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Effect of Integrated Nutrient Management on Yield and Yield Attributes and Economics of Wheat (*Triticum aestivum* L.) under Saline and Non-Saline Irrigation Water

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A B S T R A C T

Integrated use of vermicompost, biofertilizers and chemical fertilizers was carried out to evaluate the yield performance of WH-711 under saline and non saline irrigation water during rabi seasons of 2011-2012 and 2012-2013 at Hisar, Haryana. Effective tillers/mrl, ear head length (cm), number of grains/spike, grain, straw and biological yields (q/ha) were significantly higher in canal water as compared to saline water during both the years. Number of effective tillers/mrl, number of grains/spike, grain, straw and biological yields (q/ha) were maximum in *Azotobacter* ST3 and *Pseudomonas* P36 + vermicompost @5 t/ha and minimum in no inoculation treatment during 2011-12 and 2012-13. Application of 125% RDF, being statistically at par with 100% RDF, produced significantly higher number of effective tillers/mrl, grains/spike, grain, straw and biological yields (q/ha) than 75% RDF during 2011-12 and 2012-13. Test weight (g) and harvest index did not differ significantly under quality of irrigation water, levels of fertilizer and inoculation and vermicompost treatments during both the years. The INM treatment INVC125% RDF recorded maximum gross returns (avg. Rs. 90,133/ha), but net returns were better in IN125% RDF (avg. Rs. 55, 242/ha). Moreover, integrated use of bio-fertilizer and 100% RDF resulted in maximum B: C ratio (avg. 2.80).

Introduction

Wheat (*Triticum aestivum* L.) is the second most important staple food crop at global scenario after rice. In India, it is cultivated extensively in north western and central zones. In Haryana state, it is grown over an area of 2.52 million hectares with 11.63 million tonnes of production and highest productivity of 4624 kg per hectare in the country during 2014-15 (Anonymous, 2016). In Haryana state, more than half (55%) ground water is of poor quality. Amongst the poor quality waters, the proportion of sodic, saline and saline-sodic waters are 18, 11 and 26 per cent, respectively (Manchanda, 1976). The yield of a plant is the combined effect of its inherited genetic constitution and the environment to which it is exposed during its life period. Although, it is not possible to modify the environment to suit the need of a particular plant, however one can manipulate the environment to harness the genetic potential of that plant type. In modern agriculture, keeping in mind status of the soil health, it is well recognized that neither organic manures nor chemical fertilizers individually can supplement the balanced amount of nutrients required by the plant to sustain production.

Although, crop responses to organic and bioinoculants do not bring a spectacular and immediate change as chemical fertilizers, but lead to increased use efficiency of fertilizers and enhanced physico-chemical properties of soil on long term basis. Moreover, quality of irrigation water has deteriorated over the years due to excessive use of chemical fertilizers. Salinity is also a major hindrance threatening wheat productivity in semi-arid regions by inducing physiological drought stress, ion toxicity and mineral deficiencies. Hence, it was realized to integrate biofertilizers, chemical fertilizers and vermicompost with an aim to improve wheat yield, productivity and net income at the end under both saline water and non-saline irrigation water.

Materials and Methods

Integrated nutrient management studies in wheat crop under saline and non saline irrigation water were conducted during rabi seasons of 2011-2012 and 2012-2013 at Research Farm, Department of Soil Science, of Chaudhary Charan Singh, Haryana Agricultural University, Hisar. Hisar is situated in the sub-tropics at 29º 10´N latitude and 75º 46´E longitudes at an elevation of 215.2 meter above mean sea level in Haryana, India.

The soil was sandy loam in texture, low in organic carbon and available nitrogen, medium in available phosphorus and high in available potassium. WH-711 was used as seedling material, vermicompost was used as organic source and urea, diamonium phosphate and zinc sulphate were used as chemical fertilizers at the recommended dose (RDF) as per the package and practices of CCSHAU. WH-711 seeds were inoculated with *Azotobacter* ST3 and *Pseudomonas* P36 during both the years.

