International Journal of Science and Research (IJSR)
ISSN: 2319-7064
ResearchGate Impact Factor (2018): 0.28 | SJIF (2019): 7.583

# Effect of Dairy Effluent on Growth, Development and Protein Content of Lentil (*Lens culinaris, Medik)*

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**Abstract:** ***Decrease in length of shoot, root and shoot/root ratio of plant was observed in all the effluent concentrations. Number of nodules, number of branches and number of compound leaves per plant were found to be very high at 20% effluent concentration. Increase in fresh weight, dry weight and R.G.R of plants were observed at 20% effluent concentration. Number of seeds per plant and yield also increased at 20% effluent concentration to maximum. Increase in protein nitrogen and protein content were observed at 20%--60% effluent concentrations. But it was maximum at 20% effluent concentration.***

**Keywords:** Dairy effluent, growth, lentil, protein

## 1. Introduction

Dairy effluent, at higher concentrations is toxic due to presence of ammonical nitrogen in higher concentration. But at lower concentrations, it is a good manure, a nitrogen source for developing plants (*Bishnoi & Gautam* 1991).

For the present study, Lentil has been undertaken. It is a herbaceous winter crop, cultivated due to its high protein and starch content. It belongs to family Fabaceae. Principal protein of lentil is globulin. It is good source of vitamin

B-complex(Viz Thiamine,Riboflavin, Nicotinic acid, Choline, Folic acid, Inositol, Pantothenic acid, Biotine and Pyrodoxine).
Lentil is cultivated widely in temperate and sub-tropical regions of the world.

Plant growth was studied in terms of length of shoot, root, shoot/root ratio, number of branches, number of leaves, number of nodules per plant, fresh weight, dry weight, R.G.R and total yield. *Verma & Mehta* (1984) found fresh weight, frond number, length and dry weight measurement as satisfactory growth parameters.

Biochemical growth parameters include protein nitrogen and protein content of seeds determination in this very paper.

## 2. Material & Methods

Treated dairy effluent was collected from the discharge outlet of Food and Balancing dairy Phulwarisharif,Patna at regular intervals during experimental period and stored at $4^{o}$C. Physico-chemical characteristics of sample were analyzed after APHA (1989).

Different grades (20%,40%,60%,80% and 100%) of effluents were prepared by diluting the effluent with tap water. Tap water was used as control.

Lentil seeds var BR-25 were procured from Agriculture farm Mithapur, Patna.

Seeds were sown in earthen pots containing equal amount of garden soil . Pots were marked as 20%,40%,60%,80%,100% concentrations.

Pots were irrigated twice in a week with equal volume of corresponding effluent concentrations. Five replicates of each set were taken to avoid experimental error.

Length of shoot, root was measured in cm. Shoot/root ratio was also determined.

Number of nodules, number of branches, number of leaves per plant were determined by counting. Fresh weight was taken by weighing fresh plant and dry weight after keeping the same plant in oven at $90^{0}$C for 48 hours.

R.G.R (Relative Growth Rate)was determined after Sinha (1993).

Data obtained on growth parameters were subjected to statistical analysis

After ripening of fruits/pods, the yield was measured in terms of number of pods and weight of seeds.

Protein nitrogen was extracted after Thimann and Loose (1957) and determined after Oser(1965). Total protein = Protein nitrogen × 6.25.

## 3. Observation/ Result

At 20% effluent concentration, maximum growth was observed. Shoot/root ratio was found to be lower. Number of nodules, number of compound leaves, number of branches per plant were found to be higher.

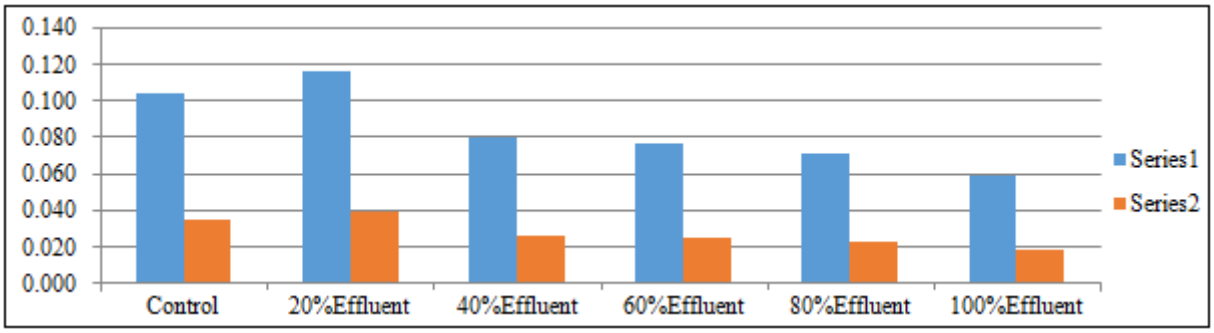
Fresh weight, dry weight and R.G.R also increased over control. Total yield was also found higher.

