Nature & Environment
Vol. 21 (1), 2016: 01-04
Website: www.natureandenvironment.com

ISSN (Print) : 2321-810X
ISSN (Online) : 2321-8738

RESEARCH ARTICLE

Response of Sodium Adsorption Ratio (Sar) on Growth, Yield, Oil Content and Uptake of Nutrients by Linseed

Satyavir Singh
Deptt. Of Soil Science & Agri. Chemistry, Institute of Agricultural Sciences,
Bundelkhand University Campus, Jhansi, U.P, India.
Email: satyavirsingh.solanki@gmail.com

Received: 20th October 2015, Revised: 14th December 2015, Accepted: 02nd January 2016

ABSTRACT

A green house experiment was conducted to investigate the response of Sodium Adsorption Ratio (SAR) on growth, yield, oil content and uptake of nutrients by linseed. The present study comprised 5 levels (control, 10. 20. 30 and 40) of SAR in irrigation water. It was recorded that plant height number of branches plant"1, number of capsule plant', number of seeds capsule^{-1} . stover, seed yield and oil content decreased significantly with increasing levels of SAR in irrigation water over control in both the consecutive years except 10 SAR in case of stover, seed yield and oil content which were statistically at par with the control. The content and uptake of nitrogen, phosphorus, calcium, magnesium and sodium increased while potassium decreased with increasing levels of SAR in irrigation water in both years of experimentation, linseed crop can be grown successfully upto 10 SAR level in irrigation water. The sodium dominated water had impact on the physio-chemical properties of the soil.

Keyword: Water Sodicity, Oil Content, Nutrients

INTRODUCTION

The underground irrigation water contains number of dissolved salts which promote salinization and alkalinization in arid and semi-arid climatic conditions, such problematic situation is responsible for poor germination. Stunned crop growth and disturbance in nutrients supply, resultant into the decline of crop production. Besides salinity, alkalinity is also a problem of Agra region. This problem may be due to use of poor quality underground sodium dominated irrigation water. Excess sodium in irrigation water increase the exchangeable sodium in the soil which affect the physical properties of soil and plays a significant role in making a soil infertile, in order to utilize brackish water, knowledge of tolerance of crop with respect to water sodicity is the pre-requisite. Linseed is most important crop which can be grown under arid and semi-arid
salt affected region. Linseed containing 24-36 percent oil depending upon the varieties. Its oil used for edible and non-edible purpose in different countries of world. Oil is used as non edible
for paints, varnishes, printing ink, oil cloth etc. (Parischa et al. 1987). It grows in Rabi season in Indian climate, with little or no management in his production. Linseed has been supplementary food in Ancient time and still being so used in certain part of country (JESWANI, 1985) due to high content of linoleic acid increased in seed which determines the quality. It is also used in the treatment of migraine in human beings. Keeping this in view this investigation on Linseed crop was undertaking to find out the suitability under problematic irrigation water conditions in Agra region.

MATERIAL AND METHODS

A green house experiment was conducted during Rabi season in the Deptt. of Agricultural Chemistry & Soil Science at R.B.S. College, Bichpuri, Agra. The experimental soil was sandy loam in

texture and alkaline in reaction contained 65% sand, 20%, silt and 14.6% clay. The pH, ECe and ESP of the soil were 8.7, 1.7 dSm"1 and 2.30 respectively. The contents of Ca, Mg, Na and K were 4.2, 5.1, 6.4 and 0.2 me/1 respectively, while CO_3, HCO_3", Cl and SO_4 were 1.0, 7.5, 6.7 and 8.2 me/1, respectively in the saturation extract of the soil. The soil had organic carbon 0.4%, available N 148.5 kg ha"1, available P 25.2 kg ha-1 available K 390 kg ha-1. The pots were filled with well mixed 10 kg soil. Recommended doses of fertilizers (50:30:20 kg/ha "N, P2O5) and K2O) were applied, after filling the pots linseed seeds were sown. The observations were recorded regarding plant height, number of branches plant-1, number of capsule plant-1, number of seeds capsule^{-1}, stover, seed yield and oil content. Standard methods were adopted for chemical analysis.

RESULTS AND DISCUSSION

Perusal of data in Table 1 shows that plant height of linseed reduced significantly with increasing levels of SAR in irrigation water as 7.08, 44.81 and 46.60% in first year and 5.16, 43.29 and 50% in irrigation water in second year at 10, 20 and 30 SAR level respectively, over control. The crop was not germinated at SAR 40 in irrigation water in both seasons. Number of branches plant^{-1} reduced as per increasing level of SAR in irrigation water, though significant effect was recorded at 30 SAR level over control in both the years. The maximum reduction in plant height and number of branches plant-1 was noted at 30 SAR level in both the years. Similar results have also been recorded by Paliwal et al 1978 and Singh and Abrol 1986. Number of capsules plant-1 decreased with increasing levels of SAR in irrigation water except SAR 10. The maximum reduction was 55.66 per cent in first year and 53.85 per cent in second year at 30 SAR level over control. There was no germination at SAR 40 in both the experimental year. The number of seed capsule-1, decreased significantly at SAR 30 in both the years. The maximum reduction was noted as 34 per cent in first year 30 per cent in second year at 30 SAR over control.