The experiment comprised of two levels of quality of irrigation water viz., canal (non saline) water and saline water (8-10 dS/m) and four inoculation and vermicompost treatments viz., no inoculation (control), vermicompost @ 5 t/ha, *Azotobacter* ST3 + *Pseudomonas* P36 and *Azotobacter* ST3 + *Pseudomonas* P36 + vermicompost @ 5 t/ha in main plots and three levels of fertilizer viz., 75, 100 and 125% RDF in sub-plots.

The 24 treatment combinations were tested in split plot design replicated thrice. The data on yield and yield attributing parameters namely number of effective tillers/mrl, number of grains/spike, ear head length, test weight, harvest index, grain, straw and biological yields were analyzed using OP Stat at 5% level of significance.

Economics

Input cost (₹/ha)

The cost of field preparation, sowing of seeds, thinning, weeding, fertilizer application, harvesting and cleaning contributed to fixed cost. The variable cost included the cost of irrigation charges and labour for application of irrigation.

Gross returns (₹/ha)

The grain yield was multiplied by minimum support price of wheat and straw yield by market rate of straw and both were added to find out the gross return of each treatment.

Net returns (₹/ha)

To find out the most profitable treatment, economics of different treatments was worked out in terms of net returns by taking into account the cost of cultivation and gross returns per hectare.

Net returns = Gross returns - Input cost

Benefit cost ratio (B: C)

Treatment wise benefits cost (B: C) ratio was calculated to ascertain economic viability using the following formula:

$$B:C = \frac{\text{Gross return (₹/ha)}}{\text{Cost of cultivation (₹/ha)}}$$

Results and Discussion

Yield attributes and yield

Effective tillers per row meter length

Effective tillers/mrl was significantly higher in canal water treatment (93.22, 78.33) as compared to saline water (88.25, 75.31) during 2011-12 and 2012-13, respectively (Table 1). Kumar (2000), Saqib *et al.*, (2004) and Dikgwatlhe *et al.*, (2008) also reported that effective tillers/m^2 was significantly reduced under salinity stress. They further reported that the reduction in number of effective tillers was due to severe reduction in tiller number during the early growth stages of wheat ascribed to the fact that viability of primary and secondary tillers is greatly influenced by salinity stress. Effective tillers/mrl was significantly higher in *Azotobacter* ST3 and *Pseudomonas* P36 + vermicompost @5 t/ha (90.03, 84.44) followed by vermicompost @5 t/ha (86.38, 82.69) and minimum in no inoculation (81.11, 78.77) during both the years, respectively which may be due to increased and steady availability of N, P and K in addition to other plant nutrients released by vermicompost. This is in accordance with Chopra *et al.*, (2016), Singh *et al.*, (2017) and Verma *et al.*, (2017). Furthermore, inoculation with *Azotobacter* and *Pseudomonas* might have increased the availability and uptake of nutrients by plants which resulted in improved yield components (Malik *et al.*, 2009). Maximum effective tillers/mrl was observed in 125% RDF (87.67, 83.67) which was statistically atpar with 100% RDF (86.76, 82.62) and significantly superior over 75% RDF (83.00, 79.04) during both the years, respectively. In concordance, maximum number of fertile tillers was recorded in the treatment of 150 kg N/ha followed by 125 kg N/ha, whereas the minimum number of fertile tiller/m^2 was recorded in control treatment (Maqsood *et al.*, 2000). Similar results were reported by other workers (Singh and Agarwal, 2001; Chauhan, 2014 and Jat *et al.*, 2014 and Chopra *et al.*, 2016).

