

Study of the Impact on Morphological Features of *Abelmoschus esculentus* var. Ankur 41, irrigated by the Waste Water from AmanishahNallah, Sanganer Town, Jaipur, Rajasthan

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Abstract- In the present Study , Waste Water from AmanishahNallah, Sanganer Town, Jaipur is used for the irrigation of *Abelmoschus esculentus* var. Ankur 41, in Experimental Pot analysis. Water is used in many Diluted Levels to assess the Impact of Water Quality on the Morphology of selected Plant Species in their three Developmental Stages viz. Pre Flowering , Peak Flowering and Post Flowering Stage. Results show that the Water Quality affected the Morphology of Plant Species and retardation in Growth Parameters and Developmental Structures at various Developing stages had been observed by increase in the Dilution Levels(increase in Waste Water Concentration) and after comparing them with the Control Level. Results reveal that the Waste Water is not utilized directly for the irrigation purpose without prior treatment and not beyond certain level.

Index Terms- Waste Water, Morphology, Developmental Stages, *Abelmoschus esculentus*, AmanishahNallah.

I. INTRODUCTION

Water and its Quality Impacts all the Living Beings which depend on it for their survival. Today in our fast growing Metropolitan World, the rapid Industrialization and Developmental activities stresses out our all the natural resources, one of them is Water. Availability of the Water impacts its consumption pattern and later on impacted its Quality. Direct accumulation of untreated Waste Effluents into the water body changes its Physico- Chemical Parameters and when this quality of water is utilized for the irrigation purpose then it impacts the associated Soil quality as well as induces the negative impacts on the Plant Species, if irrigated by that untreated Waste Water directly without prior treatment. The

untreated and partially treated waste water contains Fertilizers, Pesticides, Textiles waste water, Pharmaceuticals and, various types of other chemicals which have been prove harmful for Living Beings including animals, Plants and Human Beings¹⁻⁴. Physico- Chemical parameters are induced due to discharge of Untreated or partially treated Industrial waste and Sewage Waste into Water Bodies⁵⁻⁷. The Untreated or Partially treated Waste Water from Industries are continuously used in irrigating the agricultural fields in Developing Countries including India⁸⁻¹⁰. Continuous use of this Waste Water for irrigation effects Soil Quality^{11,12}. The industrial effluents, in lower quantities provide macro and micro nutrient requirements of the plants, but higher quantity becomes harmful. Green vegetables are rich source of minerals like Calcium, Magnesium, Iron and Potassium, Vitamin K and C. They are low in fat, high in protein, and contain good amount of dietary fiber and water.

The Present Study aimed at studying the Impact of WasteWater collected from AmanishahNallah on the Morphological Features of *Abelmoschus esculentus* var. Ankur 41.

II. MATERIAL AND METHODOLOGY

Study Area and Collection of Water Samples: The Waste Water samples were collected from the AmanishahNallah at Sanganer Town, Jaipur, Rajasthan. Area is a hub of large number of Textile , Dyeing and Printing Industries , famous for its Sanganeri Printing. The Waste Water samples were collected from the area where the Industrial effluents directly merge inside the flowing Nallah.



Figure 1: Showing Map of Amanishah Nallah, flowing through Sanganer area, Jaipur, Rajasthan.

Experimental Setup and Rising of Plants:

Experimental Pot Study had been carried out for analyzing the Impact of Water Quality on the Morphology of *Abelmoschus esculentus* var. Ankur 41; during all the Three Developmental Stages of the plant viz. Pre, Peak and Post Flowering Stage.

Morphological Analysis had been carried out to Study all the growth parameters of the Plant like: Root Length (cm); Shoot Length (cm); Root Dry Wt. (mg); Shoot Dry Wt. (mg); Total No. of Leaves; Leaf Length (cm); Leaf Width (cm); Total No. of Flowers; Total No. of Fruits; Fruit length (cm); Total No. of Seeds; Seed Colour; Seed Length (cm) and Seed Dry Wt. (mg). All the Morphological Features are studied timely from days to days in all the Three Stages of Plant.

