPK**	**Bio + 25% NPK**	**Bio + 50% NPK**	**Bio + 100% NPK**	**Mean**
Clay	Zero	0.16	0.19	0.29	0.28	0.3	0.33	0.26	0.13	0.16	0.27	0.24	0.27	0.3	0.23
	400 ppm	0.18	0.21	0.33	0.29	0.32	0.34	0.28	0.16	0.19	0.31	0.27	0.3	0.31	0.26
mean		0.17	0.2	0.31	0.29	0.31	0.34	0.27	0.15	0.18	0.29	0.26	0.29	0.31	0.2

															4
Sandy loam	Zero	0.15	0.18	0.26	0.22	0.28	0.3	0.23	0.13	0.16	0.22	0.19	0.25	0.28	0.2
	400 ppm	0.18	0.18	0.3	0.24	0.3	0.31	0.25	0.15	0.17	0.29	0.22	0.28	0.3	0.2 3
mean		0.16	0.18	0.28	0.23	0.29	0.31	0.24	0.14	0.16	0.26	0.2	0.26	0.29	0.2 2
Saline loamy sand	Zero	0.13	0.15	0.28	0.2	0.26	0.3	0.22	0.11	0.13	0.26	0.17	0.24	0.27	0.2
	400 ppm	0.14	0.17	0.3	0.24	0.3	0.31	0.24	0.12	0.16	0.28	0.23	0.28	0.29	0.2 3
mean		0.13	0.16	0.29	0.22	0.28	0.3	0.23	0.11	0.14	0.27	0.2	0.26	0.28	0.2 1
Mean of ascorbic acid	Zero	0.14	0.17	0.28	0.23	0.28	0.31	0.24	0.12	0.15	0.25	0.2	0.25	0.28	0.2 1
	400 ppm	0.16	0.19	0.31	0.26	0.31	0.32	0.26	0.14	0.17	0.29	0.24	0.29	0.3	0.2 4
G.MEAN		0.15	0.18	0.29	0.24	0.29	0.32	0.25	0.13	0.16	0.27	0.22	0.27	0.29	0.2 3
		S	F	A	S.F	S.A	F.A	S.F. A	S	F	A	S.F	S.A	F.A	S. F. A
LSD at															
5%		N. S.	0.03	N. S.	0.02	N. S.	0.02	0.01	0.03	0.02	0.01	0.01	0.01	0.01	0.0 1
1%		N. S.	0.04	N. S.	0.03	N. S.	0.03	0.11	N. S.	0.03	0.02	0.01	0.02	0.02	0.0 1

S=soil
F= fertilizer
A= Ascorbic acid
100% NPK (500 kg/fed ammonium sulfate + 150 kg/fed calcium super phosphate + 50 kg/fed potassium sulfate) and biofertilizers (Azotobacterine + phosphorein)

Table 5 Effect of bio and mineral fertilization as well as ascorbic acid and their interactions on K% in of roselle herb under clay, sandy loam and saline loamy sand soils during the two successive seasons 2007 and 2008

Soil type	Ascorbic acid	K% in of roselle herb Fertilizer treatments Season (2007) Non fertilizer	Biofertilizers	100% NPK	Bio + 25% NPK	Bio + 50% NPK	Bio + 100% NPK	Mean	Season (2008) Non fertilizer	Biofertilizers	100% NPK	Bio + 25% NPK	Bio + 50% NPK	Bio + 100% NPK	Mean
Clay	Zero	1.27	1.42	2.56	1.73	2.03	2.56	1.93	1.24	1.4	2.43	1.7	2	2.42	1.86
	400 ppm	1.3	1.46	2.62	1.82	2.08	2.62	1.98	1.32	1.57	2.64	1.89	2.42	2.6	2.07
mean		1.29	1.44	2.59	1.77	2.05	2.59	1.96	1.28	1.49	2.53	1.79	2.21	2.51	1.97
Sandy loam	Zero	0.98	1.3	2.25	1.42	2.02	2.36	1.72	0.94	1.23	2.12	1.39	1.98	2.3	1.66
	400 ppm	1.17	1.43	2.51	1.78	2.11	2.49	1.91	1.19	1.51	2.57	1.82	2.17	2.5	1.96
mean		1.08	1.36	2.38	1.6	2.06	2.43	1.82	1.07	1.37	2.35	1.61	2.07	2.4	1.81
Saline loamy sand	Zero	0.76	1.03	2.18	1.38	1.95	2.23	1.59	0.71	0.98	2.12	1.4	1.88	2.16	1.54
	400 ppm	1.14	1.41	2.52	1.77	2.1	2.45	1.94	1.2	1.49	2.58	1.82	2.12	2.46	1.74
mean		0.95	1.22	2.35	1.57	2.03	2.34	1.74	0.96	1.23	2.35	1.61	2	2.31	1.74
Mean of ascorbic acid	Zero	1.01	1.25	2.33	1.51	2	2.38	1.75	0.97	1.21	2.22	1.49	1.95	2.29	1.69
	400 ppm	1.2	1.43	2.55	1.79	2.1	2.52	1.93	1.24	1.52	2.6	1.85	2.23	2.52	1.99
G.MEAN		1.1	1.34	2.44	1.65	2.05	2.45	1.84	1.1	1.36	2.41	1.67	2.09	2.41	1.84