Ear head length (cm)

Under quality of irrigation water, ear head length was significantly higher in canal water (9.36, 9.78) as compared to saline water treatment (8.93, 9.43) during both the years, respectively. Similarly significant decrease in ear head length due to salinity was reported by Asgari *et al.*, (2011), Kumar *et al.*, (2012), Mojid *et al.*, (2013) and Kalhoro *et al.*, (2016) as compared to control. Higher ear head length was observed under application of 125% RDF than 100%RDF and 75% RDF during both the years which is in conformity with the findings of Kumar (2000) at similar levels of fertility.

Similar results were reported by Sharma and Das (1982) and Singh (1987). Inoculation and vermicompost treatments have no significant effect on ear head length during both the years. However, maximum ear head length was recorded in the inoculation (*Azotobacter*

ST3 and *Pseudomonas* P36) + vermicompost @5t/ha treatment which is supported by Devi *et al.*, (2011).

Number of grains/spike

Significantly more number of grains/spike was observed in canal water (47.97, 47.72) than under saline water (43.50, 43.35) during both the years, respectively. Similarly significant decrease in number of grains/spike due to salinity was reported by Kumar (2000), Asgari *et al.,* (2011), Kumar *et al.,* (2012), Mojid *et al.,* (2013) and Kalhoro *et al.,* (2016) as compared to control.

Inoculation (*Azotobacter* ST3 and *Pseudomonas* P36) + vermicompost @5t/ha produced significantly higher number of grains/spike (47.83, 47.73) followed by vermicompost @5t/ha (45.83, 45.70) and minimum was observed under no inoculation (44.22, 44.11) during rabi seasons of 2011-12 and 2012-13, respectively.

Similar trend has been reported by Devi *et al.,* (2011). Application of 125% RDF produced higher number of grains/spike followed by 100% RDF and minimum under 75% RDF during both the years. Present findings are in conformity with the findings of Delogu *et al.,* (1998), Kumar (2000), Singh and Agrawal (2001) and Yousefi *et al.,* (2014).

Test weight (g)

A cursory glance on the data in Table 1 revealed that various treatments of quality of irrigation water, fertilizer levels and inoculation and vermicompost did not bring any significant variation in 1000-grain weight (g) during both the years of experimentation. Similar findings were reported by Kumar (2000), Singh and Agrawal (2001), Ragab *et al.,* (2008) and Bana *et al.,* (2012).

Grain, straw and biological yield (q/ha)

Wheat crop irrigated with canal water produced 24.98 and 16.80 per cent higher grain yield over saline water in2011-12 and 2012-13, respectively (Table 2).

Likewise, higher grain yields to the tune of 14.49, 27.50 and 18.46 per cent were recorded in canal water as compared to saline water treatments in wheat crop by Kumar (2000), Kumar *et al.,* (2012) and Mojid *et al.,* (2013). In general, the significant decrease in yield under influence of different salinity levels was due to the increase in EC of soil which in turn was responsible for the reduction in grain yield by causing a restricted availability of water and nutrients to the plant.

Inoculation brought significant change in grain yield. Integrated use of inoculation and vermicompost (*Azotobacter* ST3 & *Pseudomonas* P36 + vermicompost @ 5t/ha) significantly increased the grain yield to the tune of 10.44 and 9.99 per cent over no inoculation in 2011-12 and 2012-13, respectively. Similar findings were also reported by Devi *et al.,* (2011) and Davari *et al.,* (2012).

The increase in grain yield might be due to adequate quantities and balanced proportions of nutrients supplied to the crop resulting in favourable increase in yield attributing characters which ultimately led towards an increase in economic yield. Improved physico-chemical properties of the soil and microbial activities by the application of vermicompost and biofertilizers might be the other possible reason for higher productivity. Application of 100% RDF significantly increased the grain yield over 75% RDF; however, it was at par with 125% RDF during both the years. The findings are in concordance with Kumar (2000), Jat *et al.,* (2014), Chauhan (2014) and Chopra *et al.,* (2016).

