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# ECOLOGY OF THE EFFLUENT CHANNEL FLOWING FROM DISTILLERY FACTORY AND ITS IRRIGATIONAL IMPACT ON SEED GERMINATION AND SEEDLING GROWTH OF SOME CROPS

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## ABSTRACT

The effect of Superior Industry Ltd. (distillery factory C.B. Ganj, Bareilly, U.P.) on growth parameters seed germination and seedling growth of selected crops viz. Mustard, Groundnut, Pea, Gram, Onion, Lahsun, Cauliflower, Potato and carrot were found to be dependent on concentration. The effluent treatment plants of superior industry consist of main zone site I, 0.75 Km. west site II treatment plant and site III 100 m. south effluent after treatment. The germination of various seeds was determined on the bases of growth with respect to different effluents such as site I, site II & site III. Untreated site I showed a deleterious effect while site III treated effluent indicated a stimulatory effect on all the crops. The high germination in site II effluent and site III effluent support that frequent addition of fertilizers, which provide food sources for biomass and act as nutrient in the effluent. The chemical analysis of distillery factory effluent (Site I, site II and Site III) samples carried out with various parameters, violated tolerance limit. In the present manuscript an attempt has been made to access the effect of distillery factory effluent treated as well as untrated on germination of various crops to ensure the safe landing of such effluent for irrigational purpose.

## INTRODUCTION

The rapid increase in industrialization excretes immense amount of waste water, as demands for fresh water is amplifying day by day. The effluent from superior industry ltd. located at C.B. Ganj Bareilly (U.P.) is disposed of through several drains which carry pollution load in the river, cultivars of adjacent villages irrigate their cops with the polluted water of the factory. This has resulted colossal damage to their crops.[1,2,3] Reports have suggested that the effluents have an inhibitory effect on seed germination and seedling growth performance of wheat cultivers.[4,5] Industrial effluent, in addition to other effects, directs affects soil not only in industrial areas but also in agriculture fields and river beds, thereby creating secondary source of pollution. In view of these reports, an attempt has been made in the present study to assess the various physico-chemical characteristics of effluent of distillery factory and their effects on germination and growth behaveiour of some crops viz. Mustard, Groundnut, Pea, Gram, Onion, Lashun, Cauliflower, Potato and carrot.

**EXPERIMENTAL**

The distillery factory effluents were collected fortnightly intervals at site I (main dischange point), site II (treatment tank) and site III (effluent after treatment) and were analysed according to A.P.H.A. (1980)[6]. Quantitative estimation of heavy metals in effluent was made by using atomic absorption spectrophotometer (A.A.S. 300 parkin and Elmer) table (1 & 2).

The seeds of crops Mustard, Groundnut, Pea, Gram, Onion, Lashun, Cauliflower, Potato and carrot were keep in petri dishes lined with three layer of whatman filter paper no. 1 moistened with different effluents (site I, site II and site III). A control with distilled water was also set. The emergence of radicle and plumule was considered as criterion for germination and shoot length. Each treatment was replicated three times for all the crops. Germination and shoot length was measured by simple scale method on apical parts. In planting procedure 5 seeds of each crop were planted 3-4 cm apart and 2 cm deep in each 9 planting pot containing 4 kg of soil. Irrigation was done on the basis of moisture in soil.

