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Impact of Waste Water Irrigation on Cauliflower Yield in Punjab, Pakistan

Muhammad Majeed[1], Muhammad Shafiq Chaudhry[2], Syeda Sadaf Zehra[3], Syed M. Naeem Gillani[4], Fahad Ajmal[5]

[1, 4, 5]Cholistan Institute of Desert studies, The Islamia University of Bahawalpur, Pakistan

[2,3] Department Life Sciences, The Islamia University of Bahawalpur, Punjab , Pakistan

Abstract: ***In Peri-urban areas of Punjab a large number of populations is directly related to agriculture sector and depend upon it for food and economy. On the other words, waste water proved to be useful for the yield of vegetables. In a given study conducted in the Department of Life Sciences, the Islamia University Bahawalpur, Pakistan during 2012, and analysis of three treatments i.e. waste water, mix water and fresh water was carried out by applying production criteria. The data of yield of Cauliflower was collected from Rangillpur peri-urban area of District Multan, 5 Km away toward South-West to the main city center. So, it is clear that Waste water play good role for the yield of Cauliflower. Results indicated that there was an increase of 12 % fruit diameter, 37 % fruit yield and 16 % in fruit yield per acre were obtained from waste water irrigation were higher (positive impacts) as compared to mix water and fresh water site of irrigation. Such type of findings will useful for impact of waste water on production of vegetables cultivated in peri- urban areas.***

Keywords: Waste water; fresh; Pakistan, Cauliflower, nutrients

1. Introduction

Due to large volume and having much nutritional value for crops and vegetables, the cultivars of city sectors prefer to use it. A large volume of Waste water is dispose of without treatment daily. It is concluded that in 50 countries of the world a large part of cultivated land is irrigated with untreated or partial treated Wastewater. [5] Kauser*et al*. (2007) has predicted that, nearly one-tenth of population of the world eats food and vegetables produced are irrigated with waste water. He also describes that with increase in population of the World, the much volume of fresh water used for house hold purposes in cities and more than 70 % comes out in the form of waste water. Growers of cauliflower in many developing countries commonly used diluted, treated or untreated Waste water for irrigation of crops and vegetables. It is due to the availability of Waste water all the year. Pumping of Waste water is of low cost due to above ground level on the other hand it is costly due to deep ground level. Waste water is a reliable source of output in the form of employment opportunities all around the year and increases the economic status in the form of cultivation and selling off high yield and valuable crops e.g., vegetables (Cauliflower) [6] Keraita *et al*. (2008)].

Studies reveal that irrigation of crops and vegetables with Waste water had much impact on various aspects on human life .Moreover, use of Waste water has both positive and negative aspects and less attention has been given for the planning in agriculture sector [8] Qadir *et al*. 2009 .Irrigation of crops and vegetables with Waste water is useful because Wastewater contains important elements in form of nutrients which play significant role in the growth and production of plants. This is useful in those areas where Waste water is the only way of irrigation of crops and vegetables and available all the year. It is concluded that about 20 million hectors of crops and vegetables throughout World is irrigated with diluted, partly treated and untreated Waste water [4] Jiménez and Asano *et al*. (2008).

2. Material and Method

I have used two experimental approaches to find out Positive impacts of waste water irrigation on cauliflower yield Punjab, Pakistan. The given study was conducted in the Department of Life Sciences, the Islamia University Bahawalpur, Pakistan during 2012, and analysis of three situations i.e. waste water, mix water and fresh water was carried out by applying production criteria. The data of yield of Cauliflower was collected from Rangillpur peri-urban area of District Multan, 5 Km away toward South-West to the main city center. Where cultivated area of Cauliflower was irrigated with waste water comes from city sewerage and factories. While Mix water from NullahWalli Muhammad linked from Head No Bahar of main canal. Source of fresh water is tube wells and pumps run by electricity.

Three replications were used and experiment was designed by using randomized complete block design. Germinated seeds were observed one after the other day. Germination of seeds was started after 36 hours (assumed to be germinated with the emerging of radical). Investigation and observation of germinated seeds were taken on daily basis. In all treatments such as Fresh water (Fw), Mix water (Mw) and Waste water (Ww), regular increase in leaf length, Stem height and height of plant were observed frequent days during research.

