Effect of Dairy effluents on seed germination and seedling growth of Lentil (*Lens culinaris, Medik*)

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Abstract:

Lentil (*Lens culinaris, Medik*) is a leguminous herbaceous rabi crop. Dairy effluents are rich in nitrogen and phosphorus content along with high BOD & COD.

At low dairy effluent concentrations seed germination and seedling growth was enhanced while at high concentration the growth was retarded. A negative correlation has been found between the concentrations of the effluent and the seed germination and seedling growth.

Key words: Effluent, Seed germination and Seedling growth.

Introduction:

Dairy effluent has been reported to have high organic loads due to possession of high BOD, COD, oil, grease, nitrogen and phosphorus content (Braio & Taveres 2007).

Dairy effluents are found to be rich in organic matter and plant nutrients, thereby agricultural crops promoters (Dhanam 2009). They are cheap source of fertilizer. Daniel & Husiel (2002) also reported that Dairy effluent may not contain serious toxic substances, they may have fertilizing effect.

For the present study a leguminous crop plant namely *Lens culinaris, Medik* (*Lentil*) has been selected for the experimentation due to its high protein and carbohydrate content. Lentil comprises of 25% protein, 59% carbohydrate, 0.7% fibre. It ranks next to Arhar (*Cajanas cajan*). It is next to soyabean in its protein content. It is also called poor man crop. It is consumed as dal in Bihar.

According to Vance et al (2000) the grain legume fulfils 33% of the dietary protein nitrogen needs of human beings.

Material & Methods:

The dairy effluent samples were collected in polythene cans from the discharge outlet of Food & Balancing Dairy, Phulwari sharif, Patna at regular intervals. The Dairy discharges its effluent after treatment. Effluent was analysed for Physico-chemical characteristics after APHA (1989).

Seeds of Lentil (*Lens culinaris sys Lens esculenta*) variety BR-25 were collected from agriculture firm Mithapur, Patna, Bihar.

The seeds were subjected to viability test with 0.1% tetrazolium salt. Ten seeds were sterilized with 0.1% HgCl₂ solution followed by washing. Then 50 sterilized seeds were soaked in different grades of effluents (20%, 40%, 60%, 80%, 100%) in petridishes containing 25ml solutions. 0% effluent Solution (Tap water) was treated as control.
Different grades of effluents viz 20%, 40%, 60%, 80%, 100%, 0% was prepared by diluting the collected effluent with tap water. Collected effluent was considered as stock solution.

After 48 hours, seeds were placed on blotting paper moisten with different grades of effluent in respective labelled petri dishes (6” diameter) for germination and seedling growth. Seed germination was recorded after 4-5 days of experimental set up. Emergence of radicle was taken as index for germination. Total germination % was calculated at the average of 5 readings.

Seedling growth was measured in terms of radicle length, plumule length, plumule/ radicle ratio, fresh weight and dry weight.

Fresh weight and dry weight were taken of 7 days old seedlings separately and average determined. Fresh weight was taken immediately (by blotting adhered water to seedlings and dry weight after drying the seedlings in an incubator at 90°C for 2 days. All the results obtained were statistically analysed to get the significance of the observation.

Results:

Germination occurred after 4-5 days at lower concentrations but get delayed and retarded at higher concentrations.

At 20% effluent concentration it was maximum and decreased gradually with increase in effluent concentration.

Seeds get differentiated into radicle and plumule after 7 days of experimental set up and form seedlings.

Radicle length at all the concentrations was much more than plumule.

Lower concentration of dairy effluent showed promoting effect on seed germination and seedling growth, dry matter accumulation. Maximum promoting effect was recorded at 20% effluent concentration, while at higher concentrations they showed retardation in growth (Histogram- 1,2,3)

Observed data were found to be statistically significant at 1% level of significance.

<table>
<thead>
<tr>
<th>Germination Percentage</th>
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<tbody>
<tr>
<td><strong>Treatment</strong></td>
</tr>
<tr>
<td>Control</td>
</tr>
<tr>
<td>20%Effluent</td>
</tr>
<tr>
<td>40%Effluent</td>
</tr>
<tr>
<td>60%Effluent</td>
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<tr>
<td>80%Effluent</td>
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<tr>
<td>100%Effluent</td>
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Histogram No. 1

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Length of Radicle (in cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>11.9</td>
</tr>
<tr>
<td>20% Effluent</td>
<td>10.5</td>
</tr>
<tr>
<td>40% Effluent</td>
<td>8.31</td>
</tr>
<tr>
<td>60% Effluent</td>
<td>7.27</td>
</tr>
<tr>
<td>80% Effluent</td>
<td>4.71</td>
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<tr>
<td>100% Effluent</td>
<td>3.63</td>
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</table>
Histogram No. 2

<table>
<thead>
<tr>
<th>Length of Plumule (in cm)</th>
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<tbody>
<tr>
<td><strong>Treatment</strong></td>
</tr>
<tr>
<td>Control</td>
</tr>
<tr>
<td>20%Effluent</td>
</tr>
<tr>
<td>40%Effluent</td>
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<tr>
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<td>80%Effluent</td>
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<td>100%Effluent</td>
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Length of Radicle

- Control
- 20%Effluent
- 40%Effluent
- 60%Effluent
- 80%Effluent
- 100%Effluent

**Legend:** Length of Radicle
Histogram No. 3

**Discussion:**

Most stimulating effect of 20% concentration on seed germination & seedling growth and gradually retardation at higher concentration in the present study finds support from Pandit et al (1996), Bishnoi & Gautam (1991) and Dhanam (2009).

The promotion of seed germination & seedling growth at 20% diluted effluent might be due to presence of appropriate level of nutrient /turbidity/ total dissolved solids which favours sufficient amount of water absorption thereby highest germination & seedling growth.

Absorbed water in seeds causes hydrolysis of seed reserve foods(eg starch, protein) by enzymes which favour seed germination followed by seedling growth.

At higher concentrations of effluent, retardation/ delay in seed germination & seedling growth might occurred because of hinderance in water absorption by seeds as effluents have high TDS / nutrient value in undiluted/ less diluted effluent. Analysis of effluent revealed that TDS was 28 times & turbidity 29 times was higher than control in undialuted effluent. Likewise , sulphate, phosphate & ammonical nitrogen were also found to be 3, 105, and 150 times more than control in undiluted effluent respectively.
According to Kirby (1968) excess ammonia causes suppression of Krebs cycle which led to retardation of respiration rate in germinating seeds. Thereby less uptake of nitrogen from effluent which caused retardation of seed germination & seedling growth.


Treated dairy effluent has been found to be natural fertilizer and soil conditioner if managed effectively can enhance pasture growth and improve soil texture. It is liquid fertilizer.

**Conclusion:** It was concluded that dairy effluent after 20% dilution may be used as chemical fertilizer, a cheaper substitute of chemical fertilizer. It is ecofriendly too. Selling effluents to farmers may also generate revenue to the dairy industries and the farmers will get it at low cost comparatively.

Further, problems of disposal of effluents to nearby fields, pastures, water bodies will also be solved if arrangement be made to dilute the effluent up to proper level before discharge.

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**References:**


