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Vikram Singh
Department of Agronomy, CCS HAU, Hisar, Haryana, India

Praveen Kumar
Department of Agronomy, CCS HAU, Hisar, Haryana, India

Meena Sewhag
Department of Agronomy, CCS HAU, Hisar, Haryana, India

Corresponding Author:
Vikram Singh
Department of Agronomy, CCS HAU, Hisar, Haryana, India

Effect of INM practice on nutrient uptake in wheat crop under sewage water irrigation

Vikram Singh, Praveen Kumar and Meena Sewhag

Abstract
The present study (2017-19) was carried out to study the impact of organic and inorganic nitrogen fertilization on nutrient uptake in wheat crop under sewage water irrigation. The experiment consisted of three irrigation sources *i.e.* treated sewage water (TSW), canal water (CW) and tube well water (TW); and seven nitrogen sources *i.e.* control (T_1), 100% RDN through chemical fertilizers (T_2), 100% RDN through vermicompost (T_3), 50% RDN through chemical fertilizers + 50% RDN through vermicompost (T_4), 100% RDN through FYM (T_5), 50% RDN through chemical fertilizers + 50% RDN through FYM (T_6), 50% RDN through chemical fertilizers + 25% RDN through FYM + 25% RDN through vermicompost (T_7). The results revealed that the treatments receiving treated sewage water recorded significantly higher nutrients (N, P, and K) uptake in grain and straws of wheat crop during both the years. While among the nitrogen sources, treatment T_2 exhibited higher nutrient accumulation over rest of the treatments. However, T_2 remained at par with T_4, T_7 and T_6. Hence, use of sewage water under wheat cultivation with integrated nitrogen application of chemical fertilizers and organic manures proved to beneficial in terms of nutrient accumulation.

Keywords: Farm yard manure, Nitrogen sources, Nutrient uptake, Sewage water irrigation, vermicompost, wheat

1. Introduction

With the advent of water scarcity, urban wastewater is being used for agricultural irrigation as an alternate to freshwater resources in many arid and semi-arid regions of the world. Worldwide, wastewater, often untreated, is used to irrigate 10 per cent of the world's crops amounting around 20 million ha of land (Hussain *et al.*, 2002) [7]. This is likely to increase noticeably during the next few decades as water scarcity intensifies and generation of wastewater amplifies. At present, more than 80% of the sewage generated in developing countries (e.g., Bangladesh) is discharged untreated into the environment, and about 50% of the population depends on polluted water sources for various uses, including irrigation (UNESCO, 2003) [15]. The disposal of wastewater is a major concern in the large metropolitan areas with limited space for land-based treatment and disposal. In this case, applying wastewater to agricultural lands is a more economical alternative and more ecologically sound than the uncontrolled dumping of waste- water into lakes and streams. Various studies have shown that land application of municipal wastewater as water and/or nutrient source for agricultural crop production can represent a sustainable alternative (Shah *et al*., 2015; Meena *et al*., 2016) [10].

Wheat (*Triticum aestivum* L.) was one of the first domesticated plants and has been the staple food for major civilizations worldwide. Wheat popularity and success can mainly be attributed to the fact that it is unrivalled in its range of cultivation. It can be grown in many areas with different weather, elevation, or soil properties. Mineral fertilizers play a significant role in replenishing shortages of nutrients for plants, improving crop productivity and preventing losses of yield quantity and quality (Lu and Tian, 2017) [9]. The highest demand for N fertilizers in 2016 was recorded in Asia (59.2 million tons) which is expected to be 62.0 million tons in 2022 (FAO, 2020) [5]. The unsuitable management of nitrogen fertilization may not only reduce wheat yield (Carvalho *et al.*, 2016; Rossini *et al*., 2018) [4, 11], but also lead to losses of this nutrient caused by leaching, runoff, volatilization, or denitrification (Tabak *et al*., 2020) [14]. Therefore, optimizing the use of N fertilizers is important as it ensures economic sustainability of cropping systems and suitable plant production, and at the same time reduces environmental threats caused by the introduced nitrogen.