Plant Height: All the Five Plants from per Pot in the Form of Five Replicates were taken out, Height of shoot and Root of these plants were measured by Meter Scale from the Soil Surface to the base of the fully expanded top leaf at each harvest. Average was calculated on the basis of number of plants/replicates.

Biomass Estimation:

For Dry Wt. determination Individual plants were carefully removed from pots and field keeping the Root and Shoot system intact. Plant roots were thoroughly washed in running water to remove soil particles. Roots and Shoots (Biomass of shoot was taken without ear) were separated and dried in the oven at 80°C for 48 hours then their Dry weights were recorded. These

Weights were expressed in g/plant. Average was calculated on the basis of number of plants/replicates.

Genotype of the Species:-

Abelmoschus esculentus var. Ankur 41.
Common name is Bhindi, (okra; Ladyfinger)

- Kingdom – Plantae
- Order - Malvales
- Family – Malvaceae
- Genus – Abelmoschus
- Species – A. esculentus
- Variety – Ankur 41
- Edible Part – Green Seed Pods

Use – one of the most common Vegetable, Medicinal use in curing Diabetes, Hair loss solutions, source of Vitamin E and Vitamin K .

Sowing – January- February

Maturity- March – April

Experimental Design for studying Impact of Water Quality on Plant Species through Pot Experiment :-

Levels of Irrigation Water samples	Distilled Water (Control, 100% D.W.), 20%, 50%, 80%, 100%
Frequency of Irrigation by Particular Water samples with Dilution Levels	Every Next Day

Site of application of Levels	Soil Surface in the pot
Mode of application	Poured in the pot
Duration of Experiment	Almost 90 days
Number of Harvest	Total three harvest- Pre, Peak and Post Flowering Stage
Individual Pot size	12 inches diameter
Population of Plants Maintained per pot	5
Plant Harvested per Harvest per Level	5

Following 5 treatment levels were prepared by diluting the water from AmanishahNallah , Jaipur with the Distilled water. The Plants investigated at 3 stages of their maturation at Pre, Peak and Post Flowering Stage.

Level 1: DW(control): WW (100:00)

Level 2: DW:WW (80:20)

Level 3: DW:WW (50:50)

Level 4: DW:WW (20:80)

Level 5: DW:WW (00:100)

Earthen Pots (with a diameter of 12 inch) were used for conducting pot experiment for the test Plant species i.e. *Abelmoschusesculentus* var. Ankur 41.

Results and Discussion:

S.no.	Morphological Features	AmanishahNallah Irrigated		(Pre Flowering Stage)		
		Control (DW:WW) (100:00) (Level 1)	(DW:WW) (80:20) (Level 2)	(DW:WW) (50:50) (Level 3)	(DW:WW) (20:80) (Level 4)	(DW:WW) (00:100) (Level 5)
1.	Root Length(in cm)	21.36±0.152	21.26±0.057	19.43±0.115	18.16±0.057	13.06±0.057
2.	Shoot Length(in cm)	15.2±0.208	14.2±0.1	14±0.1	12.46±0.230	11.76±0.230
3.	Root Dry Weight(in mg)	1.78±0.012	1.68±0.011	1.66±0.010	1.58±0.012	1.48±0.010
4.	Shoot Dry Weight(in mg)	1.97±0.012	1.86±0.059	1.74±0.023	1.61±0.010	1.57±0.011
5.	Total No. of Leaves	18	17	17	16	16
6.	Leaf Length(in cm)	6.46±0.057	5.8±0.173	5.36±0.057	5.26±0.057	3.96±0.057
7.	Leaf Width(in cm)	7.16±0.057	6±0.1	5.76±0.057	5.4±0.173	4.33±0.057
8.	Leaf Colour	Dark Green	Dark Green	Light Green	Light Green	Light Green