Table-1

Physico-chemical characteristics and tolerance limit for effluent

| Parameters | Site I observed range | Site II observed range | Site III observed range | Tolerance limit irrigational water mg/L ISI:3306-1974 |
|---|---|---|---|---|
| colour | Brown | Yellowish | Yellowish | - |
| Odour | Vinegar | Vinegar | | - |
| Conductivity | 0.24-4.13 | 0.22-3.91 | 0.22-3.40 | 3.0($mScm^{-1}$) |
| Transparency | 2.54-90.46 | 2.63-91.64 | 3.10-90.4 | 100 |
| pH | 4.60-8.10 | 4.8-8.00 | 6.8-7.7 | 6.5-7.2 |
| TDS | 38.4-1220.6 | 36.7-1126.3 | 45.6-809.6 | 100-250 |
| COD | 65.5-1540.6 | 64.6-1340 | 67.6-602.6 | 250 |
| BOD | 36.2-1320.2 | 40.2-1260.1 | 78-889.6 | 500 |
| Free $CO_2$ | 0.18-271.0 | 1.12-221 | 1.2-122 | 6 |
| Cl | 13.6-4311.2 | 16.8-3516.6 | 15.2-811.6 | 600 |
| Oid & Grease | 55-75 | 50-70.2 | 35-49.6 | 10 |
| Total-$N_2$ | 9.10-72.64 | 8.3-68.1 | 6.2-41.3 | - |
| $SO_4^{--}$ | 0.96-5.01 | 0.91-4.36 | 0.81-3.61 | 100 |
| $PO_4^{---}$ | 0.17-1.23 | 0.18-1.22 | 0.18-0.96 | - |
| Ca | 6.82-90.2 | 7.21-88.4 | 8.42-80.4 | 75 |
| Mg | 1.53-92.4 | 1.81-90.3 | 2.81-68.3 | 50 |
| K | 5.40-24.3 | 6.34-23.6 | 7.43-27.4 | 60 |
| Na | 5.32-23.4 | 6.22-28.6 | 7.10-26.4 | 60 |

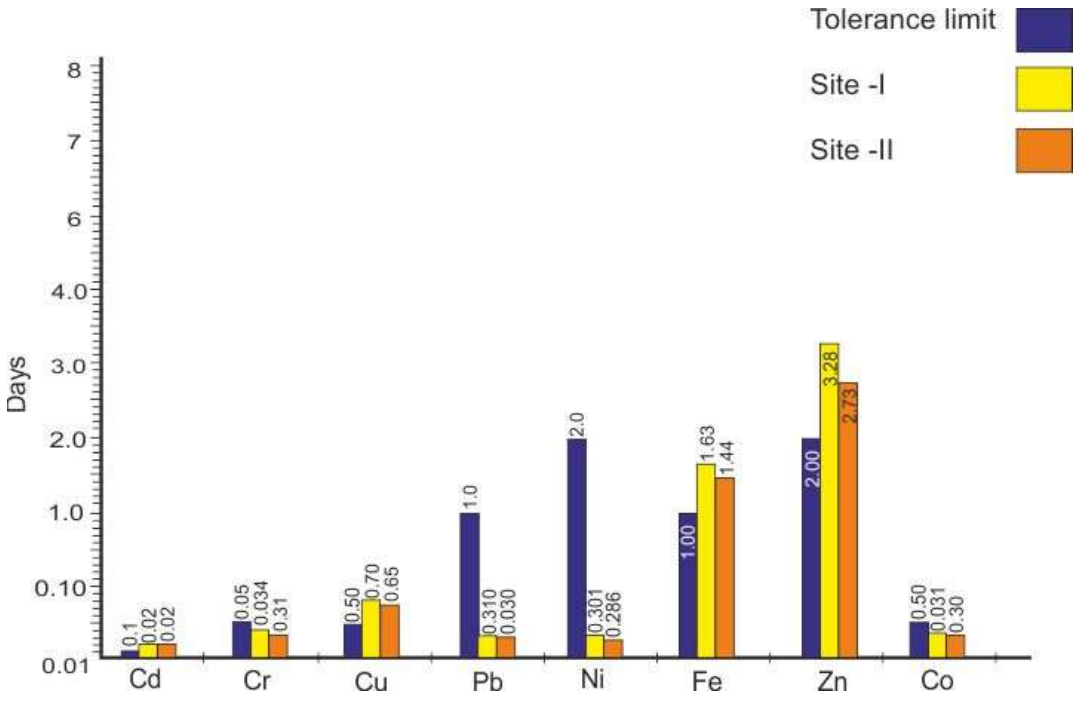
All values are expressed as mg/L except colour, odour, pH, conductivity and transparency.

