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 3 (11): 1979-1980, 2000

Impact of Sewage Effluent on Maize Crop

Qasim M., S. Faridullah Shah, Himayatullah and Rahim Din
Faculty of Agriculture, Gomal University, D.I.Khan, Pakistan

Abstract: Sewage effluent application had significantly effected all parameters of maize crop except germination percentage and root dry weight. Maximum number of leaves per plant, leaf area, shoot length, root length, total plant height and shoot dry weight of maize crop were obtained where sewage effluent were applied at concentration from 75 to 100%. It was recommended that application of sewage effluent at 75 to 100% concentration will have favorable effect on the maize crop under the agro-climatic conditions of D.I.Khan.

Key words: Sewage effluent, maize crop

Introduction

There are many reports from all over the world that Sewage effluent and sludge material can be effectively used as a source of fertilizer for crop yield and for improving physical and chemical properties of soils (Benmouffok, 1994). In India, long term field experiments have shown that medium intensity irrigation with sewage effluent water produces higher yield (wheat 23%, rice 46% and Cotton 50%) than irrigation with fresh water (Sharma and Kansal, 1984). Berton *et al*. (1989) reported increased supply of major plant nutrients particularly N, P and K, along with some of the essential micronutrient and improvement in the soil physical properties with the application of sewage effluent. Ford *et al*. (1993) after four years of testing found no harmful effects of the effluents on the chemical or microbiological constituents of the crop material or soil from test plots, the soil physical properties were improved and crop yield was increased. Sewage application promoted growth in maize, compared with the application of traditional fertilizer. Plant height in maize increased by 77% in the sewage treated pots compared with 25% in plants treated with chemical fertilizers (Christodoulakis and Margaris, 1996).

Keeping in view the importance of sewage effluent in Agriculture, the experiment was conducted in order to study its influence on Maize crop under the Agro-climatic condition of D.I.Khan.

Materials and Methods

The research work was carried out in plastic pots under field conditions at the Faculty of Agriculture, Gomal University, D.I.Khan during the year 1997 to 1998. The sewage waste water was collected from sewerage channels (Drains) of D.I.Khan city in plastic cans and was transferred to the laboratory. It was then diluted to different concentrations as under:

Quantity of effluent water (ml)	Quantity of fresh Water (ml)	Concentration (%)
100	0	100
90	10	90
75	25	75
50	50	50
25	75	25
0	100	0

Plastic pots of the size $34 \times 34 \times 34$ cm^3 with 20 kg of air dried soil were used and the experiment was arranged in a randomized complete block design. The soil samples were collected from 0-20 cm depth from the Faculty of Agriculture Farm area, it was air dried at room temperature, ground and then passed through a 2 mm sieve. The pots were irrigated with different concentration of sewage effluent and maize seeds were sown on July 28, 1997. Each treatment was replicated three times and irrigated with the respective effluent water concentration. The moisture content of the soil was maintained at approximately 20% throughout the experiment and the loss of moisture through evaporation was compensated with appropriate volume and concentration of sewage water. All cultural and agronomic practices were followed throughout the experiment. The recorded data of various parameters were statistically analyzed.

Results and Discussion

Germination percentage: It is evident from the Table 1 that the treatments differences were statistically found nonsignificant. Maximum values of germination %age were recorded in treatments having effluent concentrations of 0, 10, 25 and 50% while the minimum values were recorded in treatments where effluent were applied at 75 and 100% concentration. The results revealed that as the concentration of the effluent increased beyond 50%, seed germination decreased by 1% which suggest that the high soluble salts content of the sewage effluent have caused an adverse effect on the seed germination. These results support the findings of Behara (1986) who observed a gradual decrease in % germination of maize with increased concentration of sewage effluent.

Table 1: % Germination, number of leaves Plant^{-1} and leaf area as effected by various concentrations of sewage effluent

Treatments Conc.(%)	Mean		
	Germination^{NS} (%)	Leaves Plant^{-1}	Leaf Area (cm)
0 (control)	7.00	7.66 B	43.21 B
10	7.00	7.33 B	49.52 B
25	7.00	6.66 B	54.43 B
50	7.00	7.33 0	62.54 AB
75	6.00	8.00 AB	60.64 AS
100	6.00	10.00 A	78.58 A

Means followed by different letters are significantly different at 5% level of probability.
NS = non-significant

Number of leaves per plant: Table 1 revealed that sewage water had a significant effect on the number of leaves per plant. Maximum number of leaves per plant were obtained where maize crop was treated with 100% sewage water concentration followed by 75% concentration. Whereas all other treatments produced statistically the same number of leaves per plant. It is evident from the results that addition of sewage effluent from 75 to 100% concentration had a favourable effect on the number of leaves per plant which could be attributed to the increased amount of plant food elements present in the sewage water. Identical results were also discussed and reported by Grigorov *et al*. (1987).

Leaf area: Table 1 also showed that the effect of concentration of sewage effluent was significant on leaf area of maize crop. Maximum leaf area 178.58 cm^2 was

recorded in pots treated with 100% sewage water followed by the treatment where sewage water was applied at 75% concentration. While minimum leaf area was observed in control treatment. The results indicated that as the treatments concentration increased, there was a substantial increase in the leaf area which could also be the cause of increasing levels of plant food elements when the sewage water was applied at a higher concentration level. The results are in line with those reported by Christodoulakis and Margaris (1996) who observed a progressive increase in leaf area with an increase in the concentration of sewage water application.

