International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2019; 7(3): 4283-4285

Received: 19-03-2019
Accepted: 21-04-2019

Vadaliya Bhumika M
Junagadh Agricultural University, Junagadh, Gujarat, India

Parmar KB
Junagadh Agricultural University, Junagadh, Gujarat, India

Vekaria LC
Junagadh Agricultural University, Junagadh, Gujarat, India

Ribadiya Trupti R
Junagadh Agricultural University, Junagadh, Gujarat, India

Davra Monali A
Junagadh Agricultural University, Junagadh, Gujarat, India

Correspondence
Vadaliya Bhumika M
Junagadh Agricultural University, Junagadh, Gujarat, India

Effect of salinity on bio-chemical parameters and yield of sesame (*Sesamum indicum* L.) varieties

Vadaliya Bhumika M, Parmar KB, Vekaria LC, Ribadiya Trupti R and Davra Monali A

Abstract
A pot experiment was conducted at Department of Agricultural Chemistry and Soil Science, College of Agriculture, Junagadh Agricultural University, Junagadh to assess the "Effect of salinity on bio-chemical parameters and yield of sesame (*Sesamum indicum* L.) Varieties" during the summer, 2017. The pot experiment comprised of four levels of salinity *viz*., <2.0, 4.0, 6.0 and 8.0 dS $m^{-1}$and tested five different varieties *viz*., G Til 2, G Til 3, G Til 4, G J Til 5 and G Til 10 in FRCD. The results revealed that the bio-chemical and yield parameters were significantly influenced by the different tested varieties of sesame. The highest seed yield (4.05 g $plant^{-1}$) and stalk yield (6.20 g $plant^{-1}$) were observed with variety V_5 (G Til 10). The highest proline (0.93 µmole/gf.wt) accumulation in leaves was found with variety V_5 (G Til 10) at 45 DAS. The proline content in varieties was observed in order: V_5> V_2> V_4> V_1> V_3. Similarly, among the different tested varieties, variety V_5 (G Til 10) exhibited significantly higher RWC (84.52%), chlorophyll a (2.37 mg/gf.wt), chlorophyll b (1.21 mg/gf.wt) and total chlorophyll content (4.19 mg/gf.wt) than other varieties.

Keywords: Sesame**,** salinity levels, varieties, yield, bio - chemical, proline, RWC and chlorophyll

Introduction
Sesame (*Sesamum indicum* L.) is an important oilseed crop in India next to groundnut and rapeseed-mustard. Sesame also known as Til, Gingelly, Simsim, Beniseed, Gergelim, *etc*. Sesame (*Sesamum indicum* L.) is one of the stress-tolerate crops that produces sorts of chemical components, unavailable in other edible oils that provide a resistance to oxidative rancidity and has made sesame well known as "Queen of oilseed crops" (Bouremia *et al*., 2011) [3].

Salinity affects both vegetative and reproductive phases of plants. In the vegetative phase, it leads to the reduction in growth and in reproductive phase, the main issue will be related to the decline in the yield (Meena *et al*., 2012) [6]. Salinity stress produces adverse effect on quality of plant and resultant reduction in leaf area and number of leaves, simultaneously increased leaf thickness and chloroplast per unit leaf area due to lower photosynthesis, thus photosynthesis is measured in terms of chlorophyll. Therefore, biochemical traits like proline and chlorophyll and RWC are important criteria for screening of crop/variety for their tolerancy against salinity stress.

Materials and Methods
A pot experiment was conducted during summer-2017 at the Department of Agricultural Chemistry and Soil Science, College of Agriculture, Junagadh Agricultural University, Junagadh. The experimental soil was silty clay in texture and alkaline in reaction with $pH_{2.5}$ 8.0, $EC_{2.5}$ 0.58 dS m^{-1}, $CaCO_3$ 31.05% and CEC 36.2 cmol (p^+) kg^{-1}. The soil was low in available nitrogen (242 kg ha^{-1}), medium in available phosphorus (39.20 kg ha^{-1}), high in available potassium (298 kg ha^{-1}) and high in available sulphur (29.50 kg ha^{-1}). In case of micro nutrient status, soil was low in available iron (3.25 mg kg^{-1}), medium in available manganese (5.20 mg kg^{-1}),low in available zinc (0.45 mg kg^{-1}) and high in available copper (1.25 mg kg^{-1}).The experiment consists of 20 treatments combinations comprising four levels of salinity water *viz.*< 2.0, 4.0, 6.0 and 8.0 dS m^{-1} and five levels of varieties *viz.* G Til 2, G Til 3, G Til 4, G J Til 5 and G Til 10 with CRD. The biochemical parameter at 45 DAS and yield was recorded at harvested of crop. The biochemical parameters like proline, chlorophyll and

RWC respectively. All collected data of various parameters were statistically analysed using F' test (Panse and Sukhatme, 1985) [7].