LSD at	S	F	A	S.F	S.A	F.A	S.F.A	S	F	A	S.F	S.A	F.A	S.F.A
5%	0.19	0.07	0.14	0.04	0.02	0.05	0.03	0.11	0.04	0.15	0.02	0.02	0.03	0.01
1%	N. S.	0.09	N. S.	0.05	0.03	0.06	0.04	0.17	0.05	N. S.	0.03	0.03	0.04	0.01

S= Soil
F= fertilizer
A= Ascorbic acid
100% NPK (500 kg/fed ammonium sulfate + 150 kg/fed calcium super phosphate + 50 kg/fed potassium sulfate) and biofertilizers (Azotobacterine + phosphorein)

Table 6 Effect of bio and mineral fertilization as well as ascorbic acid and their interactions on N uptake of roselle plants under clay, sandy loam and saline loamy sand soils during the two successive seasons 2007 and 2008

Soil type	**Ascorbic acid**	**N uptake kg/fed Fertilizer treatments Season (2007)**							**Season (2008)**						
		Non fertilizer	**Biofertilizers**	**100% NPK**	**Bio + 25% NPK**	**Bio + 50% NPK**	**Bio + 100% NPK**	**Mean**	**Non fertilizer**	**Biofertilizers**	**100% NPK**	**Bio + 25% NPK**	**Bio + 50% NPK**	**Bio + 100% NPK**	**Mean**
Clay	**Zero**	**38**	**57**	**101**	**63**	**86**	**107**	**75**	**38**	**55**	**98**	**60**	**80**	**106**	**73**
	400 ppm	43	62	116	67	108	128	87	45	64	118	67	109	117	86
mean		41	59	109	65	97	117	81	41	60	108	63	94	111	80
Sandy loam	Zero	33	47	91	59	74	93	66	30	43	84	58	70	88	62
	400 ppm	36	51	100	62	89	95	72	35	50	93	63	91	94	71
mean		35	49	95	61	81	94	69	32	47	89	60	80	91	67

Saline loamy sand	Zero	24	37	77	48	61	63	51	23	34	72	44	58	65	49
	400 ppm	33	52	93	53	83	90	67	33	52	90	52	82	85	66
mean		28	44	85	50	72	77	59	28	43	81	48	70	75	58
Mean of ascorbic acid	Zero	32	47	90	57	73	87	64	31	44	85	54	69	86	61
	400 ppm	37	55	103	61	93	104	76	37	55	100	61	94	99	74
G.MEAN		34	51	96	59	83	96	70	34	50	92	57	82	92	68
		S	F	A	S.F	S.A	F.A	S. F. A	S	F	A	S.F	S.A	F.A	S. F. A
LSD at															
5%		N. S.	6	N. S.	5	1	10	2	12	4	5	2	1	2	1
1%		N. S.	8	N. S.	7	2	14	4	21	5	8	3	2	3	2

S= Soil
F= fertilizer
A= Ascorbic acid
100% NPK (500 kg/fed ammonium sulfate + 150 kg/fed calcium super phosphate + 50 kg/fed potassium sulfate) and biofertilizers (Azotobacterine + phosphorein)

Table 7 Effect of bio and mineral fertilization as well as ascorbic acid and their interactions on P uptake of roselle plants under clay, sandy loam and saline loamy sand soils during the two successive seasons 2007 and 2008

Soil type	Ascorbic acid	P uptake kg/fed Fertilizer treatments Season (2007) Non fertilizer	Biofertilizers	100% NPK	Bio + 25% NPK	Bio + 50% NPK	Bio + 100% NPK	Mean	Season (2008) Non fertilizer	Biofertilizers	100% NPK	Bio + 25% NPK	Bio + 50% NPK	Bio + 100% NPK	Mean
Clay	Zero	6	9.2	16.7	14.2	17.2	19.3	13.8	5.7	8.8	16.6	14	16.8	19	13.5
	400 ppm	7.3	10.8	20.6	14.9	20.6	22.2	16.1	7.5	11.1	21.2	14.9	20.6	21	16.1
mean		6.6	10	18.6	14.6	18.9	20.8	14.9	6.6	10	18.9	14.5	18.7	20	14.8
Sandy loam	Zero	5.2	7.8	13.7	10.3	14.5	16.5	11.3	4.8	7.2	12.6	9.9	13.4	15.9	10.6
	400 ppm	6.7	7.9	17.6	11.8	16.1	17.2	12.9	6.3	7.8	16.6	11.6	15.9	17.5	12.6
mean		5.9	7.9	15.6	11.1	15.3	16.8	12.1	5.5	7.5	14.6	10.8	14.7	16.7	11.6
Saline loamy sand	Zero	3.6	5.6	13.2	7.9	12	14.6	9.5	3.5	5.2	12.7	7.4	11.7	14.1	9.1
	400 ppm	4.8	7.5	16.3	10.3	15.3	16.6	11.8	4.8	7.9	16	10.6	15.1	16.1	11.7
mean		4.2	6.6	14.8	9.1	13.7	15.6	10.7	4.2	6.5	14.3	9	13.4	15.1	10.4

