



## Comparison of Organic Fertilizer vs. Inorganic Fertilizer on the Growth of Cucumber (*Cucumis sativus* L.)

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### Abstract

Chemical fertilizers have been utilized extensively over last five to six decades. They significantly contribute in damaging the ecosystem, including the soil properties and the health of the future generation. Organic farming is employed as a substitute to obtain better and healthier output. To increase output and replenish soil fertility without harming the environment or having any negative impacts on human health, organic fertilizers such as sawdust, cow dung and cow urine are used instead of chemical fertilizers. Nowadays, organic farming is widely practiced around the world. Efforts were made to study the effects of organic and inorganic fertilizers on the growth of cucumber (*Cucumis sativus* L.). Experiment was conducted in pots with four treatments *i.e.*, control (water and soil), organic (cow dung, cow urine, sawdust), inorganic (NPK) and mixture of organic and inorganic. The parameters observed were stem height, number of leaves and the length of leaves. Antimicrobial activity of cucumber leaves, seeds and cow urine was checked on different bacterial strains including *E. coli*, *Pseudomonas* sp. and *Salmonella* sp. Phytochemical analysis was conducted to analyze the presence of alkaloid, carbohydrate, tannins, saponins, flavonoids, terpenoids, phenol and anthraquinone content in cucumber. In comparison to alternative treatments, organic cucumber cultivation produces higher growth rates. Cow urine was more effective against *E. coli*, moderate against *Pseudomonas* and resist against *Salmonella*. The seed extract of cucumber was more effective against *Salmonella* and less effective against *E. coli*. The leaf extract is more effective against *Pseudomonas* and less effective against *E. coli*. In cucumber leaves alkaloids, carbohydrate, tannins, saponins, flavonoids, terpenoids, phenol and anthraquinone content are present.

**Keywords:** Compost, Cucumber, Manure, Organic fertilizers, Sustainable Environment

### Introduction

In subtropical and tropical environment cucumber can be cultivated, Cucumber fruit *Cucumis sativus* L. is the most popular member of family "Cucurbitaceae" plant. In many countries of the world Cucumber are indigenous. It is an important fruit that is cultivated in most parts of world. Cucumber fruit is also called adaptable vegetable because of several uses; it is use as salads, pickles, in beauty products and digestive aids (Musa *et al.*, 2021). In the market, the demand of Cucumber is increasing day by day, the planting area of Cucumber is moderately expanding, and the off-

season planting of Cucumber in solar greenhouse has been strongly promoted. They have been known to cure some dizziness, pale skin, bleeding, and headaches. Cucumber juice contains a substance, which promotes skin blood circulation. They play a great role in primary health care service to rural people (Malik *et al.*, 2015). Despite there is huge area under vegetable production, production is low, due to number of interrelated problems. One of the main causes of low production is an imbalance in fertilizer use, and the regular use of inorganic fertilizers has resulted in a decline of soil fertility. The use of inorganic fertilizers in

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combination with organic resources resulted in the highest vegetable production. Organic fertilizers are obtained from decomposition of animal matter, animal excreta (manure), human excreta and vegetable matter. The inorganic fertilizers that are, used in standard agriculture contain just a few minerals which dissolve quickly in damp soil and give the plants large doses of minerals. The use of herbs to treat disease is almost universal is included in non-industrialized societies, and is often more affordable than purchasing expensive modern pharmaceuticals (Malik et al., 2019).

## Materials and Methods

### Sample Collection

The cow urine, cow-dung, soil, test organism, leaf and seeds were collected from the Solan, Himachal Pradesh.

### Preparation of Extract

Three types of plant extracts and seed extracts were prepared, aqueous, ethanolic, ethyl acetate extract and hexane, ethanol, ethyl acetate. The collected material were washed thoroughly with running tap water and then with sterile distilled water. The plant material was dried in sunlight. The dried plant material was crushed to powdered form using mortar and pestle and stored in airtight containers or sterile plastic bags.

Fertilizer was applied gently after interval of 7 days for consecutively for 30 days, i.e.

Treatment 1: (control) no addition of fertilizer;

Treatment 2: (organic) cow urine, cow dung and saw dust was added;

Treatment 3: (inorganic) NPK fertilizer;

Treatment 4: (mixture) cow urine, cow dung, saw dust and NPK fertilizer was added.

All the pots were supplied in adequate amount of water.