Table.1 Effect of saline water and different nutrient management practices on yield attributes of wheat crop

Treatments	Effective tillers/ mrl		Ear head length (cm)		Number of grains/spike		Test weight (g)	
	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13
Quality of irrigation water								
Canal water	93.22	88.25	9.36	9.78	47.97	47.72	39.15	38.95
Saline water	78.33	75.31	8.93	9.43	43.50	43.35	38.98	38.89
SEm±	**0.84**	**0.53**	**0.07**	**0.08**	**0.57**	**0.61**	**0.38**	**0.34**
CD at 5%	**2.56**	**1.61**	**0.21**	**0.25**	**1.72**	**1.85**	**NS**	**NS**
Inoculation and vermicompost								
Inoculation (*Azotobacter* ST3 &*Pseudomonas* 36)+vermicompost @5t/ha	90.03	84.44	9.36	9.65	47.83	47.73	39.33	39.06
Inoculation (*Azotobacter* ST3 &*Pseudomonas* 36)	85.58	81.20	9.01	9.59	45.05	45.00	39.06	38.91
Vermicompost @5t/ha	86.38	82.69	9.17	9.60	45.83	45.70	39.14	38.95
No inoculation	81.11	78.77	9.05	9.57	44.22	44.11	38.73	38.77
SEm±	**1.22**	**0.76**	**0.11**	**0.12**	**0.80**	**0.89**	**0.54**	**0.48**
CD at 5%	**3.70**	**2.31**	**NS**	**NS**	**2.44**	**2.70**	**NS**	**NS**
Fertilizers								
75% RDF	83.00	79.04	9.04	9.56	44.00	43.85	38.60	38.19
100% RDF	86.67	82.62	9.07	9.61	46.08	45.95	39.11	38.66
125% RDF	87.67	83.67	9.35	9.63	47.12	47.01	39.49	38.91
SEm±	**0.94**	**0.65**	**0.09**	**0.09**	**0.75**	**0.74**	**0.30**	**0.27**
CD at 5%	**2.72**	**1.86**	**0.25**	**NS**	**2.17**	**2.14**	**NS**	**NS**

Table.2 Effect of saline water and different nutrient management practices on grain yield, straw yield, biological yield and harvest index of wheat crop

Treatments	Grain yield (q/ha)		Straw yield (q/ha)		Biological yield (q/ha)		Harvest index	
	2011-12	**2012-13**	**2011-12**	**2012-13**	**2011-12**	**2012-13**	**2011-12**	**2012-13**
Quality of irrigation water								
Canal water	51.08	46.52	76.53	66.16	127.6	112.7	40.0	41.3
Saline water	40.87	39.83	62.99	53.18	103.9	93.0	39.3	42.8
SEm±	**0.46**	**0.40**	**0.48**	**0.37**	**0.74**	**0.62**	**0.29**	**0.24**
CD at 5%	**1.41**	**1.23**	**1.47**	**1.11**	**2.23**	**1.87**	**NS**	**NS**
Inoculation and vermicompost								
Inoculation (*Azotobacter* ST3 &*Pseudomonas* P 36) + vermicompost @ 5t/ha	48.01	45.14	72.36	62.53	120.4	107.7	39.8	42.0
Inoculation (*Azotobacter* ST3 &*Pseudomonas* P 36)	45.81	42.86	69.21	58.22	115.0	101.1	39.7	42.4
Vermicompost @5t/ha	46.61	43.67	70.46	60.56	117.1	104.2	39.7	42.0
No inoculation	43.47	41.04	67.01	57.38	110.5	98.42	39.3	41.7
SEm±	**0.66**	**0.57**	**0.69**	**0.52**	**1.04**	**0.87**	**0.41**	**0.34**
CD at 5%	**1.99**	**1.74**	**2.08**	**1.57**	**3.16**	**2.65**	**NS**	**NS**
Fertilizers								
75% RDF	42.77	40.31	66.59	57.41	109.4	97.7	39.1	41.4
100% RDF	46.92	44.17	70.75	60.09	117.7	104.3	39.8	42.4
125% RDF	48.24	45.05	71.96	61.52	120.2	106.6	40.1	42.3
SEm±	**0.52**	**0.39**	**0.54**	**0.75**	**0.88**	**0.88**	**0.29**	**0.25**
CD at 5%	**1.49**	**1.13**	**1.57**	**2.15**	**2.53**	**2.53**	**NS**	**NS**