Mean of ascorbic acid	Zero	4.9	7.6	14.5	10.8	14.6	16.8	11.5	4.7	7.1	14	10.4	14	16.3	11.1
	400 ppm	6.3	8.8	18.2	12.3	17.4	18.6	13.6	6.2	8.9	17.9	12.4	17.2	18.2	13.5
G.MEAN		5.6	8.2	16.4	11.6	16	17.7	12.6	5.4	8	15.9	11.4	15.6	17.3	12.3
LSD at		S	F	A	S.F	S.A	F.A	S.F. A	S	F	A	S.F	S.A	F.A	S.F.A
5%		N. S.	2.9	N. S.	1.2	N. S.	1.3	0.7	4	1.8	2.1	2	1.4	1	0.6
1%		N. S.	4	N. S.	1.7	N. S.	2	1.7	N. S.	2	N. S.	2.1	1.5	2	0.7

S= Soil
F= fertilizer
A= Ascorbic acid
100% NPK (500 kg/fed ammonium sulfate + 150 kg/fed calcium super phosphate + 50 kg/fed potassium sulfate) and biofertilizers (Azotobacterine + phosphorein)

Table 8 Effect of bio and mineral fertilization as well as ascorbic acid and their interactions on K uptake of roselle plants under clay, sandy loam and saline loamy sand soils during the two successive seasons 2007 and 2008

Soil type	**Ascorbic acid**	**K uptake kg/fed Fertilizer treatments**													
		Season (2007)							**Season (2008)**						
		Non fertilizer	**Biofertilizers**	**100% NPK**	**Bio + 25% NPK**	**Bio + 50% NPK**	**Bio + 100% NPK**	**Mean**	**Non fertilizer**	**Biofertilizers**	**100% NPK**	**Bio + 25% NPK**	**Bio + 50% NPK**	**Bio + 100% NPK**	**Mean**
Clay	Zero	48	70	146	86	117	151	103	47	69	139	85	116	144	100
	400 ppm	54	77	165	94	134	169	115	55	83	170	98	156	165	121
mean		51	73	155	90	126	160	109	51	76	154	91	136	154	110

Sandy loam	Zero	35	56	120	67	105	128	85	31	50	110	65	100	122	80
	400 ppm	44	62	146	89	115	137	99	44	63	139	90	115	137	98
mean		40	59	133	78	110	133	92	37	57	125	78	107	129	89
Saline loamy sand	Zero	22	39	102	55	90	110	70	20	35	97	54	85	105	66
	400 ppm	40	62	137	76	107	131	92	41	65	137	77	107	128	93
mean		31	51	120	66	99	120	81	31	50	117	66	96	116	79
Mean of ascorbic acid	Zero	35	55	123	70	104	130	86	33	51	115	68	100	123	82
	400 ppm	46	67	149	86	119	146	102	47	70	149	88	126	143	104
G.MEAN		40	61	136	78	111	138	94	40	61	132	78	113	133	93
		S	F	A	S.F	S.A	F.A	S.F.A	S	F	A	S.F	S.A	F.A	S.F.A
LSD at 5%		24	6	12	4	2	3	2	15	3	11	2	2	2	1
1%		N. S.	8	N. S.	5	4	4	3	23	4	N. S.	2	3	3	1

S= Soil
F= fertilizer
A= Ascorbic acid
100% NPK (500 kg/fed ammonium sulfate + 150 kg/fed calcium super phosphate + 50 kg/fed potassium sulfate) and biofertilizers (Azotobacterine + phosphorein)

Table 9 Effect of bio and mineral fertilization as well as ascorbic acid and their interactions on N uptake of roselle plants under clay, sandy loam and saline loamy sand soils during the two successive seasons 2007 and 2008