Result and Discussion

Yield parameters

The seed and stalk yield were significantly influenced by different varieties of sesame over different saline water (Table 1). Significantly higher value of seed (4.05g plant^{-1}) and stalk (6.20 g plant^{-1}) yield were registered with variety V_5 (G Til 10). The value of seed and stalk yield decreasing with increasing the level of saline irrigation water. Significantly higher seed (4.62 g plant^{-1}) and stalk (7.28 g plant^{-1}) yields were recorded under application of <2.0 dS m^{1} (S_1) saline irrigation water. The interaction effect of salinity level and variety in relation to seed and stalk yield was also observed (Table 1.1). The highest seed (5.89 g plant^{-1}) and stalk (8.12 g plant^{-1}) yield were observed with variety V_5 (G Til 10) at S_1 (<2.0 dS m^{-1}). Decreased seed and stalk yield by increasing salinity of irrigation water may be due to more negative water potential of soil solution causing reduced water and nutrient uptake consequently lower leaf area development in turn reduced net assimilates. Similarly, Shani and Dudley (2001) [9] reported the yield loss to reduced photosynthesis, high energy and carbohydrate expenses in osmo-regulation and interference with cell function under saline conditions. Ghadiri *et al*. (2002) [5] also concerned that restricted water uptake by salinity due to the high osmatic potential in the soil and high concentration of specific ions that may cause physiological disorders in the plant tissues and reduce yields. These results are also in concordance with most similar previous studies of Babu and Thirumurugan (2001) [1], Ali *et al*. (2005), Garg *et al*. (2005) [4] and Benzaidi *et al*. (2014) [2] in sesame.

Table 1: Effect of varieties and salinity levels on yield and bio-chemical parameters of sesame

Treatments	Yield and Bio-chemical parameters						
	Seed yield (g plant^{-1})	Stalk yield (g plant^{-1})	Proline (µmole/gf.wt)	RWC (%)	Chlorophyll a (mg/gf.wt)	Chlorophyll b (mg/gf.wt)	Total chlorophyll (mg/gf.wt)
Variety (V)							
V_1: G Til-2	2.63	5.62	0.64	82.23	2.05	1.01	4.08
V_2: G Til-3	3.58	6.15	0.85	83.23	2.19	1.08	3.98
V_3: G Til-4	2.59	5.40	0.60	80.64	1.98	0.96	3.75
V_4: G J Til-5	2.88	5.59	0.65	82.43	2.10	1.03	3.90
V_5: G Til-10	4.05	6.20	0.93	84.52	2.37	1.21	4.19
S.Em.±	0.08	0.14	0.02	0.53	0.05	0.03	0.07
C.D. (P=0.05)	0.22	0.41	0.04	1.51	0.13	0.08	0.20
Salinity (S)							
S_1: < 2.0 dS m^{-1} (tap water)	4.62	7.28	0.40	86.95	2.52	1.43	4.77
S_2: 4.0 dS m^{-1}	3.41	6.16	0.72	83.42	2.12	1.18	4.15
S_3: 6.0 dS m^{-1}	2.84	5.33	0.87	81.52	2.01	0.90	3.66
S_4: 8.0 dS m^{-1}	1.71	4.40	0.94	78.54	1.90	0.72	3.34
S.Em.±	0.07	0.13	0.01	0.47	0.04	0.02	0.06
C.D. (P=0.05)	0.20	0.37	0.04	1.35	0.12	0.07	0.18
Vx S Interaction							
S.Em.±	0.15	0.29	0.03	1.06	0.09	0.05	0.14
C.D. (P=0.05)	0.44	0.83	0.09	NS	0.26	0.15	0.39
C.V.%	8.47	8.66	7.13	2.21	7.43	8.84	6.00

Table 1.1: Interaction effect of varieties and salinity levels on yield (g plant^{-1}) of sesame