Table.3 Effect of saline water and different nutrient management practices on economics of wheat crop

Treatments		2011-12				2012-13			
		Cost of cultivation (Rs./ha)	Gross return (Rs./ha)	Net return (Rs./ha)	B:C	Cost of cultivation (Rs./ha)	Gross return (Rs./ha)	Net return (Rs./ha)	B:C
Canal Water									
INVC 75% RDF	Inoculated	49449	83001	33551	1.68	50771	80911	30140	1.59
INVC 100% RDF		50646	89221	38575	1.76	51976	86373	34397	1.66
INVC 125% RDF		51842	91369	39527	1.76	53183	88897	35714	1.67
IN 75% RDF		28549	80772	52222	2.83	29871	77229	47357	2.59
IN 100% RDF		29746	87150	57404	2.93	31076	82690	51614	2.66
IN 125% RDF		30942	88946	58003	2.87	32283	84765	52482	2.63
VC 75% RDF	Un-inoculated	49240	81975	32734	1.66	50562	78781	28219	1.56
VC 100% RDF		50437	88010	37573	1.74	51767	84220	32453	1.63
VC 125% RDF		51633	89362	37729	1.73	52974	86767	33793	1.64
I_0 75% RDF		28340	74357	46016	2.62	29662	75924	46261	2.56
I_0 100% RDF		29537	79682	50145	2.70	30867	81385	50518	2.64
I_0 125% RDF		30733	83439	52705	2.71	32074	83910	51836	2.62
Saline water									
INVC 75% RDF	Inoculated	49449	66185	16736	1.34	50771	69106	18335	1.36
INVC 100% RDF		50646	73058	22412	1.44	51976	75553	23577	1.45
INVC 125% RDF		51842	75856	24014	1.46	53183	77376	24193	1.46
IN 75% RDF		28549	62019	33470	2.17	29871	63129	33257	2.11
IN 100% RDF		29746	69264	39518	2.33	31076	68590	37514	2.21
IN 125% RDF		30942	69414	38472	2.24	32283	71107	38824	2.20
VC 75% RDF	Un-inoculated	49240	63035	13794	1.28	50562	66234	15671	1.31
VC 100% RDF		50437	70647	20210	1.40	51767	73329	21562	1.42
VC 125% RDF		51633	72042	20408	1.40	52974	73401	20427	1.39
I_0 75% RDF		28340	61458	33118	2.17	29662	61824	32161	2.08
I_0 100% RDF		29537	66836	37300	2.26	30867	67285	36418	2.18
I_0 125% RDF		30733	69347	38614	2.26	32074	69810	37736	2.18

The beneficial effect of fertilizers on grain yield can be very well explained in the light of the fact that fertilizer application increased the number of effective tillers/unit area and number of grains/spike which ultimately contributed to higher grain yield (Devi *et al.*, 2011). In present studies, wheat crop irrigated with canal water produced 21.50 and 24.41per cent higher straw yield over saline water in 2011-12 and 2012-13, respectively. Likewise, higher straw yields to the tune of 20.22, 14.90, 18.80 and 25.37 per cent were recorded in wheat crop with canal water as compared to saline water application by Kalhoro *et al.*, (2016), Kumar (2000), Kumar *et al.,* (2012) and Mojid *et al.,* (2013), respectively.

