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Anthology : The Research

# Physiological Effect of Sugar Factory Effluent on the Performances of *Vicia Faba*

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**Abstract**

The effect of different concentration of sugar factory effluent were carried out on (1) Germination percentage and seedling growth and matter transfer (2) Plant growth and yield (3) Uptake and distribution of Nitrogen, Phosphate and total heavy metal during seedling growth and further adult plant (4) Analysis of pure and selected concentration of sugar factory effluent for total Nitrogen, Phosphate and heavy metal content on Vicia faba. Studied carried out on seed germination in dark and light due to effect of effluent. Seedling growth studies also carried out in dark and light and noted the result according to the higher concentration and lower concentration of sugar factory effluent.

**Keywords:** Concentration, Effluent, Germination, Seedling growth

**Introduction**

Sugar mills figure among the industries which discharge huge amount of effluent per day without any treatment to the Environment during crushing season. Since sugar mills play major role in the economy of our country, their pollution Threat have been ignored by the management and government to great extent. It has already been reported that carbonaceous sugar mill effluentcontained high magnitude of pollution load and caused adverse effect on soil, floral distribution and biological system.

Pollution is the dark side of industrialization and its impact on man, agriculture and forestry is of serious concern. Pollutants are effectively concentrated around the biological system and its effectiveness reflects typically in food chain. Some pollutant degenerate either naturally or through engineered systems, where as some dangerously accumulate in their present state and exercising their harmful effect and unbalancing the ecosystem.

Contamination of heavy metals and other ions in the agricultural environment is of major concern because of their toxicity and threat to human life and environment. In fact, whatever amount of toxic metals is released to the environment, agricultural soil/ plants are the major sink for these elements.

With gradual urbanization and rapid industrialization, the problem of environmental pollution is assuming formidable quantity. These factory effluents have many harmful ingredients, including heavy metals, fungicides, insecticides, fertilizer, suspended partials etc. which can produce different type of changes in plants as well as in animals (versa 2009). Rapid growth in urbanization and industrialization has increased the levels of heavy metals in the environment and consequently in the food chain. Heavy metals especially those that are non-essential for crop plants such as lead, cadmium mercury etc. when present in soil at excess level and absorbed by the crop hamper the growth and productivity of crop plant. Vegetables and pulses are the main portion of human diet, providing micro and macro nutrient, vitamins and proteins but accumulation of heavy metals in pulses causes various diseases in animals and mainly in human being.

**Material and Methods**

The effect of different concentration of sugar factory effluent were carried out on-

1. Germination percentage and seeding growth and dry matter transfer in cereal *Vicia faba*
2. Plant growth and yield of Vicia faba
3. The uptake and distribution of Nitrogen , Phosphate and total heavy metal during seedling growth and further adult plant growth in materials and suitable concentration selected from above studies.

4. Analysis of pure and selected concentration of sugar factory effluent for total Nitrogen, Phosphate and heavy metal contents.

The seeds of certain legume viz. Vicia faba were procured from Indian Agricultural Research Institute New Delhi and Government Horticulture Research & Training Centre, Saharanpur (U.P.) for studies.

**Aim of the Study**

Paper publishing is a mile stone in study circle, for increase my knowledge & for making complete higher education criteria I want to publish my paper in your journal your publishing reputation will increase my stability in educational field.

**Growth Studies Method For Germination And Seedling Growth**

For the growth studies, experiments were performed in 1%, 5% and 10% concentrations of sugar factory effluent in selected legume. Sugar factory effluent was collected from the source at the point of discharge. The collected effluent was stored at $10^0$ c & than kept at room temperature before use in experimentation the effluent was sterilized and then diluted water to get 1% , 5%, and 10% concentrations. The distilled water set alone as such Served as control set.

Uniform healthy seeds (criteria being the size & colour of seeds) were selected, surface sterilized with 0.1% $Hgcl_2$ solution and washed thoroughly with distilled water. These seeds were transferred on moist filter paper in desiccators containing 1%, 5 %, and 10% concentrations of sterilized effluent. Simultaneously, a control soaked in distilled water supply to the seedling maintained through a filter paper dipping in effluent and water of the lower chamber of desiccators. The level of effluent in desiccators was maintained regularly. The germination and subsequent seedling growth were carried out in dark as well as in light . The emergence of radicle was taken as the criteria of germination.