Soil type	Ascorbic acid	N uptake kg/fed Fertilizer treatments Season (2007)							Season (2008)						
		Non fertilizer	Biofertilizers	100% NPK	Bio + 25% NPK	Bio + 50% NPK	Bio + 100% NPK	Mean	Non fertilizer	Biofertilizers	100% NPK	Bio + 25% NPK	Bio + 50% NPK	Bio + 100% NPK	Mean
Clay	**Zero**	**38**	**57**	**101**	**63**	**86**	**107**	**75**	**38**	**55**	**98**	**60**	**80**	**106**	**73**
	400 ppm	43	62	116	67	108	128	87	45	64	118	67	109	117	86
mean		41	59	109	65	97	117	81	41	60	108	63	94	111	80
Sandy loam	Zero	33	47	91	59	74	93	66	30	43	84	58	70	88	62
	400 ppm	36	51	100	62	89	95	72	35	50	93	63	91	94	71
mean		35	49	95	61	81	94	69	32	47	89	60	80	91	67
Saline loamy sand	Zero	24	37	77	48	61	63	51	23	34	72	44	58	65	49
	400 ppm	33	52	93	53	83	90	67	33	52	90	52	82	85	66
mean		28	44	85	50	72	77	59	28	43	81	48	70	75	58
Mean of ascorbic acid	Zero	32	47	90	57	73	87	64	31	44	85	54	69	86	61
	400 ppm	37	55	103	61	93	104	76	37	55	100	61	94	99	74
G.MEAN		34	51	96	59	83	96	70	34	50	92	57	82	92	68
		S	F	A	S.F	S.A	F.A	S.F.A	S	F	A	S.F	S.A	F.A	S.F.A

LSD at 5%		N. S.	6	N. S.	5	1	10	2	12	4	5	2	1	2	1
1%		N. S.	8	N. S.	7	2	14	4	21	5	8	3	2	3	2

S= Soil
F= fertilizer
A= Ascorbic acid
100% NPK (500 kg/fed ammonium sulfate + 150 kg/fed calcium super phosphate + 50 kg/fed potassium sulfate) and biofertilizers (Azotobacterine + phosphorein)

Table 10 Effect of bio and mineral fertilization as well as ascorbic acid and their interactions on P uptake of roselle plants under clay, sandy loam and saline loamy sand soils during the two successive seasons 2007 and 2008

Soil type	**Ascorbic acid**	**P uptake kg/fed Fertilizer treatments Season (2007) Non fertilizer**	**Biofertilizers**	**100% NPK**	**Bio + 25% NPK**	**Bio + 50% NPK**	**Bio + 100% NPK**	**Mean**	**Season (2008) Non fertilizer**	**Biofertilizers**	**100% NPK**	**Bio + 25% NPK**	**Bio + 50% NPK**	**Bio + 100% NPK**	**Mean**
Clay	Zero	6	9.2	16.7	14.2	17.2	19.3	13.8	5.7	8.8	16.6	14	16.8	19	13.5
	400 ppm	7.3	10.8	20.6	14.9	20.6	22.2	16.1	7.5	11.1	21.2	14.9	20.6	21	16.1
mean		6.6	10	18.6	14.6	18.9	20.8	14.9	6.6	10	18.9	14.5	18.7	20	14.8
Sandy loam	Zero	5.2	7.8	13.7	10.3	14.5	16.5	11.3	4.8	7.2	12.6	9.9	13.4	15.9	10.6
	400 ppm	6.7	7.9	17.6	11.8	16.1	17.2	12.9	6.3	7.8	16.6	11.6	15.9	17.5	12.6
mean		5.9	7.9	15.6	11.1	15.3	16.8	12.1	5.5	7.5	14.6	10.8	14.7	16.7	11.6
Saline loamy sand	Zero	3.6	5.6	13.2	7.9	12	14.6	9.5	3.5	5.2	12.7	7.4	11.7	14.1	9.1
	400 ppm	4.8	7.5	16.3	10.3	15.3	16.6	11.8	4.8	7.9	16	10.6	15.1	16.1	11.7
mean		4.2	6.6	14.8	9.1	13.7	15.6	10.7	4.2	6.5	14.3	9	13.4	15.1	10.4

Mean of ascorbic acid	Zero	4.9	7.6	14.5	10.8	14.6	16.8	11.5	4.7	7.1	14	10.4	14	16.3	11.1
	400 ppm	6.3	8.8	18.2	12.3	17.4	18.6	13.6	6.2	8.9	17.9	12.4	17.2	18.2	13.5
G.MEAN		5.6	8.2	16.4	11.6	16	17.7	12.6	5.4	8	15.9	11.4	15.6	17.3	12.3
LSD at		S	F	A	S.F	S.A	F.A	S.F.A	S	F	A	S.F	S.A	F.A	S.F.A
5%		N. S.	2.9	N. S.	1.2	N. S.	1.3	0.7	4	1.8	2.1	2	1.4	1	0.6
1%		N. S.	4	N. S.	1.7	N. S.	2	1.7	N. S.	2	N. S.	2.1	1.5	2	0.7

