http://www.pjbs.org

PJBS

ISSN 1028-8880

Pakistan Journal of Biological Sciences

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Pakistan Journal of Biological Sciences 9 (14): 2667-2671, 2006
ISSN 1028-8880

Effect of Cropping Methods and Salinity Stress on Wheat Agronomic Characteristics

[1]Mahdi Khozaei, [2]Ali Soleimani, [3]Amir Hosein Shirani, [2]Payam Najafi and [4]Mohammad Feizi
[1]Faculty of Agriculture, Khorasgan Azad University, Iran
[2]Department of Agronomy and Plant Breeding, Faculty of Agriculture,
Islamic Azad University, Branch of Khorasgan, Iran
[3]Department of Soil and Water, Faculty of Agriculture, Islamic Azad University, Branch of Khorasgan, Iran
[4]Soil and Water Research Department, Isfhan Agricultural and Natural Research Center, Iran

Abstract: Water deficit associate with salinity in irrigation water is the major limiting factor in the Center and East of Iran region. Nevertheless, an experiment was conducted in 2005 at Esfahan National Salinity Research. The purpose of this study was to evaluate effect of cropping methods and salinity stress on wheat agronomic characteristics. A Split plot layout within Randomized Complete Block Design with four replication were used. Irrigation quality water irrigation were in main plot, it consists in 4, 8 and 12 dS m^{-1} and cropping methods were in sub plots that inclusive of traditional cropping, 60 cm furrow, 80 cm furrow and aside sloping 80 cm furrow with double row planting. The results showed effect of raising salinity stress on 1000 grain weight, protein yield, grain yield, biological yield, straw yield and harvest index were decreased significantly. Effect of cropping methods on protein yield, biological yield and straw yield were more significantly. While, the highest amount of the traits agronomic were in 60 cm furrow cropping method, whereas the lowest the agronomic characteristics were in traditional cropping method with the exception of protein yield that lowest was in aside slopping 80 cm furrow. The effect of cropping methods on 1000 grain weight and harvest index were not significantly. According this study the suitable method with the highest traits agronomy in salinity stress was 80 cm method. While, the traditional cropping method did not recommended in high salinity stress condition.

Key words: Salinity stress, cropping method, harvest index, protein yield, grain yield

INTRODUCTION

Excess amount of salt in the soil adversely affects plant growth and development. Nearly 20% of the world's cultivated area and nearly half of the world's irrigated lands are affected by salinity (Zhu, 2001). Salinity is a major constraint to crop production in the arid and semiarid areas of the world, where low precipitation, high surface evaporation, irrigation with saline water, rising water tables and poor irrigation practices increase level of soluble salts (Ashraf, 1994; Hollington, 1998). Processes such as seed germination, seedling growth and vigor, vegetative growth, flowering and fruit set are adversely affected by high salt concentration, ultimately causing diminished economic yield and also quality of produce. Water deficit associated with salinity in irrigation water is the major limiting factor in the center and east of Iran where plants are subjected to extreme water deficit during the season. In this climatic condition, salts may accumulate in the soil because of high evaporative demand and insufficient leaching of ions because of low precipitation (Feizi, 1998). The deterious effect of salinity was suggested as result of water stress ion toxicities, ion imbalance, or combination of all these factors (Kurth *et al*., 1986). In view of, 55.8% of Iran's lands contained sodic soil or insufficient draining; on the other hand, resource of irrigation water quality continued too much salts and ions (Keyani, 2001). It was necessity to investigation about usage new cropping methods in salinity stress in irrigated farming for cropping plants. Bernstein *et al*. (1955) done some research about seed bed and cropping methods in salinity stress, he showed distances between planting rows and furrow caused to lower deterious effect of ions and concentration of salts zone of root and stem. Also, rising seed bed could declined confronting of plant to direct side effect of salts toxicity. The aims of this study as regards geographical occasion of Iran, which established some arid and semi arid in center, east and north east with the minimum annul raining, to evaluate effect of cropping methods and salinity stress on wheat agronomic characteristics.