Table-2

Heavy metal ions concentration (µg $ml^{-1}$) in the effluent collected from distillery factory C.B. Ganj Bareilly

| Heavy Metals | Observed Values in two side | | Tolerance Limits ISI(1977) |
|---|---|---|---|
| | Site I | Site II | |
| $Cd^{++}$ | 0.02 | 0.02 | 0.01 |
| $Cr^{+++}$ | 0.034 | 0.031 | 0.05 |
| $Cu^{++}$ | 0.070 | 0.065 | 0.50 |
| $Pb^{++}$ | 0.310 | 0.30 | 1.00 |
| $Ni^{++}$ | 0.301 | 0.286 | 2.00 |
| $Fe^{++}$ | 1.63 | 1.44 | 1.00 |
| $Zn^{++}$ | 3.28 | 2.73 | 2.00 |
| $Co^{++}$ | 0.031 | 0.030 | 0.50 |

*Heavy metals were not detected at side III, hence not shown in the table




## RESULT AND DISCUSSION

Seeds of all crops viz. mustard, groundnut, pea, gram, onion, lahsun, cauliflower, potato and carrot were sown in unglazed earthen pots (25 Cm. diam.) filled with garden loan soil mixed with farm yard manure. Effluent of site I, site II and site III and control water were added equally into the respective pots and the day of germination was noted and the height of the plant after germination was evaluated on day to day basis and observation. The germination starts after 2 days of sowing in most of the cases but in case of mustard and cauliflower does not match with them. Seeds of cauliflower does not show any germination with control and treatment sample.

Table-3

Seed Germination day in control and treatments

| Crops | Control | Day of seed germination | | |
|---|---|---|---|---|
| | | Site I | Site II | Site III |
| 1. Mustard | 8 | 8 | 6 | 6 |
| 2. Groundnut | 3 | 2 | 2 | 2 |
| 3. Pea | 2 | 2 | 2 | 2 |
| 4. Gram | 2 | 2 | 2 | 2 |
| 5. Onion | 1 | 1 | 2 | 2 |
| 6. Lahsun | 2 | 1 | 1 | 2 |
| 7. Cauliflower | - | - | - | - |
| 8. Potato | 3 | 5 | 3 | 3 |
| 9. Carrot | 2 | 4 | 3 | 2 |