S= Soil
F= fertilizer
A= Ascorbic acid
100% NPK (500 kg/fed ammonium sulfate + 150 kg/fed calcium super phosphate + 50 kg/fed potassium sulfate) and biofertilizers (Azotobacterine + phosphorein)

Table 11 Effect of bio and mineral fertilization as well as ascorbic acid and their interactions on K uptake of roselle plants under clay, sandy loam and saline loamy sand soils during the two successive seasons 2007 and 2008

Soil type	**Ascorbic acid**	**K uptake kg/fed Fertilizer treatments Season (2007)**							**Season (2008)**						
		Non fertilizer	**Biofertilizers**	**100% NPK**	**Bio + 25% NPK**	**Bio + 50% NPK**	**Bio + 100% NPK**	**Mean**	**Non fertilizer**	**Biofertilizers**	**100% NPK**	**Bio + 25% NPK**	**Bio + 50% NPK**	**Bio + 100% NPK**	**Mean**
Clay	Zero	48	70	146	86	117	151	103	47	69	139	85	116	144	100
	400 ppm	54	77	165	94	134	169	115	55	83	170	98	156	165	121
mean		51	73	155	90	126	160	109	51	76	154	91	136	154	110
Sandy loam	Zero	35	56	120	67	105	128	85	31	50	110	65	100	122	80
	400 ppm	44	62	146	89	115	137	99	44	63	139	90	115	137	98

mean		40	59	133	78	110	133	92	37	57	125	78	107	129	89
Saline loamy sand	Zero	22	39	102	55	90	110	70	20	35	97	54	85	105	66
	400 ppm	40	62	137	76	107	131	92	41	65	137	77	107	128	93
mean		31	51	120	66	99	120	81	31	50	117	66	96	116	79
Mean of ascorbic acid	Zero	35	55	123	70	104	130	86	33	51	115	68	100	123	82
	400 ppm	46	67	149	86	119	146	10 2	47	70	149	88	126	143	10 4
G.MEAN		40	61	136	78	111	138	94	40	61	132	78	113	133	93
		S	F	A	S.F	S.A	F.A	S. F. A	S	F	A	S.F	S.A	F.A	S. F. A
LSD at 5%		24	6	12	4	2	3	2	15	3	11	2	2	2	1
1%		N. S.	8	N. S.	5	4	4	3	23	4	N. S.	2	3	3	1

S= Soil
F= fertilizer
A= Ascorbic acid
100% NPK (500 kg/fed ammonium sulfate + 150 kg/fed calcium super phosphate + 50 kg/fed potassium sulfate) and biofertilizers (Azotobacterine + phosphorein)

Table 12 Effect of bio and mineral fertilization as well as ascorbic acid and their interactions on chlorophyll a of roselle plants under clay, sandy loam and saline loamy sand soils during the two successive seasons 2007 and 2008

Soil type	**Ascorbic acid**	**Chlorophyll a (mg/g F. W.) Fertilizer treatments Season (2007)**							**Season (2008)**						
		Non fertilizer	**Biofertilizers**	**100% NPK**	**Bio + 25% NPK**	**Bio + 50% NPK**	**Bio + 100% NPK**	**Mean**	**Non fertilizer**	**Biofertilizers**	**100% NPK**	**Bio + 25% NPK**	**Bio + 50% NPK**	**Bio + 100% NPK**	**Mean**
Clay	Zero	0.53	0.56	0.93	0.66	0.77	0.97	0.74	0.52	0.55	0.92	0.65	0.75	0.95	0.72
	400 ppm	0.55	0.58	0.96	0.68	0.84	0.98	0.76	0.55	0.59	0.96	0.69	0.88	0.98	0.77

mean		0.54	0.57	0.94	0.67	0.8	0.97	0.75	0.54	0.57	0.94	0.67	0.82	0.97	0.75
Sandy loam	Zero	0.49	0.52	0.67	0.59	0.71	0.73	0.62	0.48	0.51	0.67	0.58	0.7	0.72	0.61
	400 ppm	0.52	0.59	0.72	0.59	0.72	0.73	0.65	0.53	0.59	0.75	0.61	0.73	0.74	0.66
mean		0.51	0.56	0.7	0.59	0.72	0.73	0.63	0.51	0.55	0.71	0.6	0.72	0.73	0.63
Saline loamy sand	Zero	0.48	0.5	0.66	0.54	0.61	0.61	0.57	0.43	0.49	0.65	0.54	0.67	0.7	0.58
	400 ppm	0.58	0.59	0.73	0.67	0.71	0.72	0.67	0.52	0.58	0.73	0.61	0.71	0.72	0.64
mean		0.53	0.55	0.7	0.6	0.66	0.67	0.62	0.47	0.53	0.69	0.58	0.69	0.71	0.61
Mean of ascorbic acid	Zero	0.5	0.53	0.75	0.6	0.69	0.77	0.64	0.48	0.52	0.74	0.59	0.71	0.79	0.64
	400 ppm	0.55	0.58	0.8	0.65	0.76	0.81	0.69	0.53	0.58	0.81	0.64	0.77	0.81	0.69
G.MEAN		0.53	0.56	0.78	0.62	0.73	0.79	0.67	0.51	0.55	0.78	0.61	0.74	0.8	0.66
		S	F	A	S.F	S.A	F.A	S.F.A	S	F	A	S.F	S.A	F.A	S.F.A
LSD at 5%		N. S.	0.05	0.05	0.03	0.02	N. S.	0.02	0.07	0.03	0.03	0.02	0.01	0.02	0.01
1%		N. S.	0.07	N. S.	0.04	0.04	N. S.	0.03	0.11	0.04	N. S.	0.02	0.02	0.03	0.02

