Environment and Ecology 42 (1A) : 328—331, January—March 2024
Article DOI: https://doi.org/10.60151/envec/PLNS8114
ISSN 0970-0420

Performance of Wheat Variety KRL-283 in Salt Affected Soils with Saline Water in Nagaur District of Rajasthan

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Received 8 August 2023, Accepted 17 December 2023, Published on 6 March 2024

ABSTRACT

The problem of salty soils as well as saline water is serious concern point in rainfed and irrigated both conditions. The study was conducted in village Bhagwanpura of Nawan block in Nagaur district during *rabi* 2020-21 to 2021-22, with the objective to study the salt tolerant wheat variety for this region. Interviews were conducted with 20 farmers, both individually and in groups, who were chosen at random from Bhagwanpura village. Results from on farm trial showed that the salt tolerant variety KRL-283 recorded higher grain (35.8 q ha^{-1}) and straw yield (49.2 q ha^{-1}) as compared to the farmers' practiced variety C-306 (33.0 q ha^{-1} and 47.5 q ha^{-1}). Among the yield attributing characters assessed, the number of spike /plant (5.6); number of spikelets/ spike (16.7), number of grains per spike (50.0) and 1000 grain weight (47.7 g) contributed more to the yield and are considered to be the most important factors responsible for yield gap difference. The net returns (Rs 90580 ha^{-1}) and benefit cost ratio (3.54) was also maximum under technology, while these values were Rs 85524 ha^{-1} and 3.40, respectively under farmer's practices. The value for additional returns in technology (Rs 5056 ha^{-1}) was also high in KRL-283 variety. Use of this type of varieties would enhance productivity and having positive impact on food security in salt-affected areas.

Keywords On farm trial, Productivity, Salt affected soils, Saline water, Variety, Wheat.

INTRODUCTION

Recently, climate change and global warming have directly affected the crop's yield and quality by intensifying the frequency and extent of numerous stresses. Twenty percent of all cultivable land worldwide is under salt stress, and this percentage is steadily rising due to anthropogenic activities and climate change (Arora 2019). The majority of agricultural fields, which vary in salinity, are found in dry or semi-arid regions (Liu *et al.* 2020). India has 6.74 million hectares of salt-affected land, of which 3.79 million ha have sodicity issues and the remaining 2.95 million ha have salinity issues (including 1.25 million ha of coastal saline soils). Salinity is a significant abiotic

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stressor that impairs plant development and growth and reduces agricultural yield. Compared to other developmental phases, the seed germination stage of many crop species is more vulnerable to saline stress.

The three most significant staple crops in the world, wheat, rice, and maize, account for a sizable portion of daily caloric and protein intake (Kizilgeci *et al.* 2021). According to Giraldo *et al.* (2019), wheat (*Triticum aestivum*) is the most important crop of all the cereals and is ranked first globally among crops that produce grains, primarily for human consumption. However, soil salinity causes considerable losses in grain yield. High concentration of salts present in the root zone, retard the growth of the most of the plants depending on the nature of the salts present, the growth stages and the salt tolerance or avoidable mechanism of the plant tissues. Wheat suffers detrimental effects from salinity stress during growth and development, which lowers grain yield and quality.

The majority of crops can withstand salinity up to a certain point, after which their yield starts to decline (Beakal *et al*. 2016). Most frequently, traits like germination, survival, seedling growth, or biomass accumulation have been used to determine a plant's ability to withstand salinity. Because wheat plants use a variety of physiological, biochemical, and molecular mechanisms to adapt under salinity stress at the cell, tissue, and whole plant levels to optimize growth and yield by offsetting the negative effects of saline environment, bread wheat is moderately tolerant to salinity. A crop's ability to withstand and thrive in salinity is generally determined by its tolerance to salt, which varies depending on the crop and stage of growth.

MATERIALS AND METHODS

On farm trials were carried out at 10 different farmer's field of Bhagwanpura village of Nagaur district (27°52'N latitude and 74°68' E longitude with an altitude of 302 m above the mean sea level) of Rajasthan condition during *rabi*, 2020-21 (November—March) and 2021-22 (November—March). The soil of the study area was sandy loam in texture. The KRL-283 variety of wheat was used as a test variety to check the adaptability under local condition. The package of practices of local farmers was adopted to stand good crop. The size of each trial plot was 40 x 40 m^2. The farmers were selected through visit to their fields, group discussion and farmers meeting in villages. The seed material was procured from ICAR-CSSRI, Karnal. Scientists visited regularly at on farm trial and farmer's fields. The feedback information from the farmer's was also recorded for further improvement in research and extension programmes. The extension activities i.e. training, scientist's visits and field days were organized at the trial sites. Observations pertaining to agronomic and yield attributing traits (Tables 1 - 2) were recorded from 25 different randomly selected plants from each plot.

RESULTS AND DISCUSSION

The experiment's findings demonstrated that salinity negatively impacted almost every growth and yield parameters. In both kinds, the effects of high salinity were found for the number of spikes/plant, spikelets/spike, grains/spike and 1000 grain weight (Table 1), grain and straw yield (Table 2), and economics (Table 3).

Growth parameters

The plant height of wheat influenced significantly due to salt tolerant varieties (Table 1). Among the varietal treatments, KRL-283 recorded significantly higher plant height (85.4 cm) at harvesting time as compared to C-306 (84.4 cm). The same result reported by Rani *et al.* (2018).

