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Effect of different levels of saline water irrigation and mulching on growth of gaillardia under clay soil

Komal N Rathava, Dipal Bhatt, RV Tank, HM Patel and SL Chawla

Abstract
The investigation entitled "effect of different levels of saline water irrigation and mulching on growth of gaillardia under clay soil" was conducted during December 2021-22 at Floriculture Research Farm, ASPEE College of Horticulture, Navsari Agricultural University, Navsari. The experiment was laid out in Split Plot Design consisting sixteen treatment combinations, with four levels of saline water irrigation *i.e.*, Best available water (S_0), 4 dS/m saline water irrigation (S_1), 6 dS/m saline water irrigation (S_2) and 8 dS/m saline water irrigation (S_3) and four levels of mulching *i.e.*, no mulch (M_0), paddy straw mulch (M_1), sugarcane trash mulch (M_2) and silver plastic black mulch (M_3). The experiment was replicated four times. The plant height (10.69 and 47.69 cm at 30 DAT and 60 DAT, respectively), fresh weight of plant (1.464 kg) and dry weight of plant (267.67 g) were found maximum in gaillardia plants irrigated with best available water (S_0) was found statistically at par with 4 dS/m level of saline water irrigation for all vegetative parameters. Plants mulched with silver black plastic resulted maximum plant height (11.63 cm and 48.57 cm at 30 DAT and 60 DAT, respectively), fresh weight of plant (1.521 kg) and dry weight of plant (282.49 g). Gaillardia grown with best available water along with silver black plastic mulch (S_0M_3) resulted maximum plant height (12.74 cm and 53.56 cm at 30 DAT and 60 DAT, respectively), fresh weight of plant (1.579 kg) and dry weight of plant (297.32 g).

Keywords: Gaillardia, salinity, mulching and growth parameters

Introduction
Gaillardia commonly known as a "blanket flower" and belongs to the family Asteraceae. It is native to northern and western USA and Mexico. Gaillardia is one of the hardiest annual can be grown in a wide range of tropical to temperate climate. There are about twenty-eight species reported in the genus *Gaillardia*, but only two of them *viz.*, *Gaillardia pulchella* and *Gaillardia aristata* are grown in India. It can be used as a loose flower as well as cut flowers and also grown in the garden for mixed borders, flower beds, edging and use to fill corners. Besides, its utility in landscape, *Gaillardia pulchella* is useful in reducing erosion in coastal dune areas (Carig, 1977) [3]. Gaillardia is a substitute flower crop for chrysanthemum and China aster (Bose *et al.*, 2003) [2]. The gaillardia flourish well in any garden soil and can with stand high light intensities, high temperature and drought better than other flowering plants. It can also tolerant to salinity (Tija and Rose, 1988) [16].

Salinity is major constraint for the successful crop production, affecting 7 % of the world's land area, equivalent to 930 m ha. Presently, the total degraded land due to salinity and sodicity is estimated to be 6.74 M ha in India among this 2.22 M ha is in Gujarat State. About 0.12 M ha area is affected by salinity in black soil region of Gujarat covering Bara tract area (Amod, Vagra and Jambusar taluka of Bharuch district), Bhal area and part of Vadodara, Surat and Ahmedabad districts which contributes to 15 percent of the total salt affected soils in the country (Anil, 2017) [1].

Saline soils in coastal areas are having predominance of sodium chloride and sodium sulphate salts with abundance of soluble cations with dominance of Na followed by Mg, Ca and K and chloride as the predominant anion followed by sulphate. In clay soil, the use of irrigation water with high sodium chloride content is deterioration and deflocculation of the clay colloids and their structure as well as properties degraded with a reduction in porosity, permeability and hydraulic conductivity (Murray and Quirk, 1990) [13]. Salt accumulation in the root zone causes the development of osmotic stress, water deficit, oxidative stress and disrupts cell ion homeostasis by inducing both the inhibition in uptake of essential elements such as K^+, Ca^{2+} and NO_3^- and the accumulation of Na^+ and Cl^-. El-Mageed *et al.* (2016) [7] observed decrease in salts accumulation in the root zone associated with soil mulching application.