Maximum straw yield (72.36 and 62.53 q/ha) was recorded under *Azotobacter* ST3 and *Pseudomonas* P36 + vermicompost @ 5t/ha treatment while minimum (67.01 and 57.38q/ha) was recorded in no inoculation in 2011-12 and 2012-13, respectively. Research findings are in line with those of Devi *et al.*, (2011) and Davari *et al.*, (2012). Among the fertilizer levels 125% RDF resulted in higher straw yield (71.96 and 61.52q/ha) in 2011-12 and 2012-13, respectively. The findings are in concordance with Kumar (2000), Jat *et al.*, (2014), Chauhan (2014) and Chopra *et al.*, (2016). Similar trend was observed for biological yield of wheat.

Harvest index

The harvest index recorded under quality of irrigation water, fertilizer treatments and inoculation and vermicompost treatments was non-significant during both the years of investigation (Table 2). Studies in past had also revealed non-significant effect of salinity (Kumar, 2000; Singh *et al.*, 2010 and Mojid *et al.,* 2013), inoculation + vermicompost (Chopra *et al.*, 2016) and fertilizer levels (Kumar, 2000 and Chopra *et al.,* 2016) on harvest index of wheat crop.

Economics

Gross returns (Rs./ha), net returns (Rs./ha) and benefit cost ratio

The cost of cultivation of wheat in the first year (2011-12) varied from Rs. 28,340/ha ($I_0$75% RDF) to Rs. 51,842/ha (INVC 125% RDF) and from Rs. 29,662/ha (I_0 75% RDF) to Rs. 53,183/ha (INVC 125% RDF) during 2012-13. In general, the gross returns, net returns and B: C were higher in wheat crop when irrigated with canal water as compared to saline water. Increase in gross returns with application of canal water might be due to higher yield in these treatments. In canal water, maximum gross returns (Rs. 91,369/- and Rs. 88,897/ha) were recorded in the treatment INVC125% RDF (*Azotobacter* ST3 and *Pseudomonas* P36 + vermicompost @ 5t/ha + 125% RDF) and minimum gross returns (Rs. 74357/- and Rs.75924/- per hectare) were recorded in the treatment $I_0$75% RDF (no inoculation and 75%RDF) during 2011-12 and 2012-13, respectively. In canal water, maximum net returns (Rs. 58,003 and Rs. 52,482/ha) were recorded in the treatment IN125%RDF (*Azotobacter* ST3 and *Pseudomonas* P36 + 125%RDF) and minimum net returns (Rs. 32734 and Rs. 28219/ha) were recorded in the treatment VC75%RDF (vermicompost @ 5t/ha + 75% RDF) during 2011-12 and 2012-13, respectively. In canal water, maximum benefit cost ratio (2.93 and 2.66) were recorded in the treatment IN100% RDF (*Azotobacter* ST3 and *Pseudomonas* P36 + 100% RDF) and minimum benefit cost ratio (1.66 and 1.56) were recorded in the treatment VC75%RDF (vermicompost @ 5t/ha + 75% RDF) when irrigated with saline water during 2011-12 and 2012-13, respectively (Table 3).

Although net returns were higher in IN125%RDF, whereas B:C ratio was obtained higher in IN100% RDF as compared to

IN125% RDF due to high expenditure on procuring more fertilizer for the wheat crop. Similar, trend was observed in saline water with respect to gross returns, net returns and B: C during both the years. The findings corroborate with Ram *et al.,* (2014). The highest gross returns in INVC125% RDF were realized due to higher yields in this treatment. However, the net returns were higher in the treatment IN125% RDF as compared to INVC125% RDF due to higher cost of vermicompost in the INVC125% RDF treatment. Although, vermicompost resulted in higher improvement in grain quality and improved physical, chemical and biological properties of soil (Davari *et al.,* 2012), it is interesting to note that expenditure occurred on vermicompost could not be compensated by increase in gross returns, at all fertility levels, due to high cost of vermicompost (procured from market)taken in the analysis. Hence, with increased availability of vermicompost by establishment of small production units or cooperatives at farm or village level in due course of time may bring down its cost and therefore, it may give better returns than worked in the present studies.