S= Soil
F= fertilizer
A= Ascorbic acid
100% NPK (500 kg/fed ammonium sulfate + 150 kg/fed calcium super phosphate + 50 kg/fed potassium sulfate) and biofertilizers (Azotobacterine + phosphorein)

Table 13 Effect of bio and mineral fertilization as well as ascorbic acid and their interactions on chlorophyll b of roselle plants under clay, sandy loam and saline loamy sand soils during the two successive seasons 2007 and 2008

Soil type	Ascorbic acid	Chlorophyll b (mg/g F. W.) Fertilizer treatments Season (2007) Non fertilizer	Biofertilizers	100% NPK	Bio + 25% NPK	Bio + 50% NPK	Bio + 100% NPK	Mean	Season (2008) Non fertilizer	Biofertilizers	100% NPK	Bio + 25% NPK	Bio + 50% NPK	Bio + 100% NPK	Mean
Clay	Zero	0.35	0.37	0.41	0.4	0.41	0.41	0.39	0.34	0.37	0.41	0.39	0.4	0.4	0.39
	400 ppm	0.37	0.39	0.45	0.4	0.42	0.44	0.41	0.37	0.39	0.47	0.4	0.42	0.43	0.41
mean		0.36	0.38	0.43	0.4	0.41	0.42	0.4	0.36	0.38	0.44	0.4	0.41	0.42	0.4
Sandy loam	Zero	0.3	0.32	0.35	0.33	0.34	0.35	0.33	0.3	0.31	0.35	0.32	0.33	0.34	0.33
	400 ppm	0.31	0.32	0.38	0.35	0.35	0.35	0.34	0.31	0.32	0.39	0.35	0.36	0.36	0.35
mean		0.31	0.32	0.36	0.34	0.35	0.35	0.34	0.3	0.32	0.37	0.34	0.35	0.35	0.34
Saline loamy sand	Zero	0.29	0.3	0.33	0.32	0.33	0.33	0.32	0.28	0.3	0.33	0.31	0.33	0.33	0.31
	400 ppm	0.3	0.31	0.35	0.33	0.35	0.34	0.33	0.3	0.32	0.36	0.34	0.36	0.36	0.34
mean		0.3	0.31	0.34	0.33	0.34	0.34	0.32	0.29	0.31	0.35	0.32	0.34	0.35	0.33
Mean of ascorbic acid	Zero	0.31	0.33	0.36	0.35	0.36	0.36	0.35	0.31	0.33	0.36	0.34	0.35	0.36	0.34
	400 ppm	0.33	0.34	0.39	0.36	0.37	0.38	0.36	0.33	0.34	0.41	0.36	0.38	0.38	0.37
G.MEAN		0.32	0.34	0.38	0.36	0.37	0.37	0.35	0.32	0.34	0.39	0.35	0.37	0.37	0.35
		S	F	A	S.F	S.A	F.A	S.F.A	S	F	A	S.F	S.A	F.A	S.F.A
LSD at 5%		0.06	0.03	N. S.	0.02	N. S.	0.02	0.01	0.03	0.02	0.03	0.01	0.01	0.01	0.01

1%		N. S.	0.04	N. S.	0.02	N. S.	0.03	0.02	0.05	0.03	N. S.	0.01	0.01	0.01	0.01

S= Soil
F= fertilizer
A= Ascorbic acid
100% NPK (500 kg/fed ammonium sulfate + 150 kg/fed calcium super phosphate + 50 kg/fed potassium sulfate) and biofertilizers (Azotobacterine + phosphorein)

Table 14 Effect of bio and mineral fertilization as well as ascorbic acid and their interactions on carotenoids of rosell plants under clay, sandy loam and saline loamy sand soils during the two successive seasons 2007 and 2008