Corresponding Author: Mahdi Khozaei, Faculty of Agriculture, Islamic Azad University, Branch of Khorasgan, Khorasgan, Iran

MATERIALS AND METHODS

This experiment was conducted in Esfahan National Salinity Research Rodasht Station with longitude 52/11' and latitude 32/29' in Oct, 2004. A split plot layout within Randomized Complete Block design with four Replications was used. Irrigation water qualities were in main plot, it consists in 4, 8 and 12 dS m^{-1} cropping methods were in sob plot in collusive of traditional cropping, 60 cm furrow, 80 cm furrow. Aside sloping 80 cm furrow with double row planting. Measurement of plot was 32 m^2 with number of furrow 4, 5 in 80 and 60 cm furrow cropping methods respectively. The fertilizing were 100 kg ha^{-1} ammonium phosphate before planting and 100 kg ha^{-1} nitrogen in tow stage half before and half after planting used. After preparing Farm sown with seeds Wheat (*Triticum astivum*, *variety Roshan*). then Physiological progress and development plant stage, gathered all products in every plot which weighed with the exception of margins to obtain biological yield. Then, sifting and cleaning so, seeds weighed to aim of grain yield. Obtained straw yield from Subtracted grain yield of biological yield. Counted 500 seed from every plot with seed counter Set then weighed and twofold it was seed weight. Eventually, harvest indices was estimated using below formula for every plot according to Lazar *et al.* (1995). Biological yield was considered as shoot dry weight,

$$HI = \frac{\text{Seed yield}}{\text{Biological yield}} * 100$$

Statistical analyses of data were performed using MSTAT-C Program. Duncan Multiple Range Test was used to determine significant differences of means at the 5% level.

RESULTS AND DISCUSSION

Repeat affected was significantly on 1000 grain weight (Table 1). Effect of salts treatments on 1000 grain weight and harvest index was more significant (Table 1). Afzal (2004) reported Augmented salt levels caused deducted significantly on amount of kernel per spikes, grain weight per spikes and 1000 grain weight Basically, seeds weight, controlled with period and filled up nutrient material rate. Also, amount of kernel per spikes (Kirby, 1974). Amount of 1000 grain weight and harvest index decreased significantly under the rising level of salt treatments (Table 2). Prakash *et al.* (2004) reported harvest index was reduced by 3.6 and 18%, at medium and high salinity levels, respectively. Rising salt levels affected directly on Harvest Index with declined 1000 grain weight. This result is in agreement with that of Houshmand *et al.* (2005). Cropping methods did not affected significantly on 1000 grain weight and harvest index (Table 1). There were not any difference significantly between cropping methods on seed weight and harvest index (Table 2). Salinity reaction and methods cropping affected were not significant on seed weight and harvest index (Table 1). Effect of salt treatments was more significant on protein yield (Table 1). Thus, increasing salinity levels reduced significantly protein yield (Table 2). On the contrary, Francios *et al.* (1986) reported the rising salts treatment caused increasing in amount of protein in spite of, deducted in bread quality. Cropping methods affected was more significant on protein yield (Table 1). The highest protein yield was in 60 cm furrow cropping method while, the lowest was in sloping 80 cm furrow (Table 2). By this planting method soil and water salts still concentrate near the center of the bed but away from the seed rows and germination is likely to be better if salinity is a problem (Ayers and Westcot, 1985). Reaction of salt treatments and cropping methods affected were more significant on protein yield where as, the greatest depended on 60 cm furrow in salinity 4 dS m^{-1} and the lowest belonged to 80 cm furrow in salinity 12 dS m^{-1} there were not any significant difference between amount of protein yield in cropping methods in salinity 8, 12 dS m^{-1} (Fig. 1). Excess of salt creates osmotic stress by a decline in water potential producing negative effect