Treatment	Seed yield (g plant^{-1})					Stalk yield (g plant^{-1})				
	S_1:<2	S_2:4	S_3: 6	S_4: 8	Mean	S_1:<2	S_2:4	S_3: 6	S_4: 8	Mean
	EC dS m^{-1}					EC dS m^{-1}				
V_1: G Til-2	3.90	3.11	2.21	1.28	2.63	6.70	5.95	5.71	4.11	5.62
V_2: G Til-3	5.22	3.85	3.45	2.07	3.58	8.20	6.67	5.50	4.24	6.15
V_3: G Til-4	3.85	3.09	2.26	1.14	2.59	6.72	5.79	5.06	4.04	5.40
V_4: G J Til-5	4.21	3.33	2.54	1.43	2.88	6.68	5.77	5.06	4.85	5.59
V_5: G Til-10	5.89	3.95	3.75	2.61	4.05	8.12	6.61	5.30	4.77	6.20
Mean	4.62	3.41	2.84	1.71		7.28	6.16	5.33	4.40	
S.Em.±	0.15					0.29				
C.D. (P=0.05)	0.44					0.83				

Table 1.2: Interaction effect of varieties and salinity levels on proline (µmole/gf.wt) and chlorophyll a (mg/gf.wt) content in leaves of sesame at 45 DAS

Treatment	Proline (µmole/gf.wt)					Chlorophyll a (mg/gf.wt)				
	S_1:<2	S_2:4	S_3: 6	S_4: 8	Mean	S_1:<2	S_2:4	S_3: 6	S_4: 8	Mean
	EC dS m^{-1}					EC dS m^{-1}				
V_1: G Til-2	0.29	0.60	0.81	0.85	0.64	2.28	1.59	2.01	2.33	2.05
V_2: G Til-3	0.47	0.91	0.96	1.05	0.85	2.73	1.91	2.08	2.06	2.19
V_3: G Til-4	0.26	0.53	0.79	0.82	0.60	2.52	2.04	1.92	1.44	1.98
V_4: G J Til-5	0.28	0.70	0.78	0.84	0.65	2.59	2.35	1.91	1.53	2.10
V_5: G Til-10	0.69	0.87	1.00	1.16	0.93	2.46	2.71	2.14	2.16	2.37
Mean	0.40	0.72	0.87	0.94		2.52	2.12	2.01	1.90	
S.Em.±	0.03					0.09				
C.D. (P=0.05)	0.09					0.26				

Table 1.3: Interaction effect of varieties and salinity levels on chlorophyll b (mg/gf.wt) and total chlorophyll (mg/gf.wt) content in leaves of sesame at 45 DAS

Treatment	Chlorophyll b (mg/gf.wt)					Total chlorophyll (mg/gf.wt)				
	S_1:<2	S_2:4	S_3: 6	S_4: 8	Mean	S_1:<2	S_2:4	S_3: 6	S_4: 8	Mean
	EC dS m^{-1}					EC dS m^{-1}				
V_1: G Til-2	1.07	0.92	1.03	1.03	1.01	5.02	3.63	3.72	3.95	4.08
V_2: G Til-3	1.57	0.91	1.04	0.79	1.08	4.80	3.92	3.66	3.53	3.98
V_3: G Til-4	1.53	1.12	0.79	0.39	0.96	4.78	4.01	3.79	2.41	3.75
V_4: G J Til-5	1.52	1.37	0.62	0.60	1.03	4.68	4.36	3.21	3.36	3.90
V_5: G Til-10	1.45	1.58	1.01	0.78	1.21	4.56	4.81	3.94	3.44	4.19
Mean	1.43	1.18	0.90	0.72		4.77	4.15	3.66	3.34	
S.Em.±	0.05					0.14				
C.D. (P=0.05)	0.15					0.39				