## Antimicrobial Analysis

### a) Anti-microbial activity of cow urine

Antibacterial activity was carried out using pure cow urine from procured cultures viz., *E. coli*, *Salmonella*, *Pseudomonas*. Bacteria were grown on the Nutrient medium to obtain pure culture. Culture was activated in broth medium in pure form. Mueller-Hinton agar media was prepared. Media was poured in petri plates, allowed to solidify. Lawn was prepared with the help of spreader. Wells was cut with the help of gel puncture. Cow urine was filled in wells. Wait for 5 to 10 minutes. Plates were incubated at 37 °C for 24 hours. Plates were observed for zone of clearance.

### b) Antimicrobial activity by using cucumber seeds and leaves

*E. coli*, *Salmonella*, *Pseudomonas* were used for checking antimicrobial activity. Bacteria were grown on the Nutrient medium to obtain pure culture. Culture was activated in broth medium in pure form. Mueller-Hinton agar media was prepared. Media was poured in petri plates, allowed to solidify. Lawn was prepared with the help of spreader. Wells was cut with the help of gel puncture. Seed and leaf extract was filled in wells. Wait for 5 to 10 minutes. Plates were incubated at 37 °C for 24 hours. Plates were observed for zone of clearance (Xu et al., 2007).

### Phytochemical Analysis of Plant Extracts

Different tests were carried out for phytochemical analysis includes: alkaloids, saponins, phenols, flavonoids, tannins, steroids, terpenoids etc. (Yadav and Agarwala, 2011).

## Results and Discussion

### Measurement of Plant Growth after Five Days for One Month

Cucumber seeds were grown in a variety of pots using various treatments (control, organic, inorganic and mixture). For a month, the plant's growth was monitored every five days. The measurement of growth was shown in table 1.

Table 1: Measurement of plant growth

Sl. No.	Treatments	Day 1		Day 5		Day 10		Day 15		Day 20		Day 25		Day 30	
		SL	LL	SL	LL	SL	LL	SL	LL	SL	LL	SL	LL	SL	LL
1	Treatment 1: (control)	-	-	4	1.9	5	2	10.2	2.6	11	3.8	12	4.4	15.6	5.3
2	Treatment 2: (organic)	-	-	4.4	5	1.3	9	3	11.4	12.4	4	15	23.5	23.5	6.3
3	Treatment 3: (inorganic)	-	-	2.6	0.6	3.1	1.1	7.5	1.9	10	8.5	9	3	10	4.3
4	Treatment 4: (mixture)	-	-	1.7	1	2.2	1.6	6	2.1	8	7.4	8.2	4	8.7	4.4

SL: Stem length; LL: Leaf length

### Determination of Antimicrobial Activity

The antimicrobial activities were checked against different pathogenic bacteria viz., *Escherichia coli*, *Pseudomonas* species and *Salmonella* species. The antimicrobial activities were determined by agar well diffusion method. Cow urine and plant extracts shown the inhibition zone against *Escherichia coli*, *Pseudomonas* and *Salmonella*.

### a) Antimicrobial activity of cow urine against pathogenic bacteria

The cow urine was more active against *E. coli* (23 mm),

moderate active against *Pseudomonas* (20 mm) and no zone of clearance against *Salmonella*.

### b) Antimicrobial activity of seed extract and leaf extract against pathogenic bacteria

The three different seed extracts and leaf extracts were prepared hexane, ethyl acetate, ethanolic extracts and aqueous, ethyl acetate, ethanolic extract. Antimicrobial activities of these extracts were studied against three bacterial strains. Extracts showed potent activity against all the microorganisms. Antimicrobial potential was assessed

by recording the zone of inhibition of the microbial growth in mm. Table 2 depicts antimicrobial activity of seed and leaf. It is reported that medicinal plants can be good sources of antibacterial agents. In the antibacterial activity, the seed extract was the most active against *Salmonella*, moderately active against *Pseudomonas* and less active against *E. coli*. The ethyl acetate extract was the most active against *Salmonella* (23 mm), extract of seed active against *Pseudomonas* (19 mm) and less active against *E. coli* (18 mm). In the antibacterial activity, leaf extract was the most active against *Pseudomonas*, moderate active against *Salmonella*

and less against *E. coli*. The aqueous extract was the most active against *Pseudomonas* (20 mm), moderate active against *E. coli* (17 mm) and less active against *Salmonella* (14 mm) is shown in figure 1. It is reported that medicinal plant can be good source of antibacterial agents.