Table 1: Morphological Study of *Abelmoschusesculentus* var. Ankur 41, irrigated by AmanishahNallah, Jaipur, Water. (Pre Flowering Stage):-

S. No.	Morphological Features	AmanishahNallah Irrigated		Peak-Flowering Stage		
		Control (DW:WW) (100:00) (Level 1)	DW:WW) (80:20) (Level 2)	(DW:WW) (50:50) (Level 3)	DW:WW) (20:80) (Level 4)	DW:WW) (00:100) (Level 5)
1.	Root Length (in cm)	24.26±0.057	22.53±0.472	21.13±0.907	20±0.1	17.5±0.1
2.	Shoot Length(in cm)	17.76±0.152	15.56±0.493	15.13±0.057	14±0.1	12.6±0.435
3.	Root Dry Weight (in mg)	1.78±0.010	1.73±0.058	1.68±0.010	1.59±0.010	1.53±0.010
4.	Shoot Dry Weight (in mg)	2.39±0.506	2.08±0.010	1.96±0.010	1.91±0.016	1.83±0.010
5.	Total No. of	24	22	20	20	19

	Leaves					
6.	Total No. of Flowers	10	08	09	07	05
7.	Leaf Length (in cm)	6.76±0.057	6±0.1	5.73±0.057	5.36±0.230	4.13±0.115
8.	Leaf Width(in cm)	7.26±0.152	6.26±0.057	5.96±0.057	5.7±0.1	4.6±0.1
9.	Leaf Colour	Dark Green	Dark Green	Light Green	Light Green	Light Green

Table 2: Morphological Study of *Abelmoschuseculentus* var. Ankur 41, irrigated by AmanishahNallah, Jaipur, Water. (Peak Flowering Stage):-

S. No.	Morphological Features		AmanishahNallah Irrigated		Post Flowering Stage	
		Control (DW:WW) (100:00) (Level 1)	DW:WW (80:20) (Level 2)	(DW:WW) (50:50) (Level 3)	DW:WW (20:80) (Level 4)	DW:WW (00:100) (Level 5)
1.	Root Length (in cm)	26.03±0.737	23.36±0.251	22.4±0.435	20.46±0.513	19.1±0.360
2.	Shoot Length(in cm)	18.16±0.305	16.2±0.4	15.8±0.1	15.26±0.351	13.53±0.321
3.	Root Dry Weight (in mg)	1.79±0.010	1.71±0.010	1.67±0.058	1.64±0.010	1.58±0.010
4.	Shoot Dry Weight (in mg)	2.15±0.010	2.08±0.010	1.96±0.010	1.93±0.010	1.86±0.054
5.	Total No. of Leaves	28	26	27	24	23
6.	Total No. of Fruits	10	07	05	03	03
7.	Leaf Length (in cm)	7.2±0.2	6.53±0.550	6.3±0.2	5.86±0.057	4.9±0.1
8.	Leaf Width(in cm)	8.2±0.264	7.16±0.404	6.46±0.11	6.1±0.1	5.23±0.351
9.	Leaf Colour	Dark Green	Dark Green	Dark Green	Light Green	Light Green
10.	Fruit Length (in cm)	7.46±0.057	7.1±0.1	6.8±0.1	6.13±0.208	5.33±0.208
11.	Total No. of Seeds	43	35	30	28	20
12.	Seed- Shape	Round	Round	Small Round	Wrinkled Round	Wrinkled Round
13.	Seed- Colour	White	White	White	White	White
14.	Seed Length (in cm)	0.46±0.057	0.36±0.057	0.36±0.057	0.16±0.057	0.13±0.057
15.	Seed Dry Weight (in mg)	5.36±0.057	4.9±0.1	4.1±0.2	3.83±0.152	3.43±0.208

Table 3: Morphological Study of *Abelmoschuseculentus* var. Ankur 41, irrigated by AmanishahNallah, Jaipur, Water. (Post Flowering Stage):-