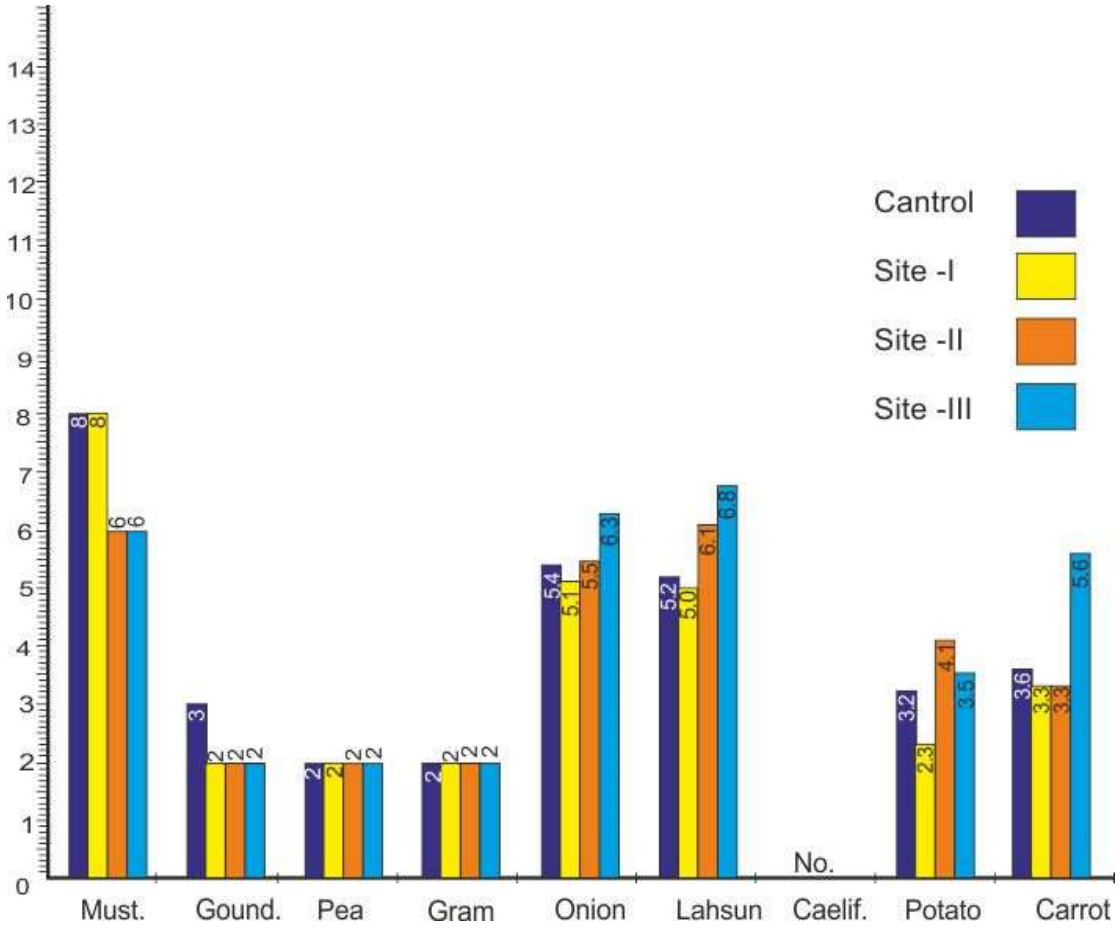
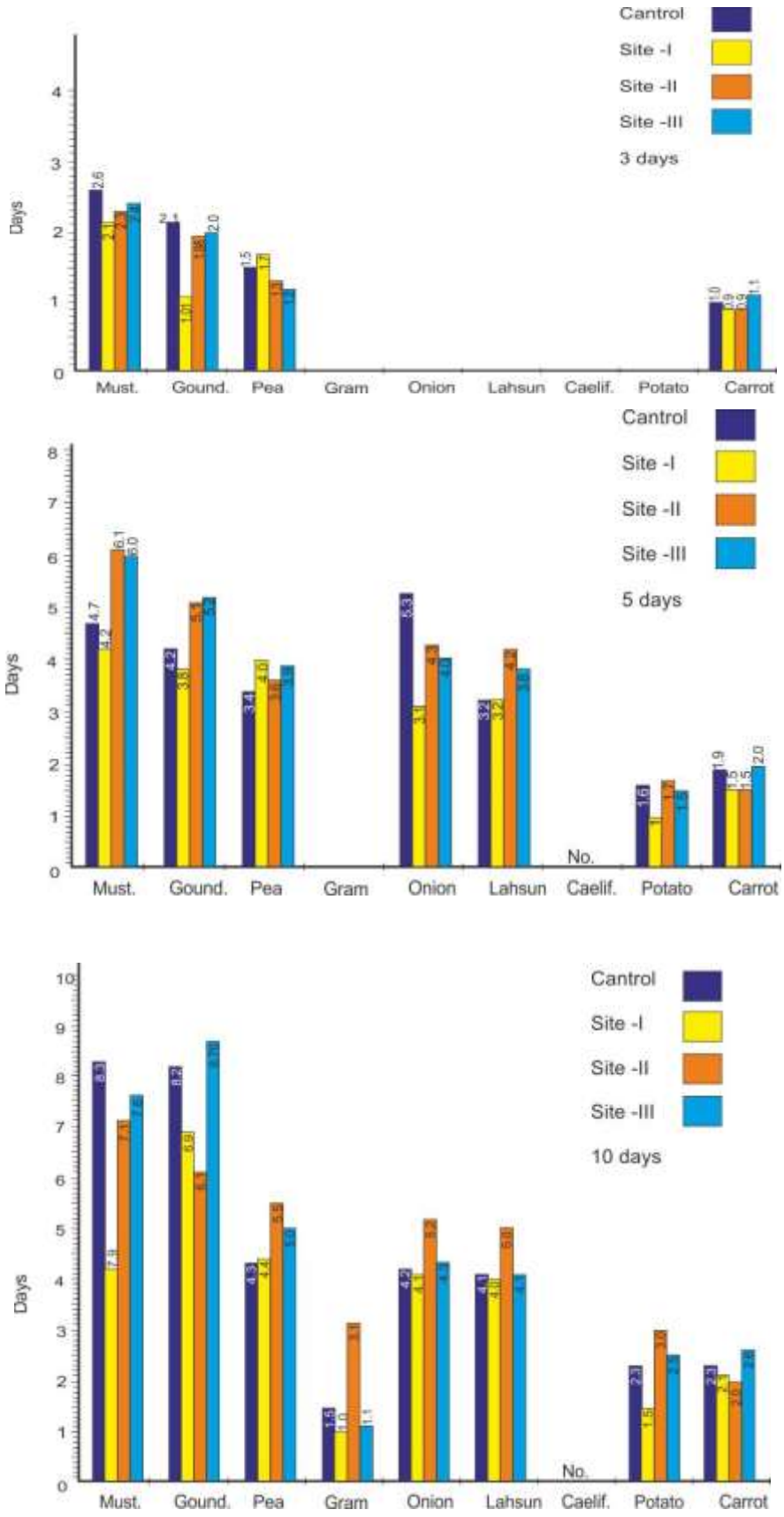