With keeping in view the above mentioned facts, the present study was undertaken to study the effect of organic and inorganic nitrogen fertilization on nutrient uptake in wheat crop under sewage water irrigation

2. Material and Methods

The present study entitled was carried out for two consecutive years during *rabi* seasons of 2017-18 and 2018-19 at Vegetable Research Farm, Chaudhary Charan Singh Haryana Agricultural University, Hisar. The experimental site was in semi-arid, sub-tropics at 29º 9´ 16´´ N latitude, 75º 41´ 54 ´´ E longitude at an elevation of 215.2 meters above mean sea level. The trial was conducted in split-plot design with three replication. It consisted of three irrigation sources i.e. treated sewage water (TSW), canal water (CW) and tube well water (TW); and seven nitrogen sources i.e. control (T_1), 100% RDN through chemical fertilizers (T_2), 100% RDN through vermicompost (T_3), 50% RDN through chemical fertilizers + 50% RDN through vermicompost (T_4), 100% RDN through FYM (T_5), 50% RDN through chemical fertilizers + 50% RDN through FYM (T_6), 50% RDN through chemical fertilizers + 25% RDN through FYM + 25% RDN through vermicompost (T_7). The organic manures was applied before sowing of crop. The initial soil samples were analyzed for various chemical properties *i.e.* pH 8.25, EC (0.37 dS/m), soil organic carbon (0.31%), available nitrogen (110 kg/ha), phosphorus (16 kg/ha), potassium (290 kg/ha), sulphur (102 ppm) and DTPA-extractable micronutrients (Fe, Mn,Zn and Cu) viz. 2.31, 4.40, 1.37 and 0.83 mg/kg, respectively. The chemical composition of irrigation water (canal, tubewell and sewage water) is depicted in Table 1. The chemical analysis of water samples (Singh *et al*., 2002) [13], soil and plant (Antil *et al*. m 2002) [3] were done by using standard methods. Nutrient uptake by calculated by multiplying their nutrient content with corresponding grain and biomass yields. For conclusions, the data were statistically analyzed by using the method as explained by Fischer (1950) [6].

Table 1: Characteristics of irrigation water

Parameter	Canal water	Sewage water	Tubewell water
pH	8.33	7.68	7.43
EC (dS/m)	0.28	1.32	2.57
Trace metals (mg/kg)			
Zn	-	0.02	-
Cu	-	0.01	-
Pb	-	ND	-
Cd	-	ND	-
Ni	-	ND	-
Co	-	0.01	-
Cr	-	0.01	-

3. Results

3.1 N uptake (kg/ha)

N uptake was significantly influenced by irrigation sources (Table 2) as STW treatment accumulated highest total N (95.5 and 99.8 kg/ha) as compared to CW (84.8 and 88.3 kg/ha) and TW (78.8 and 81.3 kg/ha) during 2017-18 and 2018-19, respectively. N uptake was recorded lowest under TW during both the years. The N uptake in wheat grain varied from 48.3 to 102.8 kg/ha and 45.1 kg/ha to 108.3 kg/ha among different nitrogen sources during 2017-18 and 2018-19, respectively. The treatment T_2 recorded highest uptake of nitrogen (102.8 and 108.3 kg/ha) which was statistically at par with T_4, and T_7 treatments during 2017-18 and 2018-19, respectively. Sole application of VC and FYM obtained significantly higher N uptake by wheat grain as compared to control (T_1) during 2017-18 and 2018-19, respectively.

Table 2: Effect of irrigation and nitrogen sources on nutrient uptake (NPK) in wheat grain