Nursery for crop cultivation had usually been grown at one side of the field where the crop is being sown. After 4 to 5 weeks (30 to 35 days) during month of August plants with 8 to 10 cm height were transplanted in the field. Bed rows were spaced by 1.5 to 2 feet in length and the distance

between each row was 2 to 2.5 feet. Height of each row was about 1.5 feet.

Therefore, blocks randomize pots and field experiments were applied for fresh weight of fruit, total weight of yield per acre. The data was calculated and summarized and was given in the form of graphs. The data of Yield of cultivated Cauliflower was collected from given site of study area from three different fields of 1 acre per field. Overall 24 acres were selected, 8 for each treatment of water to find out the impact of waste water on yield of Cauliflower. At harvest picking was performed and cauliflower fruit (head) yield per plant was calculated (kg/plant) and yield per acre was calculated as (Kg/acre or tones/ acre).Number of fruits (heads) per acre was recorded by counting them daily and then average was computed. Weight of fruits (heads) of Cauliflower was taken with the help of a digital balance. For this, 100 fresh fruits (heads) from each replicated field were taken and their stem and leaves were separated, then weight of Fruits (heads) was measured and average was taken.

Data were analyzed by MSTATC computer software program adapted by [2] Bricker et al; 1991 using ANOVA for plant characteristics were compared through with least significant difference (LSD) at the 0.05 probability level. The aim and objective of the given work was to predict a model for the study of the Positive impacts of waste water irrigation on yield of cauliflower in Peri-urban areas of South Punjab, Pakistan. The basic aims and objectives of the study were:

- To estimate the impacts of Waste water on the yield of Cauliflower in per-urban areas of South Punjab.
- To know about the positive impacts of waste water to enhance the yield of crops and vegetables cultivated in Peri-urban areas.

3. Results

3.1 Fruit Diameter (cm)

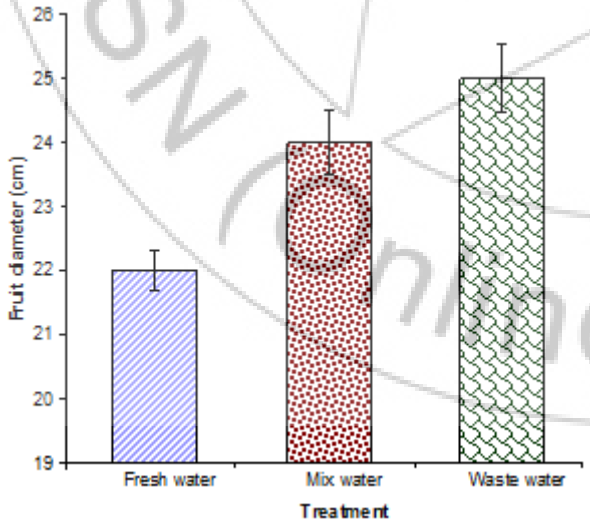

Figure 1: Impacts of different water treatments on Fruit diameter (cm) in cauliflower. Results are expressed as mean values ± standard error (n = 3).Within different columns, mean values bearing different letters were significantly different, Duncan's multiple range test; $p<0.05$.

After 90 days of sowing , at the time of harvesting the fruit diameter was measured which was 22 cm , 24 cm and 25 cm in fields irrigated with fresh water , mix water and waste water respectively. There is up to 12 % increase in fruit diameter of Cauliflower irrigated with waste water as compare to fresh water irrigation.