Based on two years of investigation, it is concluded that application of vermicompost along with biofertilizers improved the yield attributes and yield of wheat to a great extent in non-saline water as compared to saline water. From economics point of view, in terms of gross returns, vermicompost @ 5t/ha + biofertilizer (*Azotobacter* ST3 and *Pseudomonas* P36) were the most productive treatments, but biofertilizer (*Azotobacter* ST3 and *Pseudomonas* P36) treatments were most economical with respect to increase in net profit at all fertility levels. The INM treatment INVC125% RDF recorded maximum gross returns (avg. Rs. 90,133/ha), but net returns were better in IN125% RDF (avg. Rs. 55, 242/ha). Moreover, integrated use of biofertilizer and 100% RDF resulted in maximum B: C ratio (avg. 2.80).

References

Anonymous. Department of Agriculture, Cooperation and Farmer's Welfare, Ministry of Agriculture and Farmers Welfare, Government of India, KrishiBhawan, New Delhi. 100-101 (2016).

Asgari, H.R., Cornelis, W. and Damme, P.V. Effect of salinity on wheat (*Triticum aestivum* L.) grain yield, yield components and ion uptake.*Desert*, 16: 169-175 (2011).

Bana, R.S., Gautam, R.C. and Rana, K.S. Effect of different organic sources on productivity and quality of pearl millet (*Pennisetum glaucum*) and their residual effect on wheat (*Triticum aestivum*). *Annals Agril. Res*., 33(3): 126-130 (2012).

Chauhan, R.S. Effect of fertility and weed management on yield, nutrient uptake and economics of wheat. *Annals Plant & Soil Res*., 16(4): 304-307 (2014).

Chopra, R., Sharma, M., Sharma, S.K., Nepalia, V., Jain, H.K. and Singh, A. Effect of integrated nutrient management on growth and yield of wheat (*Triticum aestivum* L.) in Haplustepts. Ind. J. Sci. & Nat., 7(3): 622-628 (2016).

Davari, M.R., Sharma, S.N. and Mirzakhani, M. The effects of combinations of organic materials and biofertilizers on productivity, grain quality, nutrient uptake and economics of wheat in organic farming. *J. Org. Syst.*, 7(2): 26-35 (2012).

Delogu, G., Cattivelli, L., Pecchioni, N., de Falcis, D., Maggiore, T. and Stanca, A.M. Uptake and agronomic efficiency of nitrogen in winter barley and winter wheat. *Eur. J. Agron.*, 9: 11-20 (1998).

Devi, K.N., Singh, M.S., Singh, N.G. and Athokpam, H.S. Effect of integrated nutrient management on growth and yield of wheat (*Triticum aestivum* L.) J. Crop & Weed, 7(2): 23-27 (2011).

Dikgwatlhe, S.B., Ceronio, G.M. and van Rensburg, L.D. Wheat (*Triticum aestivum* L.) growth and yield response to saline irrigation water under controlled conditions. *South Afr. J. Plant & Soil*, 25(3): 172-177 (2008).

Jat, S.L., Nepalia, V., Chaudhary, J. and Singh, D. Effect of nitrogen and weed management on productivity and quality of durum wheat (*Triticum durum*). *Ind. J. Agron.*, 59(2): 281-285 (2014).

Kalhoro, N.A., Rajpar, I., Kalhoro, S.A., Ali, A., Raza, S., Ahmed, M., Kalhoro, F.A., Ramzan, M. and Wahid, F. Effect of salt stress on growth and yield of wheat (*Triticum aestivum* L.). *Amer. J. Plant Sci*., 7:2257-2271 (2016).