Germination percentage was recorded after 24 hrs for seedling growth, sample were collected on 3rd, 5th, & 7th day of radical emergence.These seedling dissected out into radical, epicotyls & cotyledons in *Vicia faba.*

**Effect Of Sugar Factory Feeluent On Seed Germination And Seedg Growth**

The effect of different concentrations viz.1%, 5%, and 10% of sugar factory effluent on seed germination and subsequent seedling growth were studied in *Vicia faba* Linn.cv.P-3

**Seed Germination**

Table shows that in lower concentration of sugar factory effluent some promotion in germination percentage and inhibition at higher concentrations in comparison to control in *Vicia faba*, cv.P-3 in both light and dark. Thus in 1%, 5% and 10% effluent concentration germination percentages are 105.5%, 94.4% and 90.0% of the control in dark. Thus in 1% sugar factory effluent germination percentage was promoted whereas it was inhibited in beyond 5% concentration as compared to the control. Similarly, in light germination percentage value 104.3%, 94.5% and 89.1% of control respectively in 1%, 5% and 10% sugar factory effluent concentration.

**Vicia Faba Seedling Growth in Dark**

There is promotion as well as inhibition of seedling growth in presence of different concentrations of sugar factory effluent. On the basis of table and graph result shows that 1% effluent concentration is promotory and beyond 5 % it is inhibitory to seedling growth in Vicia faba cv.P-3. The extent of inhibition was noted more in higher concentrations. Thus observations further reveal that radical growth in less effected than epicotyls growth in higher concentration.

The increase in dry matter of radical and epicotyls is paralleled by decrease in the cotyledons dry weight. Thus in 1% effluent the dry matter increase in radical and epicotyls is promoted with simultaneous increase in dry matter transfer/epicotyl at the same day. In general there is more retention of dry matter in presence of higher concentration of sugar factory effluent in cotyledons in both conditions.

**Vicia Faba Seedling Growth In Light**

The effect of different concentrations of sugar factory effluent on germination percentage and subsequent seedling growth of Vicia faba Linn. grown in light. There is an acceleration and retardation of seedling growth in presence of different concentration of sugar factory effluent. 1% concentration proved to be promotory while the Higher 5% and 10% effluent concentrations were inhibitory to seedling growth. Thus according to the table and graph result shows that extent of inhibitions is more in higher concentration both in radical and epicotyls .Thus on 5th day the result indicates that both radical fresh weight as well as epicotyls fresh weight is affected by effluent concentrations. Observation further reveals that in any effluent concentration the extents of fresh weight and dry weight inhibition may also differ.

**Conclusion**

In view of above studies the following investigations were carried out in *Vicia faba.*

There is an increase (at lower concentration i.e.1%) and inhibition (at all higher concentration i.e. 5% to 10 %) of seed germination and seedling growth of Vicia faba. Similar promotion and inhibition in seed germination and seedling growth was observed in this plant. Further in lower concentration of sugar factory effluent, the dry Matter increase in seedling part in induced with simultaneous increase in dry matter transfer/loss from cotyledons. However, in higher concentration of sugar factory effluent, in higher concentration of sugar factory effluent, the dry weight increases in seedling parts in suppressed with simultaneous decrease in dry matter transfer/ Loss from the cotyledon to different plant parts studied.