Bio-chemical parameters

Bio-chemical parameters like proline, RWC, chlorophyll a, b & total, significantly affected by different varieties of sesame. The highest proline (0.93 µmole/gf.wt) accumulation in leaves was found with variety V_5 (G Til 10) at 45 DAS. The proline content in varieties was observed in order: V_5> V_2> V_4> V_1> V_3. Similarly, among the different tested varieties, variety V_5 (G Til 10) exhibited significantly higher RWC (84.52%), chlorophyll a (2.37 mg/gf.wt), chlorophyll b (1.21 mg/gf.wt) and total chlorophyll content (4.19 mg/gf.wt) than other varieties. The proline accumulation increased with increase in salt concentration. Significantly higher proline accumulation (0.94 µmole / gf.wt) observed at salinity level S_4 (8.0 dSm^{-1}), while, it was lowest (0.40 µmole/gf.wt) at salinity level S_1 (< 2.0 dS m^{-1}). The different salinity levels produce significant effect on biochemical parameters like RWC, chlorophyll a, chlorophyll b and total chlorophyll content and they were recorded highest at salinity level S_1 (< 2.0 dSm^{-1}). Bio-chemical parameter i.e. proline accumulation observed highest with variety V_5 (G Til 10) at S_4 (8.0 dS m^{-1}), while other parameters RWC, chlorophyll a, chlorophyll b and total chlorophyll content at salinity level S_1 (< 2.0 dS m^{-1}) in sesame at 45 DAS.

Sneha *et al*. (2013) [10] also observed that the salt concentration increased the biochemical components *viz.*, proline and free amino acid act as compatible solute in sesame to protect the cellular macro molecules, maintain the osmotic balance and also scavenge the free radicle under salt stress condition in sesame. Sailaja and Sujatha (2013) [8] reported that the chlorophylls and accessory photosynthetic pigments declined with increasing salt concentrations which elucidates the propounding effect of salt stress on the processes of photosynthesis and affecting plant growth in saline soils.

Conclusion

On the basis of results, the sesame variety G TIL 10 showed significantly higher values of yield (seed and stalk) and bio-chemical parameters (proline, RWC, chlorophyll a, chlorophyll b and total chlorophyll). The sesame variety G TIL 10 is found better up to EC 4 dS m^{-1} irrigation water. Overall, relative tolerance sequence order of sesame varieties was found in order of: G Til 10 > G Til 3 > G J Til 5> G Til 2> G Til 4 against salinity in silty clay soil.

References

1. Babu S, Thirumuragan T. Effect of NaCl priming for increased salt tolerance in sesame. Journal of Ecobiology. 2001; 13(4):309-311.
2. Benzaidi H, Ibriz M, Mautaoui A, El-Midaoui M, Benbella M. Effect of salinity on grain yield, root and shoot dry weight, leaves and stems content of macro and micro elements of sesame (*Sesamum indicum* L.), fenugreek (*Trigonella foenum-graceum* L.) and black cumin (*Nigella sativa* L.). European Journal of Scientific Research. 2014; 126(3):240-254.
3. Bouremia S, Eyletters M, Diouf M, Cisse N, Van DP. Sensitivity of seed germination and seedling radical growth to drought stress in sesame (*Sesamum indicum* L.) Research Journal of Environment Science. 2011; 5(6):557-564.
4. Garg BK, Kathuja S, Vyas SP. Salinity, fertility interaction of growth, photosynthesis and nitrate reeducates activity in sesame. Indian Journal of Plant Physiology. 2005; 10(2):162-167.
5. Ghadiri H, Dordipour I, Bybordi M, Malakouti MJ. Potential use of Caspian Sea water for supplementary irrigation in Northern Iran. Chapter in Faculty of Environment Science, Griffith University, Nathan, Australia, 2002.
6. Meena HN, Bhalodia PK, Jat RS, Vekaria LC. Prospects of using saline water for irrigation in groundnut (Arachis hypogea)-Pearl millet (*Pennisetum glaucum*) cropping system in saline black soil of Saurashtra. Indian Journal of Agronomy. 2012; 57(2):9-13.
7. Panse VG, Sukhatme PV. Statistical methods for Agricultural Workers. Indian Council of Agricultural Research, New Delhi, 1985, 361.
8. Sailaja K, Sujatha B. Impact of salt stress (NaCl) on pigments, phenols and flavonoids in C_4 (*Sorghum bicolor*) and C_3 (*Oryza sativa*) cutivars. International Journal of Biology & Pharmaceutical Research. 2013; 4(5):361-367.
9. Shani U, Dudley LM. Field studies of crop response to water and salt stress. Soil Science Society of American Journals. 2001; 65:1522-1528.
10. Sneha S, Rishi A, Chandra S. Effect of short term salt stress on chlorophyll content, protein and activities of catylase and ascorbate peroxidase enzyme in pearl millet. American Journal of Plant Physiology, 2013, 1-6.