The English word 'mulch' is derived from the German word "molsch," which implies soft or decaying (Jacks *et al.*, 1955) [9]. Mulching is the technique of covering the soil surface with organic or inorganic particles to improve plant growth, development, and crop production efficiency. Mulching improves soil physical conditions, chemical environment and biological activity by modifying the soil hydrothermal regime, improving soil aggregation and reducing erosion and soil loss (Chalker-Scott, 2007) [4].

It is speculated that results of present investigation are expected to significantly improve the production of gaillardia near coastal areas or with the use of various mulches and saline water for irrigation purposes open new opportunities for farmers and nurserymen for production and beautification of seashores with the use of poor soil and water. Thus, the experiment was conducted to study the effect of saline water irrigation and mulching on growth of gaillardia under clay soil.

Materials and Methods

The present investigation was carried out during year 2022 at Floriculture Research Farm, ASPEE College of Horticulture, Navsari Agricultural University, Navsari, Gujarat. According to agro-climatic situation, Navsari is placed in 'South Gujarat Heavy Rainfall Zone-I, AES-III'. The soil of the experimental plot was deep, moderately clay with good water holding capacity, medium to poor drainage, pH 7.65, electrical conductivity 0.89 dS/m, 0.62 % organic carbon, 179.32 kg/ha available N, 34.28 kg/ha available P_2O_5 and 327.42 kg/ha available K_2O with 40.29 me/100g cation exchange capacity and 3.02 % exchangeable sodium.

The experiment was laid out in Split Plot Design consisting sixteen treatment combinations, with four level of saline water irrigation *i.e.*, Best available water (S_0), 4 dS/m saline water irrigation (S_1), 6 dS/m saline water irrigation (S_2) and 8 dS/m saline water irrigation (S_3) and four levels of mulching *i.e.*, no mulch (M_0), paddy straw mulch (M_1), sugarcane trash mulch (M_2) and silver plastic black mulch (M_3). The experiment was replicated four times. Irrigation was given by preparing different levels of EC as per treatments by using sea water and diluted with best available water having 2.2 dS/m EC at experimental field was applied as control. Observation on plant height was recorded at 30 and 60 DAT while fresh weight and dry weight of plant were recorded at the end of the experiment.

Result and Discussion

Growth parameters

Plant height (cm)

Maximum plant height at 30 DAT (10.69 cm) and 60 DAT (47.69 cm) was recorded with best available water (S_0) which was found at par with 4 dS/m salinity level (S_1). While, minimum plant height at 30 DAT (8.50 cm) and 60 DAT (35.05 cm) was noticed with 8 dS/m level of saline water irrigation (S_3). The reduction in plant height with increasing salinity might be due to an increase in osmotic pressure in soil solution ultimately which may have resulted in decreased water uptake by plant roots or else salinity must have adversely affected cell enlargement and cell division. These results are in conformity with the findings of Khimani and Patil (1994) [10] and Rao and Shahid (2011) [15] in gaillardia, Ishida *et al.* (1979) [8] in carnation and Mantur *et al.* (1996) [12] in China aster. In case of mulching maximum plant height at 30 DAT (11.63 cm) and 60 DAT (48.57 cm) was observed with silver black plastic mulch (M_3), whereas minimum plant height at 30 DAT (8.60 cm) and 60 DAT (36.67 cm) was recorded in plants without mulch (M_0). Mulching application was found better for plant height this might be due to silver black polythene mulch could be attributed to favourable soil temperature, more conservation of soil moisture, better weed control and activity of micro-organism in soil, resulting in more availability of nutrient and ultimately more photosynthesis. The results are in confirming with the finding of Chawla (2006) [5] and Malshe *et al.* (2017) [11] in marigold.