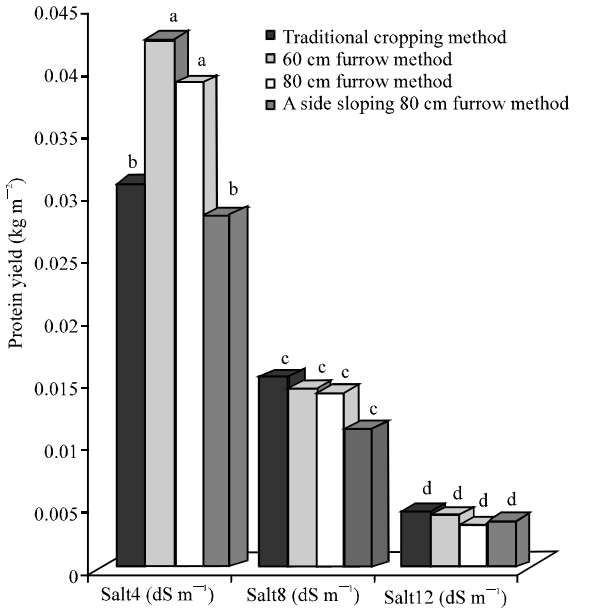

Fig. 1: Means of comparison protein yield on reaction of salt treatments and cropping methods

Table 1: ANOVA analysis 1000 grain weight, harvest index, protein yield, grain yield, biological yield and straw yield

		Means square					
Source of variation	df	1000 grain weight (g)	Harvest index (%)	Protein yield (kg m^{-2})	Grain yield (kg hec^{-1})	Biological yield (kg hec^{-1})	Straw yield (kg hec^{-1})
Repeat (Block)	3	50.583*	61.516	6.4759	26.518	252.635	133.978**
Salinity	2	711.750**	19.3370**	407.462**	196.854**	11464.8**	3969.006
Error A	6	7.75	58.52	5.8564	23.233	100.123	32.55
Cropping method	3	17.917	50.841	7.8684**	50.393**	212.830**	54.739**
Interaction on salinity and cropping method	6	23.417	18.741	5.6363**	36.556**	234.089**	91.515**
Error B	27	10.713	19.978	1.2725	6.041	29.8835	14.249

** and * significant at the 5 and 1% probability levels, respectively

Table 2: Means comparison salt levels and cropping methods on 1000 grain weight, harvest index, protein yield, grain yield, biological yield and straw yield

Experimental factor	1000 grain weight (g)	Harvest index (%)	Protein yield (kg m^{-2})	Grain yield (kg hec^{-1})	Biological yield (kg hec^{-1})	Straw yield (kg hec^{-1})
Salinity						
4 dS m^{-1}	35.00a	41.46a	25.08a	7594.0a	18320a	10730a
8 dS m^{-1}	24.50b	34.94b	13.67b	2347.0b	6085b	3880b
12 dS m^{-1}	22.63b	24.77b	3.883c	842.8c	2139c	1540c
Cropping methods						
Traditional cropping	27.42a	33.53ab	16.80bc	3243.0c	8277c	5218c
60 cm furrow method	28.50a	33.89ab	20.27a	4212.0a	10010a	6053a
80 cm furrow method	27.92a	36.55a	18.76ab	40.35b	10000b	5845b
A side sloping 80 cm furrow method	27.67a	31.22b	14.35c	2890.0d	7111d	4418d

All means followed by the same letter in column are not significantly different at the 5% probability level

on physiology processes the some negative effect have also been reported by Sheveen *et al.* (2001). Effect of salt treatments on grain yield, biological yield and straw yield were more significant (Table 1). Raising salinity levels declined significantly amount of grain yield, biological yield and straw yield (Table 2).

Afzal (2004) reported salinity imposed with 20 dS m^{-1} saline water reduced grain yield compared with control and 10 dS m^{-1} saline water by 25 and 37%, respectively. Also, Afzal (2004) shown although, time of salinity treatment had not any significant effect on straw yield but any increasing in salinity levels, reduced straw yield significantly. Hasany *et al.* (1995) believed that raising salinity levels reduced significantly in biological yield. Cropping methods were more significant (Table 1) the greatest grain yield, biological yield and straw yield were in 60 cm furrow; though, the lowest of grain yield biological yield and straw yield were in sloping 80 cm furrow (Table 2). It seems the 60 cm furrow was suitable distance between planting rows which shown the highest yields because of distance encourage plant to growth and development procedure so, with the diminish of exceed ions and salts. Reaction of salinity and method cropping affected were more significant on grain yield, biological yield and straw yield (Table 1). The highest grain yield, biological yield and straw yield belonged to traditional cropping method in salinity 4 dS m^{-1} in case, the lowest grain yield biological yield straw yield were in aside sloping 80 cm in salinity 12 dS m^{-1} (Fig. 2-4). It seems in salinity 4 dS m^{-1} were not any foes of ions and salts on growth development of plant. On the contrary, in salinity 12 dS m^{-1} there were much force on stages of growth. Cerda and Bingham (1978) believed the reason of declined the grain yield and straw yield due ot diminish amount of tillers and clusters. The greatest amount of grain yield, biological yield and straw yield in salinity 8, 12 dS m^{-1} belong to 80 cm furrow then, 60 cm furrow cropping methods, respectively whereas, the lowest grain yield, biological yield and straw yield were in aside sloping 80 cm furrow. Creation distance between planting rows in salt treatments 8, 12 dS m^{-1} reduction deterious and side effect as result of salt concentration on plant growth on