Treatments	N (kg/ha)		P (kg/ha)		K (kg/ha)	
	2017-18	2018-19	2017-18	2018-19	2017-18	2018-19
Irrigation sources						
Canal water- CW	84.8	88.3	14.9	15.6	19.9	20.6
Treated sewage water- TSW	95.5	99.8	17.4	18.6	23.5	25.2
Tubewell water- TW	78.8	81.3	13.2	13.6	18.0	18.1
S.Em±	1.0	1.6	0.3	0.4	0.5	0.1
CD (P=0.05)	4.1	6.1	1.0	1.6	2.2	2.6
Nitrogen sources						
Control- T_1	48.3	45.1	8.5	8.0	11.9	10.8
RDN through fertilizer- T_2	102.8	108.3	18.2	19.3	21.6	21.8
100% RDN through vermicompost (VC)- T_3	84.3	86.6	14.9	15.5	20.6	21.3
50% RDN through fertilizer + 50% RDN through VC- T_4	100.2	106.0	17.6	19.2	24.3	26.7
100% RDN through FYM- T_5	80.5	83.5	14.1	14.9	19.7	20.5
50% RDN through fertilizer + 50% RDN through FYM- T_6	93.2	98.6	16.0	17.0	22.2	23.8
50% RDN through fertilizer + 25% RDN through FYM + 25% RDN through VC- T_7	95.3	100.4	16.7	17.7	23.0	24.3
S.Em±	2.8	2.5	0.5	0.6	0.6	0.6
CD (P=0.05)	8.0	7.1	1.6	1.8	1.9	1.6

The data (Table 3) pertaining to nitrogen uptake by wheat straw revealed that STW reported significantly higher N uptake (31.4 and 32.5 kg/ha) by wheat straw as compared to CW (27.5 and 28.2 kg/ha) and TW (25.4 and 25.6 kg/ha) during 2017-18 and 2018-19, respectively. However, the N uptake in wheat straw varied from 18.4 to 32.3 kg/ha and 16.8 kg/ha to 33.5 kg/ha among different nitrogen treatments during 2017-18 and 2018-19, respectively where T_2 treatment recorded highest uptake of nitrogen (32.3 and 33.4 kg/ha) which was statistically at par with T_4 and T_7 treatments during 2017-18 and 2018-19, respectively but showed significant superiority overall other treatments during both years. Sole application of VC and FYM obtained significantly higher N uptake by wheat straw as compared to control (T_1) during 2017-18 and 2018-19, respectively.

3.2 P uptake (kg/ha)

The data regarding P uptake by wheat grain presented in table 2 revealed that it was significantly influenced by irrigation and N sources. The treatment STW accumulated significantly highest total P (17.4 and 18.6 kg/ha) as compared to CW (14.9 and 15.6 kg/ha) and tube well water (13.2 and 13.6 kg/ha) during 2017-18 and 2018-19, respectively. Among fertilizer treatments, T_2 treatment recorded highest uptake of P (18.2 and 19.3 kg/ha) which was statistically at par with T_4, and T_7 treatments during 2017-18 and 2018-19, respectively, but showed significant superiority overall other treatments during both the seasons. However, Sole application of VC and FYM obtained significantly higher P uptake by wheat grain as compared to control (T_1) during 2017-18 and 2018-19, respectively.

The P uptake was significantly influenced by irrigation and nitrogen sources (Table 3). The treatment STW obtained significantly highest total P (7.5 and 8.4 kg/ha) as compared to CW (6.2 and 7.1 kg/ha) and TW (4.6 and 5.5 kg/ha) during 2017-18 and 2018-19, respectively. However, the P uptake in wheat straw ranged between 3.6-7.1 kg/ha and 3.6-8.1 kg/ha among different nitrogen treatments during 2017-18 and 2018-19, respectively where T_2 treatment exhibited highest uptake of P (7.1 and 8.1 kg/ha) which was statistically at par with T_4 and T_7 treatments during 2017-18 and 2018-19, respectively.

Table 3: Effect of irrigation and nitrogen sources on nutrient uptake (NPK) in wheat straw

Treatments	N (kg/ha)		P (kg/ha)		K (kg/ha)	
	2017-18	2018-19	2017-18	2018-19	2017-18	2018-19
Irrigation sources						
Canal water- CW	27.5	28.2	6.2	7.1	107.8	110.8
Treated sewage water- TSW	31.4	32.5	7.5	8.4	120.1	124.5
Tubewell water- TW	25.4	25.6	4.6	5.5	101.2	101.7
S.Em±	0.8	0.9	0.1	0.1	2.4	1.4
CD (P=0.05)	3.1	3.4	0.5	0.5	9.4	5.7
Nitrogen sources						
Control- T_1	18.4	16.7	3.6	3.6	72.6	67.1
RDN through fertilizer- T_2	32.3	33.4	7.1	8.1	113.6	116.3
100% RDN through vermicompost (VC)- T_3	27.8	28.5	6.1	7.1	109.7	112.8
50% RDN through fertilizer + 50% RDN through VC- T_4	31.5	33.0	6.9	8.1	124.9	130.3
100% RDN through FYM- T_5	27.3	27.9	6.0	6.9	107.6	110.6
50% RDN through fertilizer + 50% RDN through FYM- T_6	29.3	30.3	6.4	7.5	118.9	122.8
50% RDN through fertilizer + 25% RDN through FYM + 25% RDN through VC- T_7	30.2	31.6	6.7	7.9	120.8	126.6
S.Em±	0.9	1.0	0.1	0.2	3.1	3.1
CD (P=0.05)	2.6	3.0	0.4	0.5	8.9	8.8