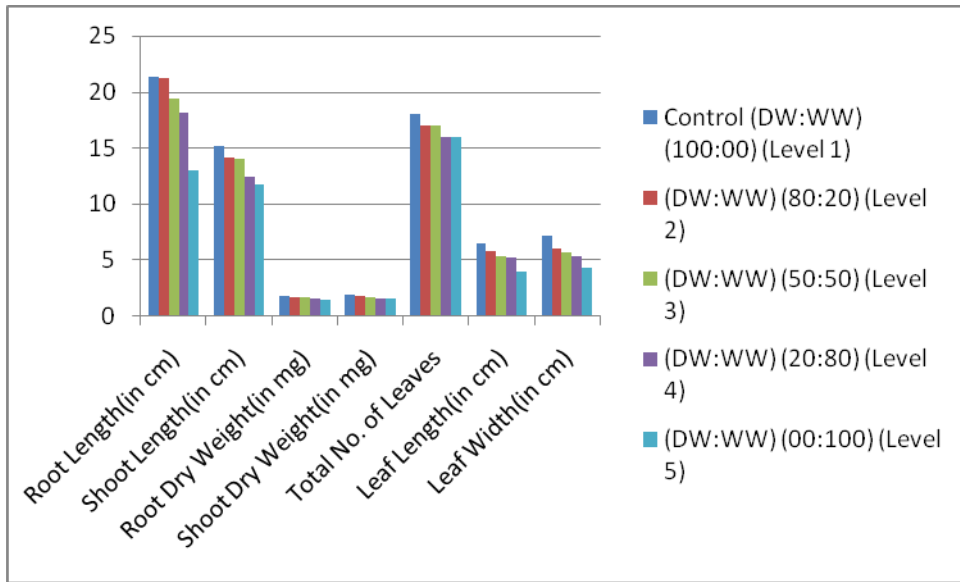


Figure 1: Morphological Analysis of Abelmoschus esculentus var. Ankur 41, irrigated by Water of Amanishah Nallah, Jaipur. (Pre Flowering Stage).

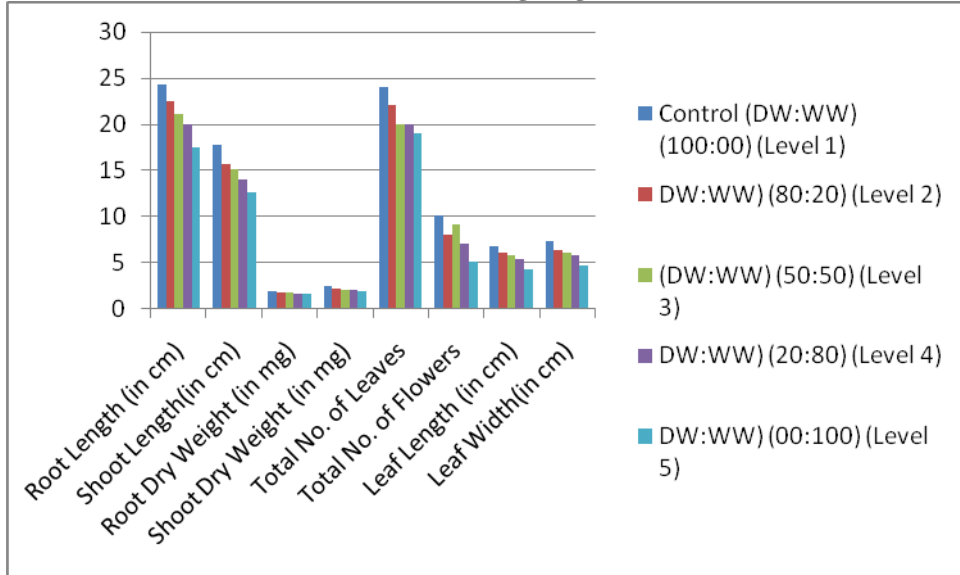


Figure 2: Morphological Analysis of Abelmoschus esculentus var. Ankur 41, irrigated by Water of Amanishah Nallah, Jaipur. (Peak Flowering Stage).