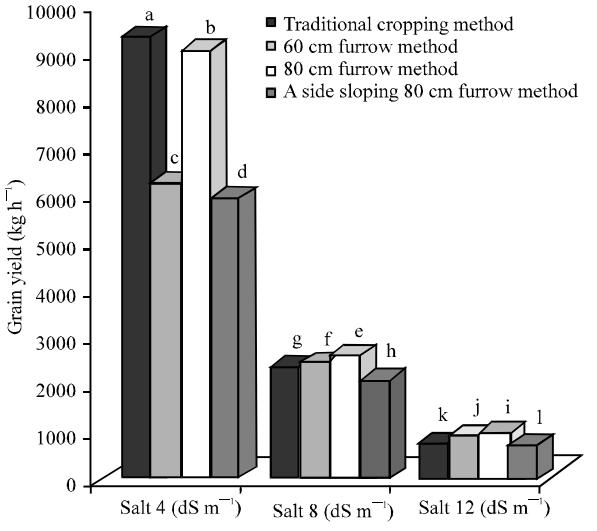

Fig. 2: Means of comparison grain yield in reaction of salt treatments and cropping method

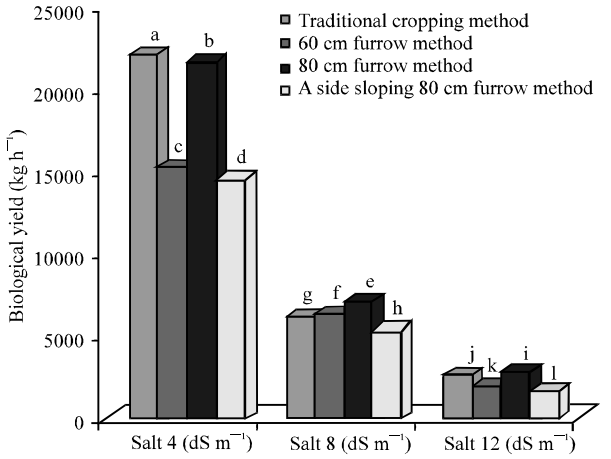

Fig. 3: Means of comparison biological yield in reaction of salt treatments and cropping methods

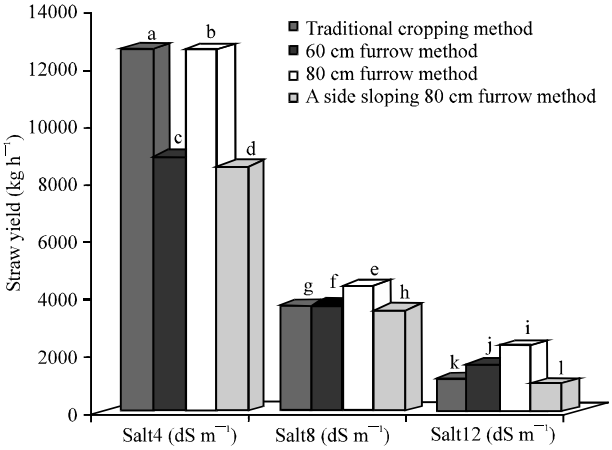

Fig. 4: Means of straw yield in reaction of salt treatments and cropping methods

the contrary, assembling salt and excessive ions between planting tow row of a side slopping 80 cm furrow caused risen osmotic pressure and declined up took mineral nutrients. Growth and development of plants are inhibited due to occurring defect in metabolism. Some investigators thought that because of ion accumulation by changing membrane permeability, metabolism was negatively in flounced (Cramer *et al*., 1985; Grieve and Fujiyama, 1987). In conclusion, with the rising salinity stress in arid and semiarid where low precipitation, high surface evaporation, irrigation with saline water the Ions and salts concentrated so, the beneficiary way was creates rising plant bed with the suitable distance to avoid of deterious effect. In present study in salinity 8, 12 dS m^{-1} the best chosen was 80 cm furrow which showed the highest amount of agronomic characteristics.