3.3 K uptake (%)

The data related to potassium uptake by wheat grain is presented in table 2. Among irrigation sources, K uptake was significantly highest total K (23.5 and 25.2 kg/ha) as compared to CW and TW during 2017-18 and 2018-19, respectively. K uptake was recorded lowest under TW during both the years. Among fertilizer treatments, K uptake in wheat grain was obtained significant higher in T_4 treatment being at par with T_7 during 2017-18 and 2018-19, respectively. However, integrated application of organic manures and inorganic fertilizer obtained higher K uptake as compared to their sole application during both years.

K uptake in straw was significantly influenced by irrigation sources as STW accumulated significantly highest K uptake (120.1 and 124.5 kg/ha) as compared to CW (107.8 and 110.8 kg/ha) and TW (101.2 and 101.7 kg/ha) during 2017-18 and 2018-19, respectively. Among fertilizer treatments, the K uptake in wheat straw ranged between 72.6-113.6 and 67.1-116.3 kg/ha among different nitrogen treatments where T_4 treatment recorded significantly highest uptake of P (124.9 and 130.3 kg/ha) but was statistically at par with T_6 and T_7 treatments during 2017-18 and 2018-19, respectively. Integrated application of organic manures and inorganic fertilizer obtained higher K uptake as compared to their sole application during both years.

4. Discussion

The application of treated sewage water significantly enhanced the NPK uptake in wheat crop compared to tube well water due to addition of nutrients through wastewater irrigation (Meena *et al*., 2016) [10]. However, treatments TSW and CW were found at par with each other. The congenial environment of adequate moisture and nutrient availability resulted in improved vegetative growth that ultimately increased mineral nutrients absorption or enhanced NPK uptake by wheat grain and straw (Shah *et al*., 2015). Aljaloud (2010) [1] found a significant increase in NPK content in wheat crop irrigation with municipal treated wastewater as compared to fresh water. The wheat grain yield was increased by 11% with the use of municipal treated wastewater over fresh water. No significant difference was observed under canal water irrigation and tube well water irrigated treatments. The lowest nutrient uptake were obtained under tube well water irrigation. This might be due to higher EC which inhibited nutrient uptake through osmotic stress and ionic imbalance in the soil-plant system (Ankush *et al*., 2021) [2].

Among nitrogen sources, the significant highest nutrient (NPK) and their uptake was recorded with T_2 treatment where chemical fertilizer alone was applied (Tables 2 & 3). At the same time, it was at par with the treatments where 50% RDN was supplemented by vermicompost and FYM along with

50% RDN through chemical fertilizer. The highest nutrient uptake in wheat grain and straw with T_2 was due to easily and direct availability of nutrients (Ankush *et al*., 2021) [2]. The integrated manurial application recorded at par nutrient concentration with chemical fertilizer alone means that the crop recommended demand of nutrients can be fulfilled with the addition of organic manures into the package practice of wheat cultivation. It might be due to greater availability of nutrients in the soil which improved vegetative growth of plants and ultimately results in higher accumulation of nutrients in their parts along with enhance uptake (Yadav *et al*., 2017; Kamble *et al*., 2018) [16, 8]. In addition, the application of vermicompost had increased nutrient uptake compared to FYM due to its nutrient composition. However, treatments T_3 and T_5 were found at par with each other.