Soil type	**Ascorbic acid**	**Carotenoids (mg/g F. W.) Fertilizer treatments Season (2007) Non fertilizer**	**Biofertilizers**	**100% NPK**	**Bio + 25% NPK**	**Bio + 50% NPK**	**Bio + 100% NPK**	**Mean**	**Season (2008) Non fertilizer**	**Biofertilizers**	**100% NPK**	**Bio + 25% NPK**	**Bio + 50% NPK**	**Bio + 100% NPK**	**Mean**
Clay	Zero	0.36	0.37	0.47	0.4	0.57	0.6	0.46	0.33	0.34	0.44	0.37	0.54	0.58	0.43
	400 ppm	0.38	0.39	0.5	0.44	0.59	0.61	0.49	0.36	0.37	0.49	0.44	0.58	0.6	0.47
mean		0.37	0.38	0.49	0.42	0.58	0.61	0.47	0.35	0.36	0.47	0.41	0.56	0.59	0.45
Sandy loam	Zero	0.33	0.36	0.43	0.38	0.49	0.58	0.43	0.32	0.35	0.41	0.37	0.47	0.57	0.42
	400 ppm	0.37	0.38	0.53	0.43	0.53	0.58	0.47	0.37	0.39	0.55	0.44	0.55	0.58	0.48
mean		0.35	0.37	0.48	0.41	0.51	0.58	0.45	0.34	0.37	0.48	0.41	0.51	0.57	0.45
Saline loamy sand	Zero	0.3	0.32	0.44	0.39	0.48	0.54	0.41	0.3	0.33	0.39	0.35	0.45	0.55	0.4
	400 ppm	0.33	0.39	0.54	0.43	0.54	0.56	0.46	0.35	0.37	0.53	0.42	0.53	0.56	0.46
mean		0.32	0.36	0.49	0.41	0.51	0.55	0.44	0.32	0.35	0.46	0.39	0.49	0.55	0.43
Mean of ascorbic acid	Zero	0.33	0.35	0.45	0.39	0.51	0.58	0.44	0.31	0.34	0.42	0.37	0.49	0.57	0.41
	400 ppm	0.36	0.39	0.52	0.43	0.55	0.58	0.47	0.36	0.38	0.52	0.43	0.55	0.58	0.47

G.MEAN		0.35	0.37	0.49	0.41	0.53	0.58	0.45	0.34	0.36	0.47	0.4	0.52	0.57	0.44
		S	F	A	S.F	S.A	F.A	S.F.A	S	F	A	S.F	S.A	F.A	S.F.A
LSD at															
5%		N. S.	0.05	0.03	0.03	0.01	0.03	0.02	0.02	0.02	0.05	0.01	0.01	0.01	0.01
1%		N. S.	0.06	N. S.	0.04	0.02	0.05	0.03	0.03	0.02	N. S.	0.01	0.01	0.01	0.01

S= Soil
F= fertilizer
A= Ascorbic acid
100% NPK (500 kg/fed ammonium sulfate + 150 kg/fed calcium super phosphate + 50 kg/fed potassium sulfate) and biofertilizers (Azotobacterine + phosphorein)

Table 15 Effect of bio and mineral fertilization as well as ascorbic acid and their interactions on anthocyanin content of roselle plants under clay, sandy loam and saline loamy sand soils during the two successive seasons 2007 and 2008

Soil type	**Ascorbic acid**	**Anthocyanin content (mg/g) Fertilizer treatments Season (2007)**							**Season (2008)**						
		Non fertilizer	**Biofertilizers**	**100% NPK**	**Bio + 25% NPK**	**Bio + 50% NPK**	**Bio + 100% NPK**	**Mean**	**Non fertilizer**	**Biofertilizers**	**100% NPK**	**Bio + 25% NPK**	**Bio + 50% NPK**	**Bio + 100% NPK**	**Mean**
Clay	Zero	14.27	16.18	19.01	17.1	18.65	20.2	17.57	12.63	15.07	17.34	15.81	17.31	18.72	16.15
	400 ppm	14.96	16.88	21.2	17.86	20.83	21.15	18.81	14.3	16.4	20.59	17.34	20.34	20.46	18.24
mean		14.61	16.53	20.11	17.48	19.74	20.68	18.19	13.47	15.75	18.97	16.58	18.83	19.59	17.2
Sandy loam	Zero	12.28	14.19	17.04	14.97	16.65	18.2	15.55	11.28	12.86	15.64	13.5	15.31	16.66	14.21
	400 ppm	12.81	14.86	19.21	15.86	18.83	19.19	16.79	12.47	13.7	18.54	15.53	17.27	18.19	15.95
mean		12.54	14.52	18.13	15.41	17.74	18.7	16.17	11.88	13.27	17.09	14.51	16.29	17.43	15.08