Stover yield:

The stover yield of linseed reduced significantly with the increasing level of SAR. The reduction of Stover yield was 13.13, 25.52 and 71.72 percent in first year and 13.15, 26.84 and 69.84% in second year at SAR level 10, 20 and 30 respectively, over control. There was no germination at SAR 40.

Table 1: Plant height, number of branches plant^{-1}, number of capsule plant^{-1}, number of seeds capsule^{-1}, stover yield and oil content of Linseed.

Treatments SAR	Plant height (cm)		No. of branches plant^{-1}		No. of capsule plant^{-1}		No. of seeds capsule^{-1}		Yield (gm pot^{-1})				Oil content (%)	
									Stover		Seed			
	I*	II*	I*	II*	I*	II*	I*	II*	I*	II*	I*	II*	I*	II*
Control	64.93	65.20	5.00	5.30	30.00	30.34	5.00	5.00	18.57	19.00	10.70	11.33	41.30	41.90
10	60.33	61.83	4.33	4.35	26.33	26.70	5.00	5.00	16.13	16.50	6.32	6.50	40.50	40.63
20	35.83	36.97	4.00	4.10	22.32	22.38	4.00	4.20	13.83	13.90	4.47	5.00	38.40	38.93
30	34.67	32.60	3.50	4.00	13.30	14.00	3.30	3.50	5.25	5.73	4.07	4.43	35.50	35.95
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S.EM±	1.6086	0.3691	0.3416	0.4184	0.7367	0.2789	0.6368	0.2687	1.5964	0.2993	1.4037	0.3994	0.5410	0.1794
CD at 5%	5.2461	1.2036	1.1139	1.3964	5.6642	0.9095	2.0768	0.8764	5.2076	0.9759	5.5778	1.3024	1.7643	0.5848

Seed yield:

The seed yield was decreased significantly with increasing level of SAR except 10 and reduction reached statically significant at SAR 20 and onwards over control in both the years. The reduction was noted at 40.93, 58.22 and 61.96 % in first year and 42.63, 55.86 and 60.90 % in second year

over control respectively. There was no germination of linseed at SAR 40. It may be attributed to the fact that pH and exchangeable sodium percentage of the soil increased and declined the physical condition, which intern caused nutritional disturbance resulting into reduced seed and stover yield. The similar results were observed by Mahrotra and Gangwar 1964, Yadav et al 1997.

Oil content:

The oil content in linseed decreased significantly with every increasing level of SAR in both crop seasons. The reduction of oil content was noted as 7.02 and 14.04% in first year and 7.08 and 14.20% in second year at SAR 20 and 30 respectively, over control. The findings are similar with the works of Singh and Singh 1989 and Bhati et al 1995.

Table 2: Effect of SAR levels in Irrigation water on N, P, K, Ca, Mg and Na Content (%) and uptake (mg pot^{-1}) in Linseed

Treatments SAR	Content											
	Nitrogen		Phosphorus		Potassium		Calcium		Magnesium		Sodium	
	I*	II*	I*	II*	I*	II*	I*	II*	I*	II*	I*	II*
Control	0.73	0.74	0.15	0.15	1.70	1.86	0.11	0.12	0.21	0.22	0.14	0.15
10	0.72	0.73	0.14	0.13	1.80	1.88	0.10	0.11	0.17	0.19	0.28	0.28
20	0.70	0.71	0.12	0.12	1.90	1.92	0.08	0.10	0.14	0.15	0.59	0.51
30	0.68	0.69	0.10	0.10	2.00	2.10	0.08	0.09	0.12	0.12	0.70	0.73
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S.Em±	0.0045	0.0052	0.0057	0.0031	0.0077	0.0042	0.0043	0.0026	0.0063	0.0032	0.0079	0.0048
CD at 5%	0.0148	0.0148	0.0185	0.0010	0.0253	0.0139	0.0306	0.0084	0.0206	0.0106	0.0257	0.0158
Uptake (mg pot^{-1})												
Control	**117.4**	**120.3**	**22.09**	**24.0**	**2730.0**	**2941.0**	**17.4**	**20.1**	**33.3**	**35.4**	**22.7**	**23.9**
10	113.0	115.5	25.3	26.5	2712.0	2848.0	20.6	17.9	31.4	**29.5**	**52.6**	**44.3**
20	82.8	85.3	14.6	15.7	208.5	229.2	9.4	12.1	16.5	**17.7**	**57.9**	**61.5**
30	35.8	39.6	5.3	5.9	102.8	114.9	4.2	5.2	6.0	**6.7**	**36.8**	**41.2**
40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	**0.00**	**0.00**
S.Em±	0.1101	2.0520	0.0253	0.6410	0.0252	9.3950	0.0130	0.4560	0.4835	0.5250	**0.0428**	**1.5590**
CD at 5%	0.3591	6.6930	0.0924	2.0900	0.0821	24.1150	0.426	1.4864	0.0994	**1.7110**	**0.2147**	**5.0834**