Table-4

Seedling length of the crops irrigated with industrial effluents (Site I, II & III) over their respective control sets

| Name of crops | Control | | | | Site-I | | | | Site-II | | | | Site-III | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 3 Day | 5 Day | 10 Day | 15 Day | 3 Day | 5 Day | 10 Day | 15 Day | 3 Day | 5 Day | 10 Day | 15 Day | 3 Day | 5 Day | 10 Day | 15 Day |
| Mustard | 2.6 | 4.7 | 8.3 | 9.3 | 2.1 | 4.2 | 7.9 | 9.0 | 2.3 | 6.1 | 7.1 | 9.1 | 2.4 | 6.0 | 7.6 | 9.4 |
| Groundnut | 2.1 | 4.2 | 8.0 | 8.6 | 1.91 | 3.8 | 6.9 | 8.01 | 1.98 | 5.1 | 6.10 | 8.1 | 2.0 | 5.2 | 8.70 | 8.93 |
| Pea | 1.5 | 3.4 | 4.3 | 5.6 | 1.7 | 4.0 | 4.4 | 6.3 | 1.3 | 3.6 | 5.5 | 7.3 | 1.2 | 3.9 | 5.0 | 6.0 |
| Gram | - | - | 1.5 | 4.3 | - | - | 1.0 | 2.6 | - | 0.6 | 3.1 | 4.0 | - | 1.0 | 1.1 | 5.0 |
| Onion | - | 3.3 | 4.2 | 5.4 | - | 3.1 | 4.1 | 5.1 | - | 4.3 | 5.2 | 5.5 | - | 4.0 | 4.3 | 6.3 |
| Lahsun | - | 3.2 | 4.1 | 5.2 | - | 3.2 | 4.0 | 5.0 | - | 4.2 | 5.0 | 6.1 | - | 3.8 | 4.1 | 6.8 |
| Cauliflower | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Potato | - | 1.8 | 2.3 | 3.2 | - | - | 1.5 | 2.3 | - | 1.7 | 3.0 | 4.1 | - | 4.15 | 2.5 | 3.5 |
| Carrot | 1.0 | 1.9 | 2.3 | 3.6 | 0.9 | 1.5 | 2.1 | 3.3 | 0.9 | 1.5 | 2.0 | 3.3 | 1.1 | 2.0 | 2.6 | 5.4 |


Cantrol
Site -I
Site -II
Site -III
3 days
Days
Must.
Gound.
Pea
Gram
Onion
Lahsun
Caelif.
Potato
Carrot
Cantrol
Site -I
Site -II
Site -III
5 days
Days
No.
Cantrol
Site -I
Site -II
Site -III
10 days
Days
No.

