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Effect of Yamuna River Water on growth of *Vigna Mungo* (L) Wilczek

Abstract

The present investigation deals with the studies on the effect of Yamuna River water on different growth parameters of *Vigna mungo*. Among the different concentrations (25%, 50% & 100%) of Yamuna river water, 25 % concentration showed minimum inhibitory effect on the seed germination & other growth parameters of *Vigna mungo* over control. Maximum inhibition in the growth parameters was recorded under the influence of 100% of Yamuna river water in comparison to control (Tap Water).

Keywords: Germination Percentage; Seedling Growth; *Vigna Mungo*; Yamuna River Water**.**

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Introduction

River water is the natural resource which forms the lifeline of all living organisms. Water pollution is considered as a major environmental concern of India, water pollution is the introduction of contaminating pollutants into the natural water leading to an adverse change. There are number of research data and statistics that claims that from the few decades the earths water resources are being depleted, polluted and rendered un-potable at an alarming rate. It is assumed that by the year 2025, two third of the world s population will be facing highly water shortage. According to UN surveyed reports, India is expected to face a very critical levels of water stress by 2025 and there will be serious water shortages (UN Climate Report, 2014). Approximately about 85% of the rivers pollution comes from domestic sources (CWC, 2009). The river Yamuna is the largest tributary of the River Ganga. The main stream of the river Yamuna originates from the Yamunotri glacier near Bandar Punch (38o 59' N 78o 27' E) in the Mussourie range of the lower Himalayas at an elevation of about 6320 meter above mean sea level in the district Uttarkashi (Uttaranchal). Yamuna river covers parts mainly of the states of Uttaranchal, Uttar Pradesh (U.P.), Himachal Pradesh, Haryana, Rajasthan, Madhya Pradesh and the entire state of Delhi. The river Yamuna travels a distance of about 1370 km in the plain from Saharanpur district of Uttar Pradesh to the confluence with river Ganga at Allahabad. In the past few years, heavy metal pollution has grown up as a serious concern not only in India but all over the world, as these heavy metals pose a very adverse effect on all forms of living organisms in the biosphere. These heavy metals causes the river water pollution, are not readily degradable in the environment and accumulate in the animal and human bodies to a very high toxic levels leading to undesirable effects. As we know that the increased population and the progress in agriculture and industry, in the recent years, have further complicated the whole situation (Sahu et al., 2007). Due to lack of awareness we discharge the untreated or partially treated industrial waste waters containing heavy metals into the water bodies, especially rivers, prevail in aquatic bodies and get bioaccumulated along the food chain. Heavy metals affects not only structural but also biological functioning of biomolecules (McCormick et al., 2005). They are also supposed to interfere with synthesis & metabolism of the hormones (Gaur et al., 2002). By the research it was found that the major sources contributing to the pollution of Yamuna are: untreated sewage, industrial effluents, the dumping of garbage and dead bodies, continuous immersion of idols and pollution due to in-stream uses of water (CPCB, 2006). Further, It is also found that the dilution capacity of the river is reduced due to significant water abstraction, leading to greater deterioration of the river. In view of this, the present investigation was undertaken to evaluate the effect of Yamuna river water on the growth parameters of *Vigna mungo*.

Aim of the Study

By the present investigation we study the quality of Yamuna river water by taking samples from three different locations from Mathura, Agra and Etawah respectively and investigated the effect of Yamuna river water on various growth parameters of *Vigna mungo* crop by irrigating it with Yamuna river water.

Material and methods

The healthy seeds of *Vigna mungo* variety. i.e. PUSA- URD were surface sterilized with 0.1 per cent mercuric chloride for 2 minutes and washed thoroughly with tap water and then with distilled water. Forty seeds of *Vigna mungo* were arranged equispacially in plastic trays lined with filter paper. They were irrigated uniformly with three different concentrations i.e. 25%, 50% and 100% of Yamuna river water which were taken from three different locations in Gokul Bairaj, Mathura, Bateshwar, Agra and Itawah with tap water (Control). They were allowed to grow for 10th days. Three replications were maintained for this varietal screening experiment. The number of seeds germinated in each treatment was counted on each and every day up to 10th day after sowing. Twenty seedlings were randomly selected on 10^{th} day from each treatment to record the seedling growth. The growth of the *Vigna mungo* seedlings was measured by using a centimeter scale and the values were recorded. Fresh weight of twenty seedlings was taken by using an electrical single pan balance. The average is expressed in g / seedling. Twenty seedlings were kept in a hot air oven at 75^0C for 24 hrs. Then the samples were kept in a desiccator and their dry weights were taken by using an electrical single pan balance. The average is expressed in g / seedling. Vigour index of the seedlings was calculated by using the formula proposed by Abdul-Baki and Anderson (1973). The statistical analysis of experimental results was carried out by standard deviation. In order to analyze the data statistical tool such as ANOVA was used. Standard deviation calculated by following methods of O'Brien, R. G. (1981).

Results

Location (A) – (Gokul Bairaj, Mathura)

In the case of 25% treatment the germination percentage was 80%, in 50% treatment it was 50%, in 100% treatment it was 35% and in the case of control it was 100%.The seedling length was 20.2±2.2, in 50% treatment it was 18.6±1.2, in 100% treatment it was 13.4±1.0 and in the case of control it was 25.2±.1.8. The seedling fresh weight was 1.893±0.16, in 50% treatment it was 1.046±0.22, in 100% treatment it was 0.681±0.04 and in the case of control it was 2.120±0.16. The seedling dry weight was 0.210±0.032, in 50% treatment it was 0.125±0.008, in 100% treatment it was 0.096±0.012 and in the case of control it was 0.240±0.040. The vigour index was 1616, in 50% treatment it was 930, in 100% treatment it was 469 and in the case of control it was 2520.