* I- First experimental year , II- Second experimental year

Content & Uptake studies:

Table no. 2 revealed that Nitrogen, phosphorous, potassium, calcium, magnesium content & uptake of linseed decreased, while Na, gradually increased at each higher level of SAR in irrigation water. It ranges from 0.68 to 0.73% in first year and 0.69 to 0.74% in second year in case of content. Nitrogen uptake also increases with every increasing level of SAR. Phosphorous content and uptake decreased significantly with every increasing level of SAR over control in both the years. Its content ranges from 0.10 to 0.15 % in both the years, there was no germination at SAR 40. Similar results pertaining to content & uptake of phosphorous by linseed have also been recorded by Paliwal et al. K content and uptake of linseed increased with increasing level of SAR over control in both crop seasons, there was no germination at SAR 40. Content ranged from 1.70 to 2.00% in first year and 1.86 to 2.10% in second year. Ca content and uptake of linseed decreased with increasing level of SAR over control in both crop seasons, there was no germination at SAR 40. The control and SAR 10 treatments were statically at par. The similar results were observed by Singh et al 1979. Mg content and uptake of linseed decreased with increasing level of SAR over control in both crop seasons, there was no germination at SAR 40. Mg content ranged from 0.12 to 0.21% in first year and 0.12 to 0.22% in second year. Our findings are inagreament with the work of Paliwal et al 1978 and Yadav et al 1997. Na content and uptake of linseed increased with increasing level of SAR over control in both crop seasons, there was no germination at SAR 40. Similar results were observed by Singh and Singh 1989.

Soil studies:

The results indicates that pH, ECe, ESP, soluble $Ca^{++}+Mg^{++}$, Na^{+}, K^{+}, Cl^{-}, $CO3^{--} + HCO_3^{-}$, and SO_4^{--} ions concentration in soil saturation extract were increased with increasing each level of SAR in

irrigation water after harvesting the crop in both the experimental years. The soil samples were studied after harvesting the crop. The values ranged as pH (8.7 to 9.5 and 8.6 to 9.6), ECe (1.68 to 3.82 dSm^{-1} and 1.70 to 3.95 dSm^{-1}), ESP (7.8 to 35.1 and 8.1 to 35.2), Cl^- (75.1 to 203.1 me^{-l} and 76.3 to 203.8 me^{-l}), SO_4^{--} (8.22 to 9.7 me^{-l} and 8.4 to 9.8 me^{-l}), $CO3^{--}$+ HCO_3^- (9.1 to 13.4 me^{-l} and 9.2 to 13.7 me^{-l}), K^+ (0.49 to 1 me^{-l} and 0.51 to 1.20 me^{-l}), Na^+ (60 to 169.6 me^{-l} and 62.5 to 171.2 me^{-l}), Ca^{++}+Mg^{++} (30.5 to 167.6 me^{-l} and 32.2 to 168.7 me^{-l}), while in case of hydraulic conductivity decreased (0.015 to 0.010) with increasing levels of SAR level in irrigation water in first and second experimental years. The similar trend was observed by the Lal and Singh (1974), Pal and Tripathi (1982), Paliwal (l972).

REFERENCE

1. Bains S.S. and Fireman Millton (1964): Effect of sodium percentage on the growth and absorption of essential nutrients and sodium by five crop plants. *Indian J. Agron.,* 56: 432-435.
2. Kanwar B.S. and Kanwar J.S. (1971): Effect of residual sodium carbonate in irrigation on plant and soil. *Indian J. Agric.Sci.,* 14: 54-56.
3. Paliwal K.V., Maliwal G. L. and Nandwani G.C. (1990). Effect of bicarbonate rich irrigation waters on the yield and nutrient uptake in cotton and linseed. Annuals of Arid zone, 17: 164-174.
4. Singh S.B. and Abrol (1986): Effect of soil sodicity on growth, yield and chemical composition of soyabean. *J. Indian Soc. Sail Sci.,* 34: 568-571.
5. Singh S.B., Chhabra R. and Abrol L.P. (1979): Effect of exchangeable sodium on the yield and chemical composition of raya. *Indian J. Agron.,* 71: 767-770.
6. Yadav A.C, Lai S. and Mangal J.L. (1997): Response of corinder varieties to different sodicity levels, *Haryana J. Agron.,* 13: 106-108.