Shoot length: It is explicit from the data in Table 2 that shoot length varied significantly due to sewage water concentrations. Pots treated with highest sewage water concentration (100%) caused maximum shoot length over rest of the treatments but was statistically at par with the treatment where sewage water was applied at 75% concentration, while minimum shoot length of 55.67 cm was noted in control treatment. The data indicated that sewage water concentration had a favourable bearing on the shoot length of maize and it may also be the cause of high nutrient content of the sewage water. These finding are similar to those of the Berton *et al*. (1989) who obtained higher vegetative yield of maize when sewage water was applied at a higher concentration level.

Table 2: Shoot length, root length and total plant height as effected by various concentrations of sewage effluent

Treatments Conc.(%)	Mean: Shoot length (cm)	Root length (cm)	Total plant height (cm)
0 (control)	55.67 C	12.33 C	68.00 D
10	70.00 B	13.66 BC	84.66 C
25	76.00 B	15.008	91.008
50	81.00 A	17.00 AB	98.00 AB
75	84.60 A	18.40 A	103.00 A
100	85.30 A	19.00 A	104.31 A

Means followed by different letters are significantly different at 5% level of probability

Root length: Data pertaining to root length as effected by various concentration of sewage water are presented in Table 2. It revealed that different concentrations of sewage water had a significant effect on root length of maize crop. The maximum root length of 19 cm was noted in pots which was irrigated with sewage water of 100% concentration which was statistically at par with the treatment getting 75% sewage water concentration, The minimum root length of 12.33 cm was noted in control treatment. The results indicated that by increasing concentration of sewage water there is a gradual increase in the root length of maize crop. The results support the findings of Grigorov *et al*. (1987) who noted a positive effect of sewage water on the root development of maize crop.

Total plant height: It is apparent from the data (Table 2) that plant height of maize varied significantly due to different concentration of sewage water. Increased sewage water concentration (100%) resulted in taller plants which was statistically at par with the treatment irrigated with 75% sewage water concentration while the minimum plant height of 68.00 cm was noted in control treatments. The results demonstrated that increased concentration of sewage water application contributed to the over all vegetative growth which resulted in taller maize plants. These results corroborate the findings of Christodoulakis and Margaris (1996) who observed that the height of plant increased by increasing sewage water concentration.

Shoot dry weight: The data in Table 3 showed that maximum shoot dry weight was noted in 100% sewage water concentration followed by 75% sewage water concentration and minimum shoot dry weight of 4.30 g was noted in control treatment. The result of sewage water treatments at 100 and 75% concentrations were significantly higher to all the treatments but were nonsignificant to one another. It indicated that application of sewage water at higher concentration had a favorable effect on the shoot dry weight of maize crop. These results are in agreement with those reported by Cripps *et al*. (1992).

Root dry weight: Data pertaining to root dry weight as effected by various concentrations of sewage water are presented in Table 3. The data showed that maximum root dry weight of 0.81 g was obtained from treatment receiving sewage water at the rate of 100% concentration followed by 75 and 50% concentration while minimum root dry weight of 0.409 was noted in control treatment. The results of all the treatments were statistically non-significant to one another. It indicated that by increasing sewage water concentration beyond 25 to 50%, there was a gradual increase in the root dry weight of maize crop. The results are in agreement with that of Sharma and Kansal (1984).

Table 3: Shoot dry weight and root dry weight as effected by various concentrations of sewage effluent

Treatments Conc. (%)	Mean: Shoot dry weight (g)	Root dry NS weight (g)
0 (control)	4.30 C	0.40
10	4.63 C	0.41
25	5.86 B	0.47
50	5.13 B	0.53
75	7.30 A	0.73
100	7.38 A	0.81

Means followed by different letters are significantly different at 5% level of probability.
NS = non-significant

From these discussions it could be concluded that sewage water application at the rate of 75 to 100% had a favorable effect on all parameters of maize crop. This shows that its application at such a concentration could safely be used in order to have profitable yield of maize crop.

References

Behara, P.K., 1986. Effect of paper mill wastewater on soil quality and growth. M.Phil. Thesis, Sambalpur University, India.

Benmouffok, A., 1994. Characterization of sewage sludge from Draa Ben Khedda and its partial use for Agriculture purposes. Univ. Tizi Ouzou, Algeria, 3: 295-299.

Berton, R.S., O.A. Camargo and J.M.S. Valadares, 1989. Nutrient absorption by maize and response to addition of sewage sludge to five soils in Sao Paulo State. Revista Brasileira de Ciencia do Solo, 13: 187-192.

Christodoulakis, N.S. and N.S. Margaris, 1996. Growth of corn (*Zea mays*) and sunflower (*Helianthus annuus*) plants is affected by water and sludge from a sewage treatment plant. Bull. Environ. Contam. Toxicol., 57: 300-306.

Cripps, R.W., S.K. Winfree and J.L. Reagan, 1992. Effects of sewage sludge application method on corn production. Commun. Soil Sci. Plant Anal., 23: 1705-1715.

Ford, R.J., J.A. Gillies and J.K. Mitchell, 1993. Digested sewage sludge processing system. Proceedings of the International Symposium Illinois, (ISI'93), USA., pp: 160-165.

Grigorov, M.S., S.Y. Semenenko and E.A. Khodyakov, 1987. Response of *Medicago sativa* and maize to mineral fertilizers and sewage water using underflow irrigation. Agrokhimiya, 3: 40-47.

Sharma, V.K. and B.D. Kansal, 1984. Effect of nitrogen, farmyard manure, town refuse and sewage water on the yield and nitrogen content of maize fodder and Spinach. Indian J. Ecol., 11: 77-81.