3.2 Fruit Area (cm^2)

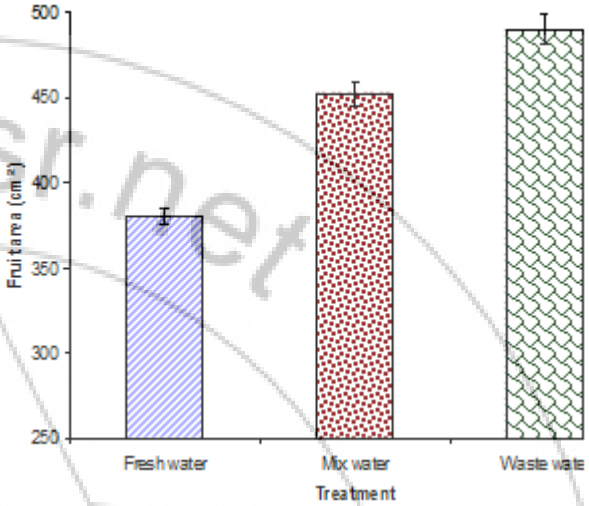

Figure 2: Impacts of different water treatments on Fruit area (cm^2) in cauliflower. Results are expressed as mean values ± standard error (n = 3). Within different columns, mean values bearing different letters were significantly different, Duncan's multiple range test; $p<0.05$.

The above graph represents the fruit area of cauliflower at the time of harvesting which is 90 days after sowing in study area. Which was recorded, 380 cm^2, 452 cm^2 and 490 cm^2 in the plants of Cauliflower on average in fresh water, mix water and waste water irrigation sites.

3.3 Fruit Yield / plant (Kg)

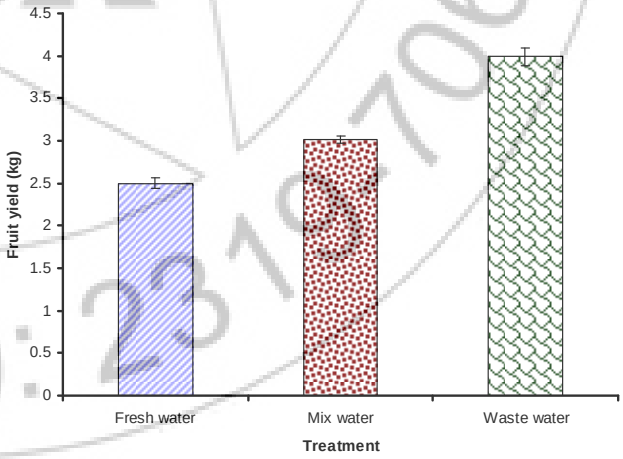

Figure 3: Impacts of different water treatments on Fruit yield /kg of cauliflower. Results are expressed as mean values ± standard error (n = 3).Within different columns, mean values bearing different letters were significantly different, Duncan's multiple range test; $p<0.05$.

After 90 days after sowing, at the time of harvesting, the fruit yield was2.5kg, 3 kg and 4 kg per fruit in fresh water,

mix water and waste water irrigated plants. There was an increase of 37 % in fruit yield per plant with waste water irrigation with respect to fresh water irrigation.

3.4 Yield / acre (Kg)

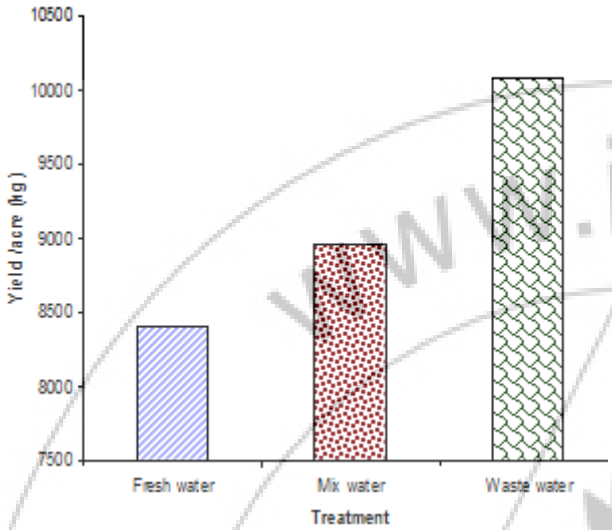

Figure 4: Impacts of different water treatments on Yield /acre (kg) of cauliflower. Results are expressed as mean values ± standard error (n = 3).Within different columns, mean values bearing different letters were significantly different, Duncan's multiple range test; $p<0.05$.

