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Evaluation of different wheat cultivars under salinity stress

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Abstract: A field experiment was conducted to study the response of different 11 wheat (*Triticum aestivum* L.) cultivars under saline condition and by applying saline irrigation water during rabi 2016-17 at Krishi Vigyan Kendra, Sri Muktsar Sahib (Punjab). Experiment site was chosen with high salinity condition (EC=1.87 dS/m) to check the response of particular cultivars in these conditions. The field was only irrigated with tube well water having very high EC (4630 micro mhos/cm). Results showed that the grain yield was recorded higher in KH 65 (5648 kg/ha), KRL 210 (5440 kg/ha), KRL 386 (5290 kg/ha) and DBW 246 (5048 kg/ha) as compared to lower grain yield recorded with KRL 384 (4353 kg/ha), KRL 19 (4423 kg/ha), KRL 370 (4538 kg/ha), DBW 248 (4608 kg/ha),WH 1316 (4838 kg/ha), DBW 247 (4860 kg/ha) and KRL 377 (4895 kg/ha). The experimental site was slightly saline in nature, so the cultivar KH 65, KRL 210, KRL 386 and DBW 246 are very suitable for the area as these were less affected due to salinity. Grain yield among these varieties were higher due higher number of effective tiller per unit area and due to large number of grains per ear. Whereas, KH 65, KRL 377 and KRL 386 also produced significantly higher straw yield from WH 1316, DBW 248, DBW 247, KRL 210, KRL 384, DBW 246, KRL 370 and KRL 19.

Keywords: Saline water, Salinity, Salt Tolerance cultivar, Wheat, Yield

INTRODUCTION

Wheat (*Triticum asestivum,* L.) is one of the major cereal crops cultivated in India to meet the food demand of burgeoning population of the country. Rapid increase in wheat consumption due to increasing population growth is projected to outpace the domestic production. Besides this, the salinity of soil and ground water resource is a major problem for irrigated agriculture in many parts of the world. Nearly 20% of the total world's cultivated area and about half of the world's irrigated lands are affected by soil salinity (Sattar *et al.,* 2010). Out of 328.73 million hectares (mha) geographical area present in India, about 120.40 mha (37%) is affected by land degradation. About 0.2-0.4% of the total arable land every year is going out of the cultivation because of salinity and water logging problem (Jabeen and Ahmad, 2012). India is facing problems of the reduction in quantity of irrigated water. One of the major reasons for decrease in crop yield is degradation of irrigation water quality.

Soil salinity is one of the major environmental stresses which affecting plant growth and productivity (Akbarimoghaddam *et al.*, 2006; Saboora *et al.,* 2006; Kandil *et al.*, 2012; Biabani *et al.*, 2013; Sharma, 2015). Excess amount of salt present in the soil adversely affects the growth and development of whole plant. Salinity induces water deficit even in the well watered soils by decreasing the osmotic potential of the soil solutes by making it difficult for plant roots to extract water from their respective surrounding media (Sairam *et al.*, 2002; Goudarzi and Pakniyat, 2008). The effect of salinity on plant can observed at whole plant level in the terms of plant death or decrease in productivity of crop (Parida *et al.*, 2004). Crop yield start declining when the pH of the soil solution exceeds 8.5 or the electrical conductivity (EC) value goes above the four dS m^{-1}. At higher EC values, crop yield are reduced to large extent (Sairam and Srivastava, 2002). Salinity stress biology and the plant responses to high salinity have discussed over two decades (Ehret and Plant, 1999; Hasegawa *et al*., 2000; Zhu, 2002).

Therefore, it is very important to develop appropriate package and practices for raising different crops and water management technologies for enhancing crop productivity from irrigated saline environment. Development of salt tolerant variety is an effective way to overcome the limitations of the crop production in certain salinized area (Munns and James, 2003; Kumar *et al*, 2016). Experiments can utilize the varietal difference in salinity tolerance that exists among the crop plants by doing appropriate traits for the salt tolerance (Kingsbury *et al.,* 1984). The crop grain yield is frequently used in crops like wheat as the main criteria for the salt tolerance (Jafari-Shabestary *et al.*, 1995). Other agronomic traits are very important such as number of effective tiller, plant height which have been used for assessment of salt tolerance of certain crop.

MATERIALS AND METHODS

A field experiment was conducted during *rabi* 2016-17

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at Krishi Vigyan Kendra, Sri Muktsar Sahib (Punjab), to find out the best suitable variety of wheat in saline condition. The geographical location of experimental site has reference to 74°30'16" east longitude, 30° 26'05" North latitude. The area is characterized by semi-arid type of climate and cold winters during December-January. The mean maximum and minimum temperatures show considerable fluctuations during different parts of the year. The soil sample was collected and tested from department of Soil science, PAU, Ludhiana. The soil was sandy loam, slightly alkaline in reaction (pH 7.8), very high EC (1.87dS/m), low in available organic carbon (0.38 %), medium in available phosphorus (16.3 kg/ha) and high in available potassium (540 kg/ha).This experiment site was chosen with high salinity condition to check the response of particular cultivars in these conditions. The field was only irrigated with tube well water having very high EC (4630 micro mhos/cm). Field experiment was laid out in randomized block design with eleven cultivars and six replications. Total eleven varieties KRL 384, DBW 248, WH 1316, DBW 247, KRL 210, KRL 19, KH 65, DBW 246, KRL 370, KRL 386 and KRL 377 were timely sown. These all varieties are provided by wheat section, Department of breeding and genetics, Punjab Agricultural University, Ludhiana for saline conditions. These cultivars were timely sown on November 15. The trials were harvest in the month of April according to the maturity of the variety. The 100 kg seed rate/ha was used and all the other agronomic practices were kept optimum in the experiment. Nitrogen was applied according to the soil test basis and three irrigations (Ist at CRI stage, Second at jointing and third at milking stage) were applied to the crop. The data on plant height (cm), number of effective tillers per square meter, number of grains per ear, 1000 grain weight, grain yield and straw yield were collected through field observations. Collected data were further analyzed by using appropriate statistical tools.