Saline loamy sand	Zero	10.24	11.2	13.66	12.53	14.54	15.84	13	9.07	10.33	12.4	11.11	13.3	14.29	11.75
	400 ppm	12.75	14.86	19.33	15.87	18.84	19.18	16.81	11.64	13.6	18.6	15.51	17.76	17.84	15.83
mean		11.49	13.03	16.5	14.2	16.69	17.51	14.9	10.35	11.97	15.5	13.31	15.53	16.07	13.79
Mean of ascorbic acid	Zero	12.26	13.86	16.57	14.87	16.61	18.08	15.37	10.99	12.75	15.13	13.48	15.31	16.56	14.04
	400 ppm	13.5	15.53	19.91	16.53	19.5	19.84	17.47	12.8	14.58	19.24	16.12	18.46	18.83	16.67
G.MEAN		12.88	14.7	18.24	15.7	18.06	18.96	16.42	11.9	13.66	17.19	14.8	16.88	17.69	15.35
LSD at		S	F	A	S.F	S.A	F.A	S.F.A	S	F	A	S.F	S.A	F.A	S.F.A
5%		1.59	1.18	2.02	N. S.	0.59	0.83	0.48	2.44	1.14	2.13	0.66	0.36	0.81	0.47
1%		2.63	1.57	N. S.	N. S.	0.89	1.11	0.64	N. S.	1.52	N. S.	0.88	0.54	1.08	0.62

S= Soil
F= fertilizer
A= Ascorbic acid
100% NPK (500 kg/fed ammonium sulfate + 150 kg/fed calcium super phosphate + 50 kg/fed potassium sulfate) and biofertilizers (Azotobacterine + phosphorein)

Table 16 Effect of bio and mineral fertilization as well as ascorbic acid and their interactions on pH values of rosell plants under clay, sandy loam and saline loamy sand soils during the two successive seasons 2007 and 2008

Soil type	**Ascorbic acid**	**pH values**	**Fertilizer treatments**												
		Season (2007)							**Season (2008)**						
		Non fertilizer	**Biofertilizers**	**100% NPK**	**Bio + 25% NPK**	**Bio + 50% NPK**	**Bio + 100% NPK**	**Mean**	**Non fertilizer**	**Biofertilizers**	**100% NPK**	**Bio + 25% NPK**	**Bio + 50% NPK**	**Bio + 100% NPK**	**Mean**
Clay	Zero	2.49	2.49	3.3	2.55	3.25	3.72	2.97	2.12	2.41	3.16	2.25	3.15	3.64	2.79
	400 ppm	2.93	3.18	3.91	2.98	3.76	4.07	3.47	2.92	3.38	3.94	2.96	3.85	3.93	3.5
mean		2.71	2.83	3.6	2.77	3.51	3.9	3.2	2.52	2.9	3.55	2.6	3.5	3.79	3.1

								2						4
								2.8						2.6
Sandy loam	Zero	2.44	2.46	3.29	2.53	3.16	3.23	5	2.07	2.16	3.05	2.22	3.15	3.3	6
	400							3.1						3.0
	ppm	2.92	2.97	3.47	2.91	3.26	3.36	5	2.48	2.74	3.43	2.94	3.41	3.43	7
								2.8						2.8
mean		2.68	2.72	3.38	2.72	3.21	3.29	3	2.28	2.45	3.24	2.58	3.28	3.36	7
Saline								2.5						2.4
loamy sand	Zero	2.12	2.16	2.96	2.2	2.86	2.93	4	2	2.11	2.93	2.13	2.76	2.9	7
	400							3.0						2.8
	ppm	2.81	2.84	3.22	2.82	3.13	3.24	1	2.41	2.57	3.16	2.82	3.11	3.29	9
								2.7						2.6
mean		2.47	2.5	3.09	2.51	3	3.09	7	2.2	2.34	3.05	2.48	2.93	3.09	8
Mean of ascorbic															
								2.7						2.6
acid	Zero	2.35	2.37	3.18	2.43	3.09	3.29	9	2.06	2.23	3.05	2.2	3.02	3.28	4
	400							3.2						3.1
	ppm	2.88	3	3.53	2.9	3.38	3.56	1	2.6	2.9	3.51	2.91	3.46	3.55	5
G.MEAN		2.62	2.68	3.36	2.67	3.24	3.42	3	2.33	2.56	3.28	2.55	3.24	3.41	2.9
								S.							S.
								F.							F.
LSD at		S	F	A	S.F	S.A	F.A	A	S	F	A	S.F	S.A	F.A	A
								0.0							0.0
5%		0.39	0.15	0.42	0.09	0.07	0.11	6	N. S.	0.16	0.25	0.1	0.04	0.11	7
								0.0							0.0
1%		N. S.	0.2	N. S.	0.11	0.11	0.14	8	N. S.	0.22	0.37	0.12	0.06	0.15	9

S= Soil
F= fertilizer
A= Ascorbic acid
100% NPK (500 kg/fed ammonium sulfate + 150 kg/fed calcium super phosphate + 50 kg/fed potassium sulfate) and biofertilizers (Azotobacterine + phosphorein)