Protein nitrogen and protein content was found more over control.

Observations were presented in tables 1-4 and histograms 1 - 4.

Data obtained on growth on various parameters were found statistically significant to 1%.

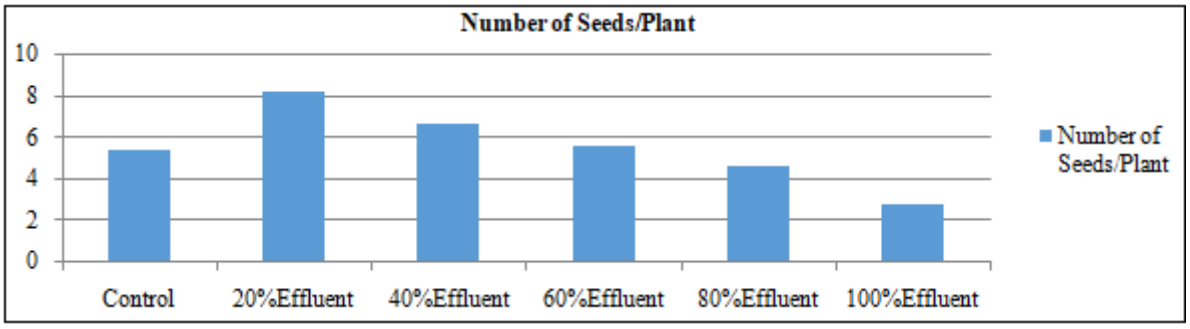
| Fresh Wt & Dry wt per Seedling(in gm) | | |
|---|---|---|
| Treatment | Fresh weight | Dry weight |
| Control | 0.105 | 0.035 |
| 20%Effluent | 0.117 | 0.040 |
| 40%Effluent | 0.080 | 0.027 |
| 60%Effluent | 0.077 | 0.026 |
| 80%Effluent | 0.072 | 0.023 |
| 100%Effluent | 0.060 | 0.019 |




**Histogram 1**

**Table 2**

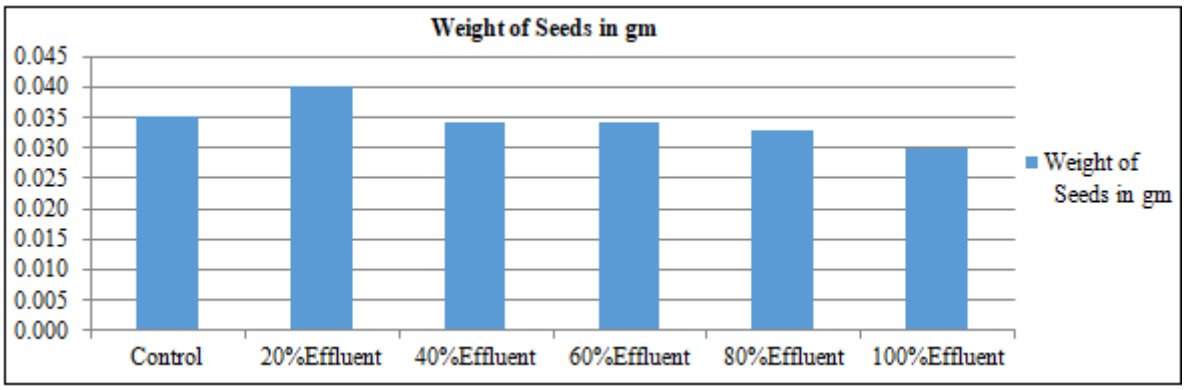
| Total Yield (Number of seeds)per plant | |
|---|---|
| Treatment | Number of Seeds/Plant |
| Control | 5 |
| 20%Effluent | 8 |
| 40%Effluent | 7 |
| 60%Effluent | 6 |
| 80%Effluent | 5 |
| 100%Effluent | 3 |