RESULTS AND DISCUSSION

Plant height: In the given experiment, the variety KH 65(103.4 cm) produced significantly higher plant height which was statistically at par with KRL 386 (102.63 cm) and KRL 377 (94.73 cm) significantly higher from WH 1316 (91.20 cm), DBW 248 (89.03 cm), DBW 247 (88.57 cm), KRL 210 (88.53 cm) and lower in KRL 384, DBW 246, KRL 370 and KRL 19 (Table 1). Plant height is not directly related to grain yield but it is directly proportion with the comparative straw yield of wheat crop. More is the plant height of certain variety more will be the comparative straw yield.

Number of effective tillers per m^2: Number of the effective tiller per unit area is one of the major yield contributing character in wheat crop. As the variety having more number of tillers, it will also contribute more toward both grain and straw yield. So, both grain and straw have directly relation with the number of tillers. Among all the varieties KH 65 (439.58/m^2) and KRL386 (397.92/m^2) produced significantly higher number of effective tiller per unit area from DBW (386.67/m^2), KRL 210 (382.92/m^2),WH 1316 (367.92/m^2), KRL 377 (366.25/m^2), DBW 246 (362.5/m^2) and lower effective tillers in KRL 384 (353.75/m^2), KRL 370 (349.58/m^2), DBW 248 (337.08/m^2) and KRL 19 (326.67/m^2). The varieties KH 65 and KRL 386 gave higher effective tiller in saline condition indicating that these cultivar are suitable in saline soil and by given saline water irrigation (Table 1).

Number of grain/ear and 1000 grain weight: Number of grain/ear is a good yield contributing characters. Number of grain/ear was significantly higher in wheat variety KRL 370 (57.9) which was statistically at par with KRL 19 (56.2), DBW 247 (54.0), DBW 246 (52.0) and WH 1316 as compared to KRL 377 (51.4), KRL 384, KRL 210, DBW 248, KRL 386 and KH 65 (Table 1). However KRL 370 (44.9 g) gave higher 1000 grain weight, which was statistically at par with WH 1316, KRL 377, DBW 346, DBW 247 and KRL 386 and significantly superior from KRL 384, DBW 248, KRL 210, KH 65 and KRL 19.

Grain yield: Grain yield is the main economical part of the wheat crop. From all varieties KH 65 recorded

Table 1. Performance of different cultivar under salinity stress.

Variety	Plant height (cm)	Tiller/m^2	No. of grains/ ear	1000 grain weight (g)	Grain yield (kg/ ha)	Straw yield (kg/ha)
KRL 384	84.53	353.75	50.4	42.0	4353	8033
DBW 248	89.03	337.08	46.6	41.4	4608	7663
WH 1316	91.20	367.92	52.0	44.6	4838	8473
DBW 247	88.57	386.67	54.0	43.0	4860	7523
KRL 210	88.53	382.92	47.8	41.5	5440	8913
KRL 19	82.33	326.67	56.2	41.0	4423	7500
KH 65	103.40	439.58	48.4	42.5	5648	11365
DBW 246	84.63	362.50	52.0	43.8	5048	8380
KRL 370	84.57	349.58	57.9	44.9	4538	7733
KRL 386	102.63	397.92	46.2	42.7	5290	9873
KRL 377	94.73	366.25	51.4	44.0	4895	9920
CD (p=0.05)	10.3	48.3	5.8	2.3	703	1925

higher grain yield (5648 kg/ha), which was statistically at par with KRL 210 (5440 kg/ha), KRL 386 (5290 kg/ha) and DBW 246 (5048 kg/ha) as compared to lower grain yield recorded with KRL 384 (4353 kg/ha), KRL 19 (4423 kg/ha), KRL 370 (4538 kg/ha), DBW 248 (4608 kg/ha),WH 1316 (4838 kg/ha), DBW 247 (4860 kg/ha) and KRL 377 (4895 kg/ha). The experimental site was slightly saline in nature, so the cultivar KH 65, KRL 210 and DBW 246 are very suitable for the area as these were less affected due to salinity. Reason for attaining higher grain yield was due to higher number of effective tiller per unit area and due to large number of grains per ear.

Straw yield: As we considered about the grain yieldthe variety KH 65 (11365 kg/ha) produced significantly higher straw yield, which was statistically at par with KRL 377 (9920 kg/ha) and KRL 386 (9873 kg/ha) and significantly higher from WH 1316, DBW 248, DBW 247, KRL 210, KRL 384, DBW 246, KRL 370 and KRL 19 (Table 1). Straw yield of these varieties was higher due to more plant height of these certain variety. Now a day the wheat straw in Punjab is also very costly and equally valuable, as it is used as animal feed and lot of paper industries. The variety which has more number of tillers and plant height will be able to get good straw yield.

Conclusion

Saline water is the main constrain of south western part of Punjab as undergroundwatercontains higher EC. Due to this saline water, the salinity in the soil is the major factors of restricting productivity of wheat crop in the area. Lot of saline and water logged area are present in Sri Muktsar sahib district of Punjab, to avoid this problem development of such wheat varieties, which are high yielding and resistance to biotic and abiotic stresses must be included. The cultivar KH 65, KRL 210, KRL 386 and DBW 246 are very suitable for the area as these were less affected due to salinity. Grain yield among these varieties were higher due higher number of effective tiller per unit area and due to large number of grains per ear.

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