REFERENCES

Afzal, Y., 2004. Determine crisis period of sensitivity to salinity tows wheat cultivars. M.Sc. Thesis. Azad Khorasghan University.

Ashraf, M., 1994. Breeding for salinity tolerance in plant. Crit. Rev. Plant Sci., 13: 17-42.

Ayers, R.S. and D.W, Westcot, 1985. Water quality for agriculture. FAO. Rev., 29: 44- 46.

Bernstein, L., M. Fireman and Reve, 1955. Agricultural Research Service bul41 (4). Is P.R.C. Control of Salinity in the Imperial Valley. US Department of Agriculture.

Cerda, A. and F.T. Bingham, 1978. Yield, mineral Composition and salt tolerance of tomato and wheat b as effected by NaCl and nutrition. Agrochemical, 22: 140-142.

Cramer, G.R., A.L. Uchli and V.S. Polito, 1985. Displacement of Ca^{+2} by Na^{+} form the plasma lemma of root cells. Plant Physiol., 979: 207-211.

Feizi, M., 1998. Quality water affect on wheat product yield. Annul Report. Esfahan Agricultural Research Center. No. 77/282.

Francios, I., E.E.V. Mass, T.J. Donovan and V.L. Youngs, 1986. Effect of salinity on grain yield quality, vegetative growth and germination of semi-dwarf and durum wheat. Agron. J., 78: 1053-1058.

Grieve, C.M.H. and Fujiyama, 1987. The response of tow rice cultivars to external Na/Cl ratio. Plant and Soil, 103: 245-250.

Hasany, H.S., S. Abdemishany and B.Y. Samadi, 1995. Determine agronomic and morphological characteristic Iran's wheat variety to response to salinity stress. Agric. Sci., 26: 87-98.

Hollington, P.A., 1998. Technological Breakthroughs in Screening and Breeding Wheat Varieties for Salt Tolerance. In: Proc. National Conference on Salinity Manage. Gupta, S.K., S.K. Sharma and N.K. Tyagi (Eds.). Agric. CSSPI, Karnal, Ind., pp: 273-289.

Houshmand, S.A., S. Arzani, A.M. Maibody and M. Feizi, 2005. Evaluation of salt-tolerant genotypes of durum wheat derived from *in vitro* and field experiments. Field Crops Res., 91: 345-354.

Keyani, A., 2001. Executive methods and management of usage salinity water the First National Conference to check lack of water. Zabol. Dec. 2001.

Kirby, E.J.M., 1974. Ear development in wheat. J. Agric. Sci. Camb., 2: 437-447.

Kurth, E., G.R. Cramer, A. Lauchli and E. Epstein, 1986. Effects of NaCl and $CaCl_2$ on cell enlargement and cell production in cotton roots. Plant Physiol., 82: 1102-1106.

Lazar, M.D., C.D. Salisbury and W.D. Worrall, 1995. Variation in drought susceptibility among closely related what lines. Field Crop Res., 41: 143-147.

Prakash, D., D. Rodriguez and D. Chen, 2004. Spatial pattern of the effect of soil salinity on crop physiological parameters, soil water content and yield of wheat. Super Soil 2004. www.regional.org.au/au/asssi for Super Soil 2004, the 3rd Australian New Zealand Soils Conference.

Sheveen, A., R. Ansari and Q. Soomrom, 2001. Salt tolerance in salinity toxicity. Quantitative resolution of multiple toxic and ameliorative effects. J. Exp. Bot., 50: 1495-1502.

Zhu, J.K., 2001. Over expression of a delta-pyrroline-s-carboxylate synthesize gene and analysis of tolerance to water and salt stress in transgenic rice. Trends Plant Sci., 6: 66-72.