Kumar, R. (2000). Effect of organic and inorganic fertilizer levels in normal and saline soil on wheat. *M.Sc. thesis* submitted to Chaudhary Charan Singh Haryana Agricultural University, Hisar.

Kumar, R., Singh, M.P. and Kumar, S. Effect of salinity on germination, growth, yield and yield attributes of wheat. *Inter. J. Scitific& Technol. Res*., 1(6): 19-23 (2012).

Malik, B., Mandal, B., Bandopandhyay, P.K., Gangopadhyay, A., Mani, P.K., Kundu, A.L. and Majumdar, D. Organic amendment influence on soil organic pools and crop productivity in a nineteen years old rice-wheat agro-ecosystem. *Amer. J. SoilSci.*, 72: 775-785 (2009).

Manchanda, H.R. Quality of ground water in Haryana Agriculture University, Hisar. 107 (1976).

Maqsood, M., Akbar, M., Mahmood, M.T. and Wajid, A. Yield and quality response of wheat to different nitrogen doses in rice-wheat cropping system. *Int. J. Agri. Biol.*, 2: 1-2 (2000).

Mojid, M.A., Murad, K.F.I., Tabriz, S.S. and Wyseure, G.C.L. An advantageous level of irrigation water salinity for wheat cultivation. *J. Bangladesh Agril. Univ*., 11(1): 141-146 (2013).

Ragab, A.A.M.M., Hellal, F.A. and El-Hady, M.A. Irrigation water salinity effects on some soil water constants and plant. *Twelfth International Water Technology Conference, IWTC12, Alexandria, Egypt*. Pp. 1-13 (2008).

Ram, M., Davari, M.R. and Sharma, S.N. (2014).Direct, residual and cumulative effects of organic manures and biofertilizers on yields, NPK uptake, grain quality and economics of wheat (*Triticum aestivum* L.) under organic farming of rice-wheat cropping system. *J. Org. Sys*., 9(1): 16-30.

Saqib, M., Akhtar, J. and Qureshi, R.H. Pot study on wheat growth in saline and waterlogged compacted soil I. Grain yield and yield components. *Soil Till. Res*., 77: 169-177 (2004).

Sharma, R. and Das, N. Response of dwarf wheat to N, P, K and Ca. *Ind. J. Plant Physiol.*, 25: 364-370 (1982).

Singh, D., Ram, P.C., Dar, S.R. and Sharma, P.C. (2010).Alleviating adverse effect of soil salinity in wheat (*Triticum aestivum* L.) through application of zinc fertilizer. *Ind. J. Plant Physiol.*, 15(4): 389-395.

Singh, H., Singh, A.K., Alam, S., Singh, T., Singh, V.P., Parihar, A.K.S. and Singh, R. Effect of various integrated nutrient management models on growth and yield of wheat in partially reclaimed sodic soil. *Int. J. Curr. Microbiol. App. Sci*., 6(3): 803-808 (2017).

Singh, I. Response of aestivum and durum wheat varieties to different level of irrigation and fertility. *Ph.D. thesis* submitted to Chaudhary Charan Singh Haryana Agricultural University (1987).

Singh, R. and Agarwal, S.K. Analysis of growth and productivity of wheat *(Triticum aestivum* L.) in relation to levels of FYM and nitrogen. *Ind. J. Plant Physiol*., 6(3): 279-283 (2001).

Verma, H.P., Sharma, O.P., Kumar, R., Yadav, S.S., Shivran, A.C. and Balwan.Yield attributes and yield of wheat (*Triticum aestivum* L.) as influenced by irrigation scheduling and organic manures. *Chem. Sci. Rev. & Lett.*, 6(23): 1664-1669 (2017).

Yousefi, A.A. and Barzegar, A.R. Effect of *Azotobacter* and *Pseudomonas* bacteria inoculation on wheat yield under field condition. *Int. J. Agri. Crop. Sci.*, 7(9): 616-619 (2014).

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