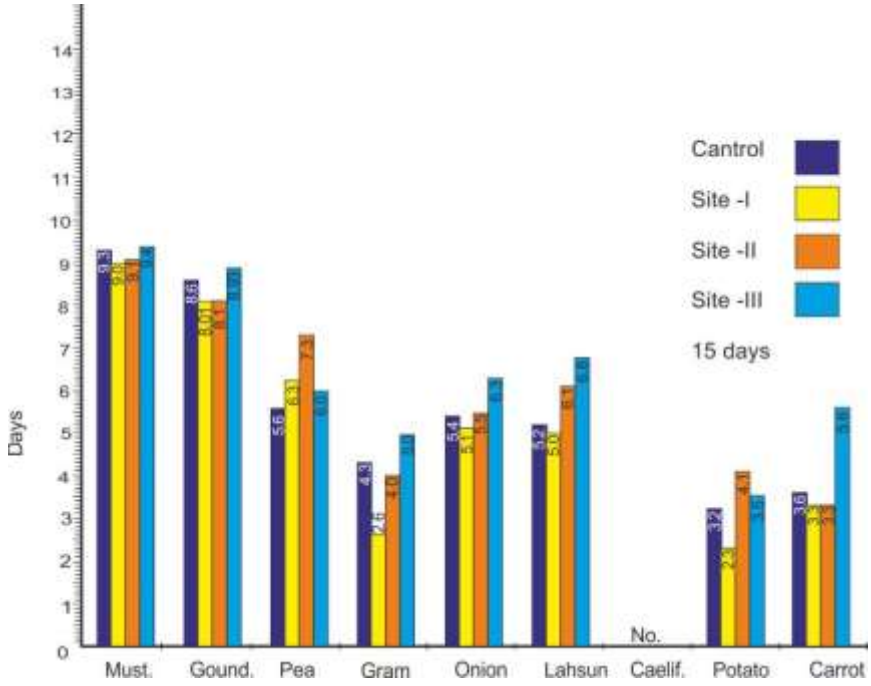



Table 4 reveals that when site I & site II effluents are used in the irrigation of all crops show decrease in both the day taken for germination as well as seedling length after germination with respect to site III. The rate of germination of different crop were analysed on the basis of 1 day, 3 day, 5 day, 10 day and 15 day. Mustard groundnut and potato show maximum rate of germination in the pot having site III effluent with respect to other plants on 15 days. Cauliflower shows no germination in any set of experiment. The germination of different 9 crops against different distillery factory effluents taken site I was found to be in decreasing order as mustard > ground nut > pea > onion > lashun > carrot > gram > potato when analysed on the basis of last day of result on 15$^{th}$ day after sowing germination. The decrease in the effluent site I might be due to high amount of dissolved solid which causes high osmetic pressure in the soil solution.[7] From the above results it can be concluded that crops can be irrigated with the effluent flowing from site-III. The treated distillery factory effluent can be used for irrigation purpose instead of throwing in to the river or canal. Most of the effluent treatment plants of industries in India are having similar type of treated effluent and they are not reusing the treated water. Thus in the scenario of water scarcity, usage of treated effluent would be highly usedfull to agriculture and farmers for irrigation of the crops and agriculture field.

The result revels that germination and seedling growth of the entire nine crops were highly sensitive to distillery factory effluent as compare to other effluents and showed their deleterious effect on seedling of all the nine crops. Good seed germination and seedling growth were observed by effluent treated water site-III as well as water used in the control sets.

It is concluded that distillery effluent is harmful for crops growth, with treated effluent crops can be irrigated. The high physico-chemical parameters of the effluent reduced the fertility and productivity of soil. It also decrease the biochemical parameters of crops so government has been made norms for discharging limit of effluent and strictly banned for untreated effluent of the industries.

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