It is evident from the data presented in Table 1 that interaction effect of different levels of saline water irrigation and mulching on plant height at 30 DAT was found non-significant. However, treatment combination of best available water along with silver black plastic mulch (S_0M_3) resulted maximum plant height at 60 DAT (53.56 cm) which was found at par with S_1M_3 and S_2M_3 for 60 DAT. Whereas, the minimum plant height at 60 DAT (32.23 cm) was noted with 8 dS/m of saline water irrigation level and without mulch (S_3M_0). Increase in plant height in saline water irrigation might be due to mulching application which helps to regulate soil temperature, moisture availability and reduced evaporation losses from soil surface that reduce the accumulation of salt near root zone which protect plant from oxidative stress cause by ionic and osmotic stress. Maintenance of appropriate soil temperature and higher moisture availability might have favoured better nutrient uptake resulting vigorous growth in terms of height.

Fresh and dry weight of plant

Data presented in Table 2 showed the results regarding fresh and dry weight of plant. Maximum fresh weight of plant (1.464 kg) and dry weight of plant (267.17 g) were noticed in best available water (S_0) whereas, minimum fresh weight (1.243 kg) and dry weight (215.10 g) were recorded with 8 dS/m level of saline water irrigation (S_3). The increase levels of salinity caused depletion in energy needed for growth, greater degree of tissue dehydration and reduce turgor as well as reduction in photosynthetic area resulted in reduced growth and ultimately less fresh and dry weight of plant. The present findings are in conformity with those reported by Nawab (2002) [14] and Rao and Shahid (2011) [15] in gaillardia, Khimani and Patil (1994) [10] in gaillardia, Devitt and Morris (1987) [6] in flowering annuals.

It is evident from the data that various mulches significantly affected fresh weight of plant. Significantly highest fresh weight of plant (1.521 kg) and dry weight of plant (282.49 g) were noticed in plants mulched with silver black plastic mulch (M_3). However, lowest fresh weight of plant (1.149 kg) and dry weight of plant (210.34 g) were observed in plants without mulch (M_0). Treatment combination of S_0M_3 (Best available water along with silver black plastic mulch) resulted maximum fresh weight of plant (1.579 kg) and dry weight of plant (297.32) which was at par with treatments S_1M_3, S_2M_3 and S_0M_2. Whereas, minimum fresh weight of plant (0.887 kg) and dry weight of plant (169.44 g) was noted with (S_3M_0) 8 dS/m of saline water irrigation level and without mulch. Application of saline water with silver black plastic mulch (M_3) influenced fresh weight of plant might be due to the fact that mulching maintained appropriate soil temperature and higher moisture availability might have favoured better nutrient uptake resulting in various growth and development

of plant which ultimately increased growth parameters with respect to plant height and plant spread ultimately increase fresh weight of plant.

Table 1: Effect of different levels of saline water irrigation and mulching on plant height (cm) in gaillardia

Plant height (cm)											
30 DAT						60 DAT					
	M_0	**M_1**	**M_2**	**M_3**	**Mean**		**M_0**	**M_1**	**M_2**	**M_3**	**Mean**
S_0	9.43	9.97	10.63	12.74	10.69	S_0	40.45	46.66	50.11	53.56	47.69
S_1	9.06	9.89	9.97	12.23	10.29	S_1	38.03	44.05	49.69	51.45	45.80
S_2	8.89	8.95	9.57	12.06	9.87	S_2	35.96	42.39	49.13	50.76	44.56
S_3	7.04	8.26	9.20	9.51	8.50	S_3	32.23	34.20	35.23	38.53	35.05
Mean	8.60	9.27	9.84	11.63		Mean	36.67	41.82	46.04	48.57	

	SEm±	**CD at 5 %**	**CV %**		**SEm±**	**CD at 5 %**	**CV %**
S	0.166	0.531	6.75	S	0.942	3.012	8.7
M	0.185	0.530	7.53	M	0.680	1.948	6.28
S × M	0.370	NS		S × M	1.359	3.897	

Table 2: Effect of different levels of saline water irrigation and mulching on survival of plant, fresh and dry weight of gaillardia plant