At the time of harvesting yield of Cauliflower per acre in study area was recorded 8,400 kg/acre, 9,000 kg /acre and 10,000 kg/ acre in sites of fresh water, mix water and waste water irrigation. The given figure represented that there was 16 % increase in yield per was obtained from the fields irrigated with waste water as compare to fresh water.

4. Discussion

In developing countries of the World, it is impossible to keep away the mixing of Waste water with fresh water which is mixing up from various sources. Finally reaching at its destination, both water (fresh and Waste) become a mixture of water which combines from various sources and contains nutrients and unwanted pollutants. In urban and per-urban areas of the arid and semi-arid countries of the world, growers use Waste water for irrigation of crops and vegetable [9] Van der Hoek and Matsuno *et al*. (2002).Due to shortage of fresh water and weak enforcement of Laws, in urban and peri-urban regions of the many countries of the world, the low land and poor farmers use Waste water for irrigation of crops and vegetables. Moreover there is no alternative source of irrigation in agriculture sector. This shows that use of Waste water for irrigation of crops and vegetables especially Cauliflower is becoming a common practice in peri-urban areas where frequent availability of Waste water is present [3] Chanduvi *et al.*(2000).

Waste water contains nutrients which add organic matter to the soil and make soil fertile. Because organic matter supplied through Waste water irrigation improves structure of soil, increases charging properties of soil [Lei *et al.* (2006)] and contains many nutrients which play positive impacts of the yield parameters of crops and vegetables (Cauliflower). Waste water (Mw) irrigated soils such as loamy clay soil contains more amount of Nitrogen (N), Potassium (K) and Phosphorous (P) as compared to loamy sand soil. These elements are useful for the soil fertility and yield of Cauliflower. Such types of findings exactly matches with results of [10] Waly *et al*. (1987).

Waste water had imparted a valuable effect on the fruit diameter of cauliflower. Additionally, waste water proved nutrients to the soil which produced healthy plants of cauliflower with better vegetative growth and showed better yield, fruit area and diameter of fruit .These findings closely related with the research work of [1] Arisha *et al*. (2003).

5. Conclusion

Due to shortage or unavailability of an alternative approachable source of water for irrigation, mostly farmers depend upon waste water for irrigation of crops and vegetables. Waste water (Ww) including city sewage from the various cities of the country is particularly applied for cultivation of vegetable including Cauliflower.

So, it is clear that Waste water play good role for the yield of Cauliflower as results of fruit diameter, fruit area and fruit yield were obtained from waste water irrigation where higher (positive impacts) as compared to mix water and fresh water site of irrigation.

6. Future Work

In the future study it is the basic duty of researchers to search out the useful and reasonable aspects of waste water for irrigation of crops and vegetables. Moreover such type of efforts will be fruitful to increase the economical value and fulfill the nutritional needs of population. Research work in future on Waste water irrigation will bring positive outcome to grow vegetables in case of yield and income.

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Author Profile

Mr. Muhammad Majeed have received degree of M.Sc. Botany from Bahauddin Zakariya University (BZU) Multan, Punjab, Pakistan in 2008. Than completed M. Phil Botany from Cholistan Institute of Desert Studies (CIDS), the Islamia University Bahawalpur (IUB) , Punjab , Pakistan. Now a day's as a Ph.D. Scholar of Botany, an honorary and visiting lecturer in well repute institutions and universities and doing a lot of research and writing research papers on Impact of waste water irrigation on various vegetables in peri-urban area of Punjab, Pakistan.

Dr. Muhammad Shafiq Chaudhr have received degree of M.Sc. Botany from University of Punjab, Pakistan in 1982. Than completed degree of Ph.D. Botany from the Islamia University Bahawalpur , Pakistan with the collaboration of University of North Wallace Bangor from U.K. in 2000. Now is working as Associate Professor and also chairing the Department of Life sciences in The Islamia University of Bahawalpur. Having 30 years of research and teaching experience in credit and published more than 42 research publications in the international journals.