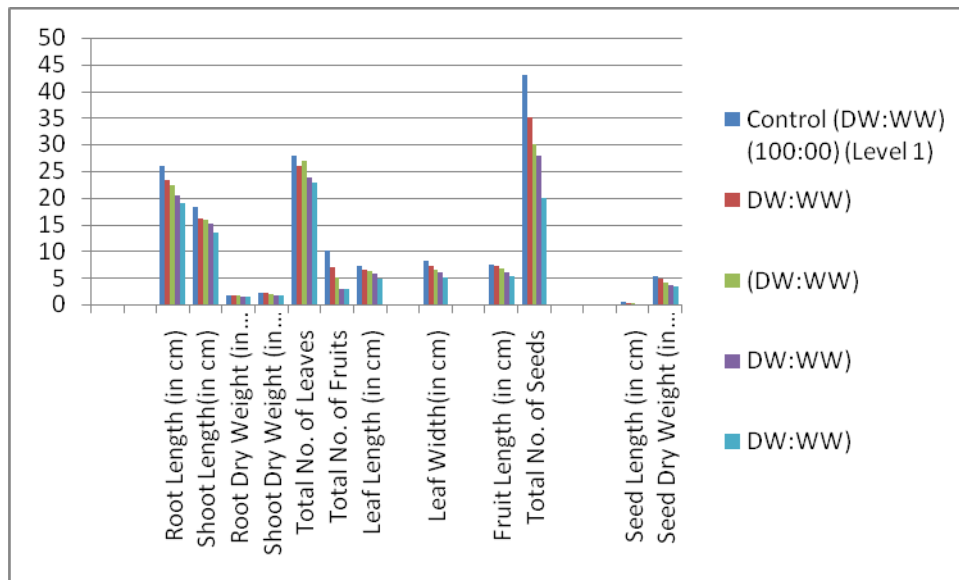


Figure 3: Morphological Analysis of *Abelmoschus esculentus* var. Ankur 41, irrigated by Water of AmanishahNallah, Jaipur. (Post Flowering Stage).

Root Length: Results show that the Root Length of *Abelmoschus esculentus* var. Ankur 41, at Pre Flowering Stage when irrigated by the Water of AmanishahNallah in all the Five Levels is 21.36, 21.26, 19.43, 18.16 and 13.06 cm respectively. Results show that the Root Length of the AmanishahNallah Water irrigated Plants in their Peak Stage is 24.26 cm in First Dilution Level and 22.53, 21.13, 20, 17.5 cm in Second, Third, Fourth and Fifth Dilution Level. **Root Length:** Results show that the Root Length of the AmanishahNallah Water irrigated Plants in their Post Stage is 26.63cm in First Dilution Level and 23.36, 22.4, 20.46, 19.1 cm in Second, Third, Fourth and Fifth Dilution Level.

Shoot length: Results show that the value of Shoot Length calculated when irrigated by AmanishahNallah at all the Five Levels is 15.2, 14.2, 14, 12.46 and 11.76 cm respectively. Results Show that the Shoot Length of the AmanishahNallah Water Irrigated Plants in Peak is 17.76 cm in First Dilution Level Stage while it is 15.56, 15.13, 14, 12.6 at Second, Third, Fourth and Fifth Dilution Levels respectively. Results Show that the Shoot Length of the AmanishahNallah Water Irrigated Plants in Post stage is 18.16 cm in First Dilution Level Stage while it is 16.2, 15.8, 15.26, 13.53 at Second, Third, Fourth and Fifth Dilution Levels respectively.