Fresh weight of plant (kg)						Dry weight of plant (g)					
	M_0	**M_1**	**M_2**	**M_3**	**Mean**		**M_0**	**M_1**	**M_2**	**M_3**	**Mean**
S_0	1.332	1.435	1.511	1.579	1.464	S_0	248.52	257.31	265.54	297.32	267.17
S_1	1.256	1.388	1.463	1.541	1.412	S_1	227.53	245.34	262.02	281.87	254.19
S_2	1.121	1.317	1.452	1.525	1.354	S_2	195.87	224.15	253.45	279.74	238.30
S_3	0.887	1.266	1.381	1.440	1.243	S_3	169.44	196.90	223.03	271.03	215.10
Mean	1.149	1.351	1.452	1.521		Mean	210.34	230.93	251.01	282.49	

	SEm±	**CD at 5 %**	**CV %**		**SEm±**	**CD at 5 %**	**CV %**
S	0.023	0.075	6.81	S	4.397	14.065	7.22
M	0.017	0.050	5.06	M	3.638	10.435	5.97
S × M	0.035	0.099		S × M	7.277	20.871	

Conclusion

It can be concluded from the present study that gaillardia plants can be grown up to 6 dS/m levels of saline water irrigation along with silver black plastic mulch (25 µ) for better plant growth in gaillardia var. Local under clay soil.

References

1. Anil R. Technical Manual, ICAR- CSSRI/Bharuch, Gujarat, 2017, p. 1-9.
2. Bose TK, Yadav LP, Pal P, Das P, Parthasarthy V. Commercial Flowers. (2nd edn.) Naya Udyog, Kolkata. 2003, p. 852-853.
3. Carig RM. Herbaceous plant for coastal dune areas. In: Proc. of the Florida State Hort. Soc. 1977;90:108-110.
4. Chalker-Scott L. Impact of mulches on landscape plants and the environment-a review. J Environ. Hortic. 2007;25(4):239.
5. Chawla SL. Response of African marigold to irrigation and mulching. J Ornam. Hort. 2008;11(2):131-135.
6. Devitt DA, Morris RL. Morphological response of flowering annuals to salinity. J American Soc. Hort. Sci. 1987;112(6):951-955.
7. El-Mageed TA, Mohamed WM, El-Wahed HA. Effect of mulching on plant water status, soil salinity and yield of squash under summer-fall deficit irrigation in salt affected soil. Agric. Water Manag. 2016;173:1-12.
8. Ishida A, Masui M, Nukaya A, Ogura T. Salt tolerance of carnation in sand and soil cultures. J Japanese Soc. Hort. Sci. 1979;48(3):322-326.
9. Jacks CV, Brind WD, Smith R. Mulching Technology. Comm., No. 49, Common Wealth. Bul. of Soil Sci. 1955, p. 118.
10. Khimani RA, Patil AA. Response of gaillardia to varying levels of naturally saline soil. Recent Hort. 1994;1(1):97-101.
11. Malshe KV, Sagavekar VV, Chavan AP. Effect of mulching on growth and flower yield of African marigold (*Tagetes erecta* L.). Bioinfolet-A Quarterly J Life Sci. 2017;14(3):233-234.
12. Mantur SM, Nalawadi VG, Biradar DP. Effect of salinity on growth, yield and nutrient content in China aster. Karnataka J Agri. Sci. 1996;9(1):168-170.
13. Murray RS, Quirk JP. Surface area of clays. *Langmuir*. 1990;6(1):122-124.
14. Nawab SI. Effect of saline irrigation water on growth, yield and chemical composition of marigold and gaillardia on soil salinity. Thesis M. Sc. (Agri.) submitted to JAU, Junagadh, 2002.
15. Rao NK, Shahid M. Response of *Gaillardia aristata* Pursh to salinity. J Appl. Hort. 2011;13(4):65-67.
16. Tija B, Rose SA. Salt tolerant bedding plants. Proc. Flor. St. Hort. Soc. 1988;100:181-182.