**Above findings are discussed from the followings**

1. Effect of carbonaceous sugar mill effluenton on root/shoot ratio of HORDIUM VULGARE- Arindum. K .(1999)
2. Effect of sugar factory effluent on soil and crop plants - Azmal M. & A.U. Khan(1983)
3. Effect of industrial effluent on seed germination and early seedling growth of Triticum aestivum - Bahadur B. & B. K. Sharma (1990)
4. Effect of auto mobile exhausts on total N ,P, and heavy metal of road side sugar cane at district

Saharanpur (U.P.) Bhargava A. K., Richa gupta and S. Bhargava(2003)

**References**

1. *Bahadur B. and B. K. Sharma, Seed germination and early seedling growth of Hordium vulgare var. Jyoti as affected by the industrial effluent.*
2. *A.K.Bhargava, Effect of Zn on seed germination, seedling growth and P distribution in Vicia faba.*
3. *A.K.Bhargava, Heavy metal uptake by Vicia faba from two zinc amended soils, Ind. J. Environ. and Agr. 2:135-38.*

**Table .1**

EFFECT OF DIFFERENT CONCENTRATIONS OF SUGAR FACTORY EFFLUENT ON SEED GERMINATION PERCENTAGE OF *VICIA FABA* CV. P-3 IN DARK AND LIGHT.

| NAME OF PLANT | EFFLUENT CONCENTRATION (%) | | | |
|---|---|---|---|---|
| | 0 | 1 | 5 | 10 |
| | | IN DARK | | |
| *Vicia faba cv. P-3* | 90.0 | 95.00 | 85.00 | 81.00 |
| | | IN LIGHT | | |
| | 92.00 | 96.00 | 87.00 | 82.00 |