Root Dry Weight: Results show that the Root Dry Weight in Pre Stage when irrigated by Water of AmanishahNallah is 1.78 mg at First Dilution Level whereas it is 1.68, 1.66 1.58 and 1.48 mg at Second, Third, Fourth and Fifth Dilution Levels. Results show that the Root Dry Weight of AmanishahNallah irrigated Plants In Peak has 1.78, 1.73, 1.68, 1.59 and 1.53 mg of First, Second, Third, Fourth and Fifth Dilution Levels respectively. Results show that in the Post stage Root Dry Weight of AmanishahNallah irrigated Plants has 1.79, 1.71, 1.67, 1.64 and 1.58 mg of First, Second, Third, Fourth and Fifth Dilution Levels respectively.

Shoot Dry Weight : Results show that the AmanishahNallah irrigated Plants have Shoot Dry Weight in all

the Five Dilutions Level in Pre is 1.97, 1.86, 1.74, 1.61 and 1.57 mg respectively. Results show that the Shoot Dry Weight of AmanishahNallah Irrigated Plants in Peak is 2.39 mg at First Dilution Level Stage the it is 2.08 mg at Second Dilution Level Stage while it is 1.96 mg at Third Level, then at Fourth Level it is 1.91 mg and finally at Fifth Dilution Level it varies to 1.83 mg. Results show that the Shoot Dry Weight of AmanishahNallah Irrigated Plants in Post is 2.15 mg at First Dilution Level Stage the it is 2.08 mg at Second Dilution Level Stage while it is 1.96 mg at Third Level, then at Fourth Level it is 1.93 mg and finally at Fifth Dilution Level it varies to 1.86 mg.

Total No. of Leaves: Results show that at Control Level the AmanishahNallah irrigated Plants have Total 18 Leaves while at Second, Third, Fourth and Fifth Dilution Levels the No. of Leaves is 17, 17, 16 and 16 respectively in Pre stage. Results show that the Total No. of Leaves in AmanishahNallah Water Irrigated Plants in Peak is 24 Leaves at First Dilution Level, 22, 20, 20 and 19 Leaves in Second, Third, Fourth and Fifth Dilution Levels respectively. Results show that in Post the Total No. of Leaves in AmanishahNallah Water Irrigated Plants is 28 Leaves at First Dilution Level, 26, 27, 24 and 23 Leaves in Second, Third, Fourth and Fifth Dilution Levels respectively.

Leaf Length: Results show that the Length of Leaves irrigated by the Water of AmanishahNallah at the Pre Flowering Stage of their Plants is 6.46 cm at First Level, 5.8 cm at Second Dilution Level, 5.36 cm at Third Level, 5.26 cm at Fourth Level and 3.96 cm at Fifth Level. Results show that the AmanishahNallah Water Irrigated Plants in Peak stage has Leaf Length of 6.76 cm in First Dilution Level while it variates to 6 cm, 5.73 cm, 5.36 cm and 4.13 cm in Second, Third, Fourth and Fifth Dilution Levels respectively. Results show that the AmanishahNallah Water Irrigated Plants has Leaf Length of 7.2 cm in First Dilution Level while it variates to 6.53 cm, 6.3 cm, 5.86 cm and 4.9 cm in Second, Third, Fourth and Fifth Dilution Levels respectively in their Post Flowering stage.

Leaf Width: Results show that the Width of the Leaves irrigated with the Water of AmanishahNallah in Pre stage has

Width of 7.16, 6, 5.76, 5.4 and 4.33 cm at their all the Five Dilution Levels respectively. Results show that the AmanishahNallah Water Irrigated Plants in Peak has Leaf Width of 7.26 cm in their First Dilution Level, 6.26 cm in Second Dilution Level and 5.96, 5.7 and 4.6 cm Width in Third, Fourth and Fifth Dilution Levels respectively. Results show that the AmanishahNallah Water Irrigated Plants has Leaf Width in Post stage of 8.2 cm in their First Dilution Level, 7.16 cm in Second Dilution Level and 6.46, 6.1 and 5.23cm Width in Third, Fourth and Fifth Dilution Levels respectively.