Location (B) – (Bateshwar, Agra)

In the case of 25% treatment the germination percentage was 82%, in 50% treatment it was 55%, in 100% treatment it was 40% and in the case of control it was 100%. The seedling length was 21.5±3.2, in 50% treatment it was 18.8±2.4, in 100% treatment it was 14±2.6 and in the case of control it was 25.5±2.6. The seedling fresh weight was 1.898±0.10, in 50% treatment it was 1.054±0.18, in 100% treatment it was 0.690±0.14 and in the case of control it was 2.128±0.22. The seedling dry weight was 0.215±0.004, in 50% treatment it was 0.130±0.012, in 100% treatment it was 0.108±0.018 and in the case of control it was 0.250±0.010. The vigour index was 1763, in 50% treatment it was 1034, in 100% treatment it was 560 and in the case of control it was 2550.

Location (C) – (Itawah)

In the case of 25% treatment the germination percentage was 74%, in 50% treatment it was 48%, in 100% treatment it was 30% and in the case of control it was 100%. The seedling length was 18.5±1.4, in 50% treatment it was 16.0±0.8, in 100% treatment it was 11.2±1.0 and in the case of control it was 25.0±2.6. The seedling fresh weight was 1.850±0.12, in 50% treatment it was 1.020±0.24, in 100% treatment it was 0.620±0.18 and in the case of control it was 2.115±0.22. The seedling dry weight was 0.200±0.010, in 50% treatment it was 0.105±0.024, in 100% treatment it was 0.090±0.020 and in the case of control it was 1.235±0.018. The vigour index was 1369, in 50% treatment it was 768, in 100% treatment it was 336 and in the case of control it was 2500.

Discussion

From old time it is known that irrigation of crops with river water affects the growth of plants (Chandra et al., 2004). According to our study it was concluded that there is a negative effect of the sample collected of Yamuna river water (100%) and diluted with tap water (50%, 25%), with tap water serving as control on growth parameters of the tested plant. These studies clearly indicates that the river water have an inhibitory effect on seed germination and early growth of plants. Supply of the undiluted (100%) effluent produced significant inhibition in seed germination and seedling growth parameters - length of radicle and plumule and fresh and dry weight in (Table-1, 2 and 3). Even though less severe, the inhibitory effect of the 1:1 diluted (50%) effluent was also significant. *Vigna mungo* seedlings irrigated with the undiluted (100%) effluent also developed visible symptoms. Most conspicuous of those were burning of leaf tips and formation of loops by the young emerging leaves. These leaves failed to expand, resulting in marked decrease in leaf size. Growth of roots was also inhibited and root tips turned brown and necrotic. Irrigation with diluted (50%) effluent produced similar but less severe effects. Somewhat similar effects were produced in treatment of 25%. The leaves of *Vigna mungo* seedlings irrigated with the undiluted (100%) effluent failed to unroll and remained needle-like. Their apical part also turned chlorotic. The root tips of the *Vigna mungo* seedlings also turned brown and necrotic. Growth of a large percentage of *Vigna mungo* seedlings was severely arrested beyond 15 days from sowing. Inhibition of growth in response to irrigation with the Yamuna river water has also been reported in pigeon pea and black

gram (Pandey, 2006a). Possibly, the inhibitory effect of the river water on seed germination, seedling growth and development of phototoxic effects is an outcome of its high salt content and presence of toxic heavy metals (Lauchli and Luttge, 2000). The visible effects produced in the different parts of plants such as roots and aerial parts of the seedlings show great resemblance to the nickel-toxicity effects. These findings are also in consonance with growth inhibition of different crops such as radish and spinach plants accumulating heavy metals, including Cr, Ni and Zn in response to irrigation from samples taken from Gomti river water in Lucknow (Pandey, 2006b). In conclusion, the river water taken from Yamuna river under investigation is not in only a potential source of pollution, but is also toxic to growth of plants irrigated with it.

Table-1
Effect of Different Concentrations of Yamuna River Water on Physiological Growth of Vigna Mungo (Location Gokul Bairaj, Mathura)

Treatments	Germination%	Seedling length	Seedling Fresh Weight	Seedling Dry Weight	Seedling Vigour Index
25%	80%	20.2±2.2	1.893±0.16	0.120±0.032	1616
50%	50%	18.6±1.2	1.046±0.22	0.125±0.008	930
100%	35%	13.4±1.0	0.681±0.04	0.096±0.012	469
Control	100%	25.2±1.8	2.120±0.16	1.240±0.040	2520

Table-2
Effect of Different Concentrations of Yamuna River Water on Physiological Growth of Vigna Mungo (Location Bateshwar, Agra)

Treatments	Germination%	Seedling length	Seedling Fresh Weight	Seedling Dry Weight	Seedling Vigour Index
25%	82%	21.5±3.2	1.898±0.10	0.215±0.004	1763
50%	55%	18.8±2.4	1.054±0.18	0.130±0.012	1034
100%	40%	14.0±2.6	0.690±0.14	0.108±0.018	560
Control	100%	25.5±2.2	2.128±0.22	1.250±0.010	2550

Table-3
Effect of Different Concentrations of Yamuna River Water on Physiological Growth of Vigna Mungo (Location Near Itawah)

Treatments	Germination%	Seedling length	Seedling Fresh Weight	Seedling Dry Weight	Seedling Vigour Index
25%	74%	18.5±1.4	1.850±0.12	0.200±0.010	1369
50%	48%	16.0±0.8	1.020±0.24	0.105±0.024	768
100%	30%	11.2±1.0	0.620±0.18	0.090±0.020	336
Control	100%	25.0±2.6	2.115±0.22	1.235±0.018	2500

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