**Figure.1**

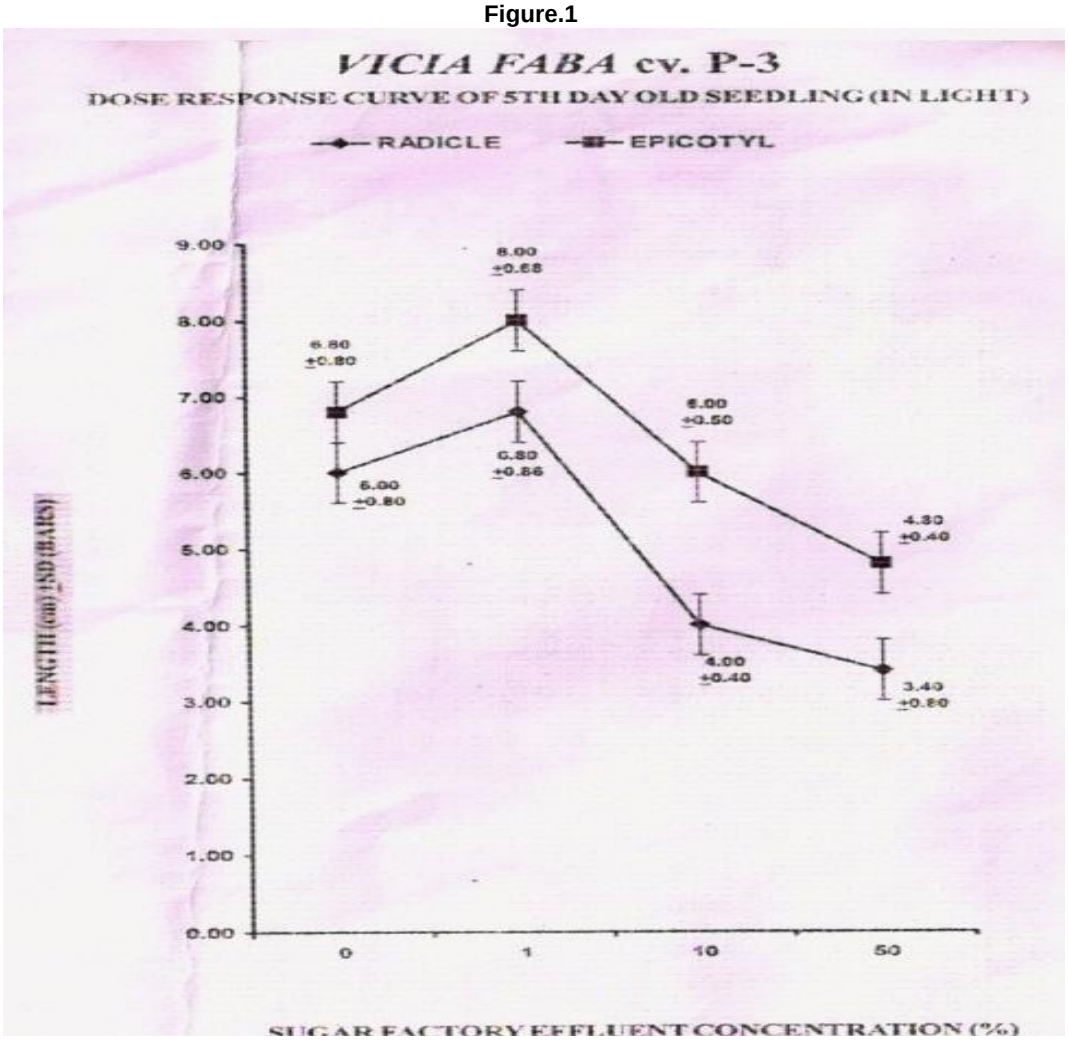

**Table 2**

EFFECT OF DIFFERENT CONCENTRATIONS OF SUGAR FACTORY EFFLUENT ON GROWTH, FRESH AND DRY WEIGHTS OF SEEDLING OF *VICIA FABA* CV. P-3 GROWN IN DARK.

| SEEDLING PART | EFFLUENT CONCENTRATION (%) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | | | 1 | | | 5 | | | 10 | | |
| | DAYS AFTER EMERGENCE | | | | | | | | | | | |
| | 3 | 5 | 7 | 3 | 5 | 7 | 3 | 5 | 7 | 3 | 5 | 7 |
| | LENGTH (cm) ± SD | | | | | | | | | | | |
| Radicle | 3.60 ±0.80 | 5.00 ±0.40 | 6.80 ±0.80 | 4.40 ±0.60 | 5.80 ±0.46 | 7.60 ±0.40 | 3.00 ±0.60 | 4.00 ±0.80 | 5.60 ±0.40 | 2.00 ±0.60 | 3.60 ±0.48 | 5.00 ±0.46 |
| Epicotyl | 4.40 ±0.0.60 | 5.80 ±0.80 | 8.00 ±0.36 | 5.60 ±0.60 | 6.80 ±0.80 | 9.00 ±0.60 | 3.40 ±0.68 | 4.80 ±0.30 | 6.40 ±0.80 | 2.60 ±0.60 | 4.60 ±0.80 | 5.50 ±0.46 |
| | FRESH WEIGHT (mg) ± SD | | | | | | | | | | | |
| Radicle | 20.00 ±1.80 | 28.80 ±2.40 | 38.40 ±3.40 | 26.00 ±2.20 | 36.40 ±2.80 | 46.40 ±4.50 | 16.00 ±0.20 | 22.10 ±2.50 | 32.00 ±3.36 | 14.10 ±0.10 | 20.73 ±2.00 | 26.15 ±2.50 |
| Epicotyl | 30.00 ±3.00 | 40.00 ±4.00 | 50.00 ±5.20 | 32.60 ±3.40 | 48.60 ±6.00 | 60.80 ±6.00 | 20.00 ±2.50 | 30.00 ±3.50 | 40.10 ±4.56 | 15.00 ±0.30 | 28.00 ±2.38 | 36.50 ±3.80 |
| Cotyledon | 126.40 ±11.10 | 100.40 ±9.00 | 80.70 ±8.00 | 116.40 ±12.00 | 90.00 ±8.20 | 70.50 ±8.80 | 120.00 ±12.00 | 100.10 ±10.00 | 80.50 ±8.00 | 136.80 ±12.00 | 120.40 ±9.38 | 104.00 ±9.00 |
| | DRY WEIGHT (mg) ± SD | | | | | | | | | | | |
| Radicle | 3.00 ±0.60 | 4.00 ±0.28 | 6.00 ±0.80 | 4.00 ±0.20 | 5.60 ±0.80 | 7.60 ±0.40 | 2.60 ±0.60 | 3.40 ±0.40 | 5.60 ±0.50 | 2.00 ±0.60 | 3.00 ±0.30 | 4.00 ±0.8 |
| Epicotyl | 3.80 ±0.28 | 6.00 ±0.80 | 8.40 ±0.86 | 4.80 ±0.38 | 7.80 ±0.90 | 10.00 ±1.00 | 2.80 ±0.38 | 5.00 ±0.48 | 7.10 ±0.48 | 2.40 ±0.36 | 4.00 ±0.40 | 6.00 ±0.60 |
| Cotyledon | 72.10 ±8.00 | 64.00 ±6.00 | 56.00 ±5.00 | 68.00 ±5.40 | 58.60 ±6.00 | 50.00 ±4.80 | 70.00 ±8.00 | 65.00 ±6.38 | 58.00 ±5.80 | 73.00 ±6.00 | 68.00 ±6.30 | 60.00 ±6.80 |