Leaf Colour: Results show that the Colour of the Leaves Irrigated by the Water of AmanishahNallah in First Dilution Level is Dark Green and in Second Dilution Level it is Dark Green in colour then later on it becomes Light Green in all the three Dilution Levels that is Third, Fourth and Fifth Level in Pre stage. Results show that in Peak the Leaf Colour of the AmanishahNallah Irrigated Plants at their First Dilution Level is Dark Green, and Dark Green is Observed in Second Dilution Level while it is Light Green in Third, Fourth and Fifth Dilution Levels. Results show that the Leaf Colour of the AmanishahNallah Irrigated Plants in Post at their First Dilution Level is Dark Green, and Dark Green is Observed in Second Dilution Level as well as Third Dilution Level, Fourth and Fifth Dilution Levels show Leaves of Light Green Colour.

Total No. of Flowers: Results show that the Total No. of Flowers in Plants Irrigated by the Water of AmanishahNallah at their Peak Flowering Stage is 10 at First Dilution Level, 08 at Second Dilution Level while 09, 07 and 05 in their Third, Fourth and Fifth Dilution Levels.

Flower Colour: Results show that the AmanishahNallah Irrigated Plants in Peak Stage are Light Yellow Colour in all the Five Dilution Levels.

Total No. of Fruits: Results show that the Total No. of Fruits in Plants in their Post Stage Irrigated by the Water of AmanishahNallah at their Post Flowering Stage is 10 at First Dilution Level, 07 at Second Dilution Level while 05, 03 and 03 in their Third, Fourth and Fifth Dilution Levels.

Fruit Length: Results show that the Length of Fruits in AmanishahNallah Water Irrigated Plants in their Post Stage is 7.46cm in First Control Level, then it is 7.1 cm in Second Dilution Level while it is 6.8 cm, 6.13 cm and 5.33 cm in Third, Fourth and Fifth Dilution Levels respectively.

Total No. of Seed: Results show that the Total No. of Seed in AmanishahNallah Water Irrigated Plants in Post stage is 43 Seeds in First Control Level while 35, 30, 28, 20 Seeds at Second, Third, Fourth and Fifth Dilution Levels respectively.

Seed Shape: Results show that the Seed Shape in AmanishahNallah Water Irrigated Plants in Post Stage is Round in Control and Second Level, while it is Small Rounded in Third Level and Slight Wrinkled Round in Fourth and Fifth Level respectively.

Seed Colour: Results show that the Seed Colour of AmanishahNallah Water irrigated Plants is White in their Post Stage.

Seed Length: Results show that the Length of the Seeds in AmanishahNallah Water Irrigated Plants in Post Stage is 0.46 cm in First Level, 0.36 cm in Second Level, while 0.36 cm, 0.16 cm and 0.13 cm in Third, Fourth and Fifth Level respectively.

Seed Dry Weight: Results show that the AmanishahNallah Water Irrigated Plants Seeds has Dry Weight of 5.36 mg in First Dilution Level, then 4.9 mg in Second Dilution Level while 4.1 mg, 3.83 mg and 3.43 mg in Third, Fourth and Fifth Dilution Levels respectively in their Post Flowering Stage.

III. CONCLUSION AND RECOMMENDATIONS

In the present Study, all the results reveal that the Waste Water is not suitable in its pure Untreated Form for the irrigation purpose in the Agricultural Fields. Here also in the Study Conducted, it can be easily observed that as the Dilution Level increases up to the pure Waste Water Range, the plants show stressed and reduced Morphological features and, up to the appropriate range which seems to be 20% diluted or maximum to the 50% dilution level, Plants show less Waste Water stress inside them. So if we want to proceed irrigation with utilization of such form of water then we have to plan and act for its proper prior treatment measures and then its utilization in the activities like Agriculture.

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