Table 1. Effect of wheat varieties on growth and yield performance parameters.

Conducted year	Height (cm)		No. of spikes/plant		No. of spikelets/spike		No. of grain/spike		1000 grain weight (g)	
	C-306	KRL-283	C-306	KRL-283	C-306	KRL-283	C-306	KRL-283	C-306	KRL-283
2020-21	84.7	85.3	4.6	5.5	16.3	18.7	44	46	46.8	47.3
2021-22	85.1	85.6	4.8	5.7	12.6	14.8	50	54	47.6	48.1
Average	**84.9**	**85.4**	**4.7**	**5.6**	**14.4**	**16.7**	**47**	**50**	**47.2**	**47.7**

Table 2. Effect of varieties on yield of wheat.

Conducted year	Grain yield (q ha^{-1})		Straw yield (q ha^{-1})	
	C-306	KRL-283	C-306	KRL-283
2020-21	32.8	35.6	46.9	47.4
2021-22	33.2	36.1	48.0	51.1
Average	**33.0**	**35.8**	**47.5**	**49.2**

Yield attributing characters

The number of spike/plant, no. of spikelets/spike, no. of grain/spike and 1000 grain weight of wheat influenced significantly due to varieties. The effect of varieties on yield attributing characters was shown in Table 1. The variety KRL-283 (5.6) has higher number of spike/plant than the plants of variety C-306 (4.7). The number of grains per spike directly affects the final wheat grain yield and is a significant yield contributing component. The results of the experiment proved that KRL-283 gave higher number of grain/spike (50.0) and no. of spikelets/spike (16.7), while the lower no. was obtained from C-306 (47.0 and 14.4, respectively). The test weight was higher for KRL-283 (47.7 g) contrasted with the C-306 (47.2 g) variety. This experiment revealed that, production of shorter plants with small and empty spikes might have influenced the yield of grain and straw in treatments with salinized soil; however, genetic difference to respond for such stress varies among wheat varieties. The same results were reported by Asgari *et al.* (2011).

Yield

Grain and straw yield : The grain and straw yield is determined by growth parameters like plant height and yield parameters like number of spike/plant, no. of spikelets/spike, no. of spike/spikelets and. The result (Table 2) indicated that KRL-283 gave higher yield of grain and straw (35.8 and 49.2 q ha^{-1}), while C-306 variety (33.0 and 47.5 q ha^{-1}, respectively) was appeared inferior other than tested wheat variety. Clear difference response to saline stress condition observed among tested materials suggests that existence of genetic variability among tested materials. Grain yield fluctuations caused by salinity were greater in sensitive genotypes than in salt-tolerant genotypes. These findings showed that the most promising methods for obtaining the highest grain yield and greatest quality under salinized circumstances would involve breeding and the usage of salt-tolerant wheat varieties. The same findings were reported by Rani *et al.* (2018). Under condition of salinity tolerance vigorous growth and continual replacement of lost leaves results in dilution of salt concentration in plant system. Tolerant genotypes can be minimized salt uptake, potential salt load per unit of new growth and provide better water use efficiency. High reduction in yield and yield parameters was due reduced growth, vegetative development, and biomass accumulation in salinity stress condition (Sobhaniana *et al.* 2011, Munns 2011).

ECONOMICS

Salt tolerant variety KRL-283 fetched net returns of Rs 90,580/ha with a net benefit cost ratio of 3.54 (Table 3) as compared to C-306 (Rs. 85524/ha and 3.40, respectively). It might be the result of both years' better grain and straw yields along with lower seed prices.

Table 3. Effect of varieties on economics of wheat.

Conducted year	Cost of cultivation (Rs/ha)		Gross returns (Rs ha^{-1})		Net return (Rs ha^{-1})		Additional return in technology (Rs/ha)	BC ratio	
	C-306	KRL-283	C-306	KRL-283	C-306	KRL-283		C-306	KRL-283
2020-21	35250	35140	111641	117710	76391	82570	6179	3.17	3.35
2021-22	36050	36350	130708	134640	94658	98590	3932	3.63	3.73
Average	35650	35745	121174	126175	85524	90580	5056	3.40	3.54

CONCLUSION

A key input into management strategies is the opinions of farmers regarding how salt affects soils, current management techniques, and preferred wheat varieties. One of the biggest concerns to the sustainability of wheat production among abiotic stresses is salt stress, particularly in arid and semi-arid regions of the world. The experiment's findings demonstrated that the salinity of the soil had a discernible impact on the growth stage of the wheat crop. It was observed that increasing soil salinity progressively decreased germination percentage, plant height, number of spike/plant, no. of spikelets/spike, no. of grain/spike, weight of 1000 grains and grain and straw yield. Rather than using other methods, farmers have restricted their crop selection to more tolerant varieties when reclaiming soils impacted by salt. This has helped to lessen the salinity of the environment. Yet it seems feasible to select the survivors or the plants that perform well from a crop grown in a saline environment, and thus improve salt tolerance.

ACKNOWLEDGMENT

I truly thank all of the farmers whose fields were used for the frontline demonstrations. The funding received from ICAR-ATARI Zone II, Jodhpur. The thoughts presented in this paper are those of the author and may not represent the donor or the author's organization.

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