**Figure. 2**

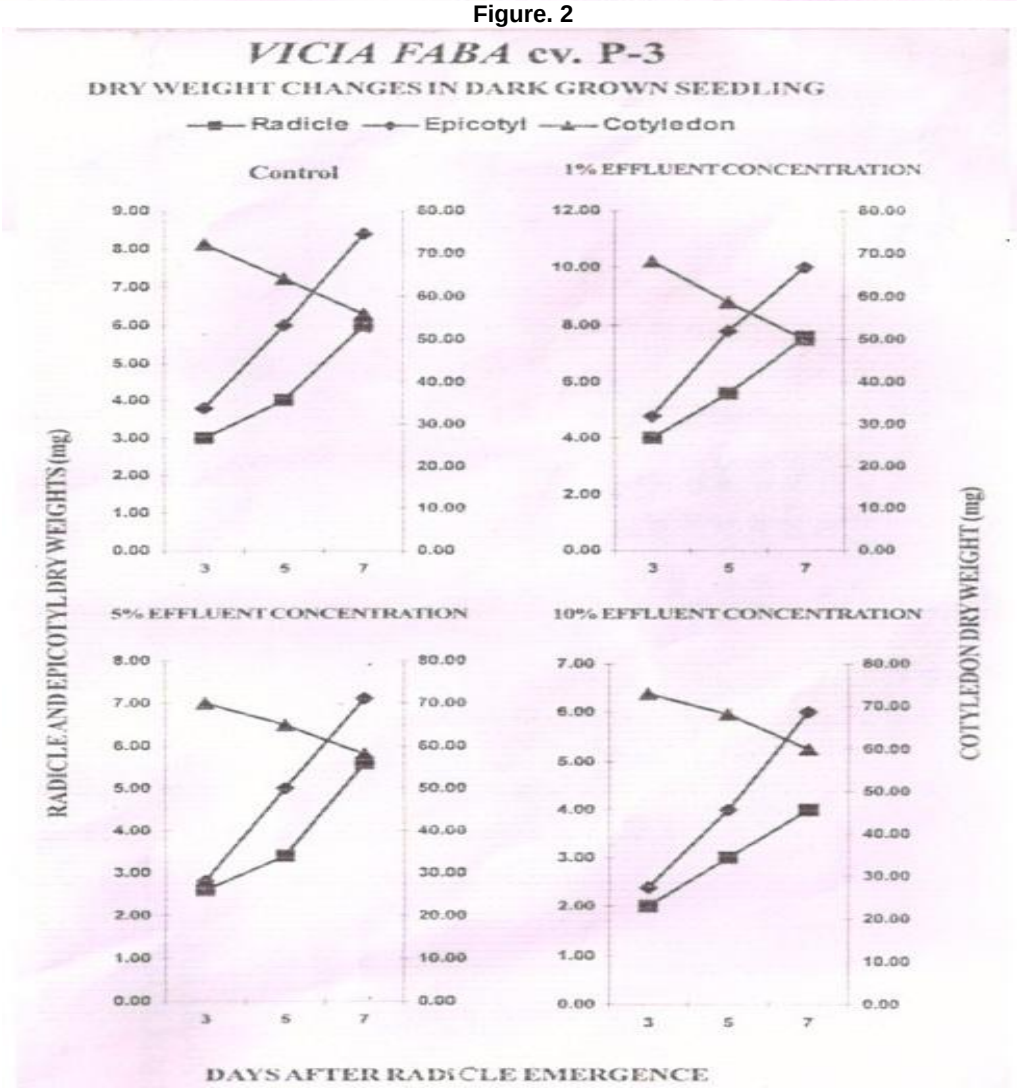

**Table. 3**

EFFECT OF DIFFERENT CONCENTRATIONS OF SUGAR FACTORY EFFLUENT ON GROWTH, FRE AND DRY WEIGHTS OF SEEDLING OF *VICIA FABA* CV. P-3 GROWN IN LIGHT.