**Histogram 2**

**Table 3**

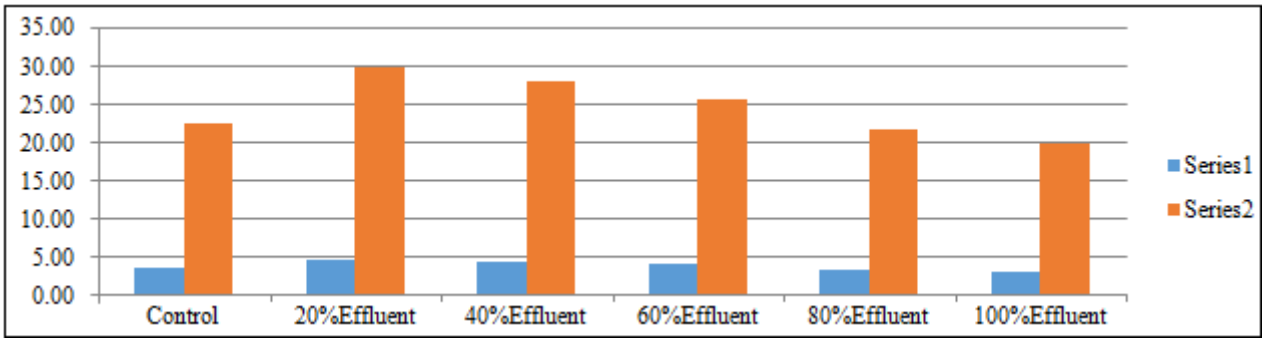
| Total Yield(wt of seeds)in gm | |
|---|---|
| Treatment | Weight of Seeds in gm |
| Control | 0.035 |
| 20%Effluent | 0.040 |
| 40%Effluent | 0.034 |
| 60%Effluent | 0.034 |
| 80%Effluent | 0.033 |
| 100%Effluent | 0.030 |




**Histogram 3**

**Table 4**

| Percentage Protein Nitrogen & Protein Content in Seeds | | |
|---|---|---|
| | Protein Nitrogen | Protein |
| Control | 3.60 | 22.50 |
| 20%Effluent | 4.80 | 30.00 |
| 40%Effluent | 4.50 | 28.10 |
| 60%Effluent | 4.20 | 25.70 |
| 80%Effluent | 3.50 | 21.80 |
| 100%Effluent | 3.20 | 20.00 |




**Histogram 4**

## 4. Discussion

Decrease in length, shoot/root ratio but increase in number of branches, number of leaves, fresh weight and dry weight at 20% effluent concentration might occur due to adequate supply of nutrients which caused loss of apical dominance thereby more branching, more the leaves more the photosynthesis .Which led to increase in fresh weight, dry weight and R.G.R.

R.G.R depends upon dry weight, any change in dry weight will affect R.G.R. Here dry weight got increased hence R.G.R got increased.

At higher concentrations, apical dominance prevailed thereby almost no branching. This might be due to high concentration of nutrients which might hinder nutrients absorption due to physiological reasons.

High ammonical nitrogen might also contribute to apical dominance. At higher concentrations, ammonical nitrogen retard nodulation hence nitrogen fixation. Increase in yield was observed in plants treated with 20% effluent concentration. This was because of more branches having leaves, flowers and fruits thereby more yield.

Number of seeds per plant was found 51.8% over control. Higher the number of leaves, higher the photosynthesis hence higher yield.

Plants treated with 20% effluent concentration showed increase in protein content of seeds over control .Dhanam(2009 ) also reported increase in protein, starch and amino acids contents at 25% dairy effluent concentration. Protein is considered to be dependent upon the carbohydrate status of the plants as suggested by Kretovich (1965). Carbohydrate content was also found higher (dealt in another paper) here.

Increase in protein content at 20% effluent concentration might be either due to increase rate of de-novo amino acids synthesis and subsequent ligation into protein or due to transportation of absorbed atmospheric nitrogen from nodules to seeds at last stage of growth (Van-Dobben (1961) or both.

Morphological study on nodules revealed that at 20% effluent concentration number of nodules per plants was maximum. More the nodules more the nitrogen fixed thereby increased protein content.

At higher effluent concentrations, nodulation decreased, it might be due to high ammonical nitrogen in effluent which might have retarded nitrogenase activity thereby low nitrogen fixation and protein accumulation. At 20% concentration there was increase in nodulation thereby increase in nitrogenase activity hence better yield.

## 5. Acknowledgement

Authors are grateful to HOD Botany,Patna University for providing Laboratory and Library facilities.

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