5. Conclusions

It is concluded from the two years study that the treatments receiving treated sewage water gave higher nutrients (N, P, and K) uptake in grain and straws of wheat crop during both the years. While among the nitrogen sources, treatment T_2 exhibited higher nutrient accumulation over rest of the treatments. However, T_2 remained at par with T_4, T_7 and T_6. The conjoint application of nitrogen through inorganic and organic (FYM and vermicompost) sources under treated sewage water irrigation proved to beneficial. In wheat crop production.

6. Acknowledgments

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7. References

1. Aljaloud AA. August. Reuse of wastewater for irrigation in Saudi Arabia and its effect on soil and plant. In 19th world congress of soil science, soil solutions for a changing world 2010,1-6p.
2. Ankush, Ram Prakash, Singh V, Diwedi A, Popat RC, Kumari S, Kumar N *et al*. Sewage sludge impacts on yields, nutrients and heavy metals contents in pearl millet-wheat system grown under saline environment. International Journal of Plant Production 2021;15(1):93-105.
3. Antil RS, Singh A, Dahiya SS. Practical Mannual for Soil and Plant Analysis. Department of Soil Science, CCS Haryana Agricultural University, Hisar - 125004. https://doi.org/10.22438/jeb/40/1/mrn-887; 2002.
4. Carvalho JMG, Bonfim-Silva EM, Da Silva TJA. Sousa, H.H.D.F.; Guimarães, S.L.; Pacheco, A.B. Nitrogen and potassium in production, nutrition and water use efficiency in wheat plants. Cienc. Investig. Agrar 2016;43:442-451. DOI: 10.1007/s42106-020-00122-4
5. FAO. World Fertilizer Trends and Outlook to 2022. Rome 2019. Available online: http://www.fao.org/3/ca6746en/CA6746EN.pdf?eloutlink=imf2fao (accessed on 10 July 2020).
6. Fischer RA. Statistical methods for Agriculture Research Workers. II[nd] Ed. Oliver and Boyand, London 1950.
7. Hussain I, Raschid L, Hanjra, MA, Marikar F, Van Der Hoek W. Wastewater use in agriculture: Review of impacts and methodological issues in valuing impacts. Working Paper 37, International Water Management Institute, Colombo, Sri Lanka 2002.
8. Kamble BM, Kathmale DK, Rathod SD. Soil nutrient status, uptake, yield and economics of groundnut- wheat cropping sequence as influenced by organic sources and fertilizers. Journal of the Indian Society of Soil Science 2018;66(1):66-75.
9. Lu C, Tian H. Global nitrogen and phosphorus fertilizer use for agriculture production in the past half century: Shifted hot spots and nutrient imbalance. Earth Syst. Sci. Data 2017;9:181-192.
10. Meena R, Datta SP, Golui D, Dwivedi BS, Meena MC. Long-term impact of sewage irrigation on soil properties and assessing risk in relation to transfer of metals to human food chain. Environmental Science and Pollution Research 2016;23(14):14269-14283.
11. Rossini F, Provenzano ME, Sestili F, Ruggeri R. Synergistic effect of sulfur and nitrogen in the organic and mineral fertilization of durum wheat: Grain yield and quality traits in the mediterranean environment. Agronomy 2018;8:189.
12. Saha JK, Srivastava A, Kundu S, Rao AS. Comparison between fertilizers and untreated sewage effluent as sources for nutrient recovery by wheat (Triticum aestivum)-soybean (Glycine max) cropping system. Journal of Plant Nutrition, 2016;39(4):470-478.
13. Singh A, Sharma SK, Dahiya SK. Practical manual for water analysis. Department of Soil Science, CCS Haryana Agricultural University, Hisar- 125004 2002.
14. Tabak M, Lepiarczyk A, Filipek-Mazur B, Lisowska A. Efficiency of nitrogen fertilization of winter wheat depending on sulfur fertilization. Agronomy 2020;10(9):1304.
15. UNESCO. Water for people, water for life: United Nations/World Water Assessment Programme. New York: UNESCO, Paris and Berghahn Books 2003.
16. Yadav GS, Singh D, Kumar R. Effect of integrated use of organic manures and inorganic fertilizers in rice. Journal of Pharmacognosy and Phytochemistry 2017,296-298p.