| SEEDLING PART | EFFLUENT CONCENTRATION (%) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | | | 1 | | | 5 | | | 10 | | |
| | DAYS AFTER EMERGENCE | | | | | | | | | | | |
| | 3 | 5 | 7 | 3 | 5 | 7 | 3 | 5 | 7 | 3 | 5 | 7 |
| | LENGTH (cm) ± SD | | | | | | | | | | | |
| Radicle | 4.00 ±0.60 | 6.00 ±0.80 | 8.00 ±0.46 | 5.40 ±0.60 | 6.80 ±0.86 | 9.09 ±0.80 | 3.00 ±0.60 | 4.00 ±0.40 | 6.00 ±0.80 | 2.40 ±0.60 | 3.40 ±0.80 | 5.00 ±0.40 |
| Epicotyl | 5.80 ±0.60 | 6.80 ±0.80 | 10.00 ±0.80 | 6.80 ±0.66 | 8.00 ±0.68 | 12.00 ±0.86 | 4.50 ±0.60 | 6.00 ±0.50 | 8.00 ±0.80 | 3.80 ±0.60 | 4.80 ±0.40 | 6.00 ±0.80 |
| | FRESH WEIGHT (mg) ± SD | | | | | | | | | | | |
| Radicle | 23.00 ±2.86 | 38.00 ±2.60 | 46.10 ±2.80 | 30.00 ±3.40 | 46.00 ±3.60 | 58.60 ±2.80 | 20.20 ±2.40 | 30.00 ±2.80 | 38.10 ±3.20 | 14.50 ±2.44 | 27.00 ±2.20 | 36.80 ±3.76 |
| Epicotyl | 36.50 ±2.98 | 46.00 ±4.00 | 60.00 ±6.00 | 42.00 ±4.00 | 56.00 ±6.10 | 70.00 ±8.80 | 23.60 ±2.40 | 36.00 ±4.00 | 48.00 ±3.38 | 20.00 ±2.36 | 30.00 ±3.30 | 40.40 ±4.10 |
| Cotyledon | 128.00 ±12.50 | 100.40 ±10.60 | 80.00 ±8.50 | 120.00 ±10.10 | 90.00 ±8.00 | 70.60 ±8.80 | 130.00 ±10.40 | 100.00 ±10.50 | 80.00 ±8.40 | 135.00 ±12.30 | 108.40 ±10.20 | 82.50 ±8.10 |
| | DRY WEIGHT (mg) ± SD | | | | | | | | | | | |
| Radicle | 5.00 ±0.60 | 8.00 ±0.45 | 10.00 ±0.80 | 6.00 ±0.80 | 9.00 ±0.50 | 12.60 ±0.40 | 3.40 ±0.40 | 6.00 ±0.50 | 9.00 ±0.40 | 3.00 ±0.60 | 5.00 ±0.40 | 8.00 ±0.80 |
| Epicotyl | 6.80 ±0.80 | 10.00 ±0.40 | 12.00 ±0.40 | 8.00 ±0.90 | 12.80 ±0.80 | 16.00 ±0.60 | 4.80 ±0.40 | 8.60 ±0.30 | 10.30 ±0.80 | 3.80 ±0.40 | 6.40 ±0.70 | 8.00 ±0.86 |
| Cotyledon | 76.00 ±6.50 | 66.00 ±6.50 | 60.00 ±6.00 | 69.50 ±6.70 | 60.10 ±6.00 | 50.45 ±5.70 | 80.40 ±8.40 | 68.20 ±8.80 | 60.70 ±7.60 | 80.10 ±9.10 | 72.80 ±8.20 | 64.20 +8.30 |

**Figure. 3**