Table 2: Antimicrobial activity of seed and leaf

Test organism	Diameter of zone of inhibition measured in millimeter (mm)		
	<i>E. coli</i>	<i>Pseudomonas</i>	<i>Salmonella</i>
<b>Plant (seeds)</b>			
Hexane	10	18	21
Ethyl acetate	18	19	23
Ethanol	16	15	17
<b>Plant (leaf)</b>			
Aqueous	17	20	14
Ethyl acetate	15	16	15
Ethanol	12	19	17

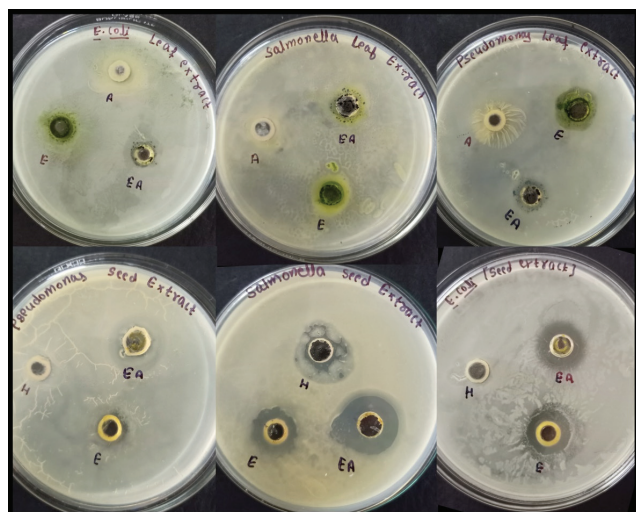


Figure 1: Antimicrobial Activity of Seed and Leaf

The microbic susceptibility to different extract of the seeds and leaves of *Cucumis sativus* L, expresses its anti-infection ability. All the solvent extracts of the seeds of *Cucumis sativus* L. was found active against the tested organisms, which indicated the presence of broad spectrum antibiotic compounds. Regular intake of this fruit may decrease the possibilities of infections.

### Phytochemical Analysis of Leaves

The phytochemical analysis of different extract i.e., ethanolic, ethyl acetate and methanolic extracts showed the presence of alkaloid, carbohydrate, tannins, saponins, flavonoid, terpenoids, phenol and anthraquinone is shown in figure 2.

Medicinal plant played an important role in the treatment of various infections caused by microorganisms. The medicinal plant consists of secondary plant products which are used for the development of novel chemotherapeutic agents.

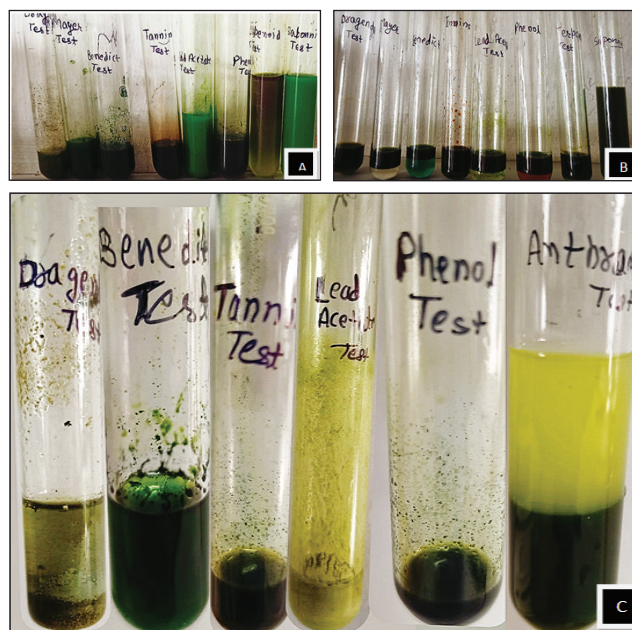


Figure 2: Phytochemical analysis [A- Methanolic, B- Ethyl acetate, C- Ethanolic extract]

### Conclusion

The present study can be summarized as follow: Cow faeces taken from Solan (Himachal Pradesh). Plant seeds and leaf extract were prepared of three types i.e., hexane, ethyl acetate, ethanolic extract and aqueous, ethyl acetate, ethanolic extract. Antimicrobial activity was determined by the cow urine, seed and leaf extracts against the pathogenic bacteria. Cow urine showed the maximum zone of inhibition (23 mm) against *E. coli*, resistant against *Salmonella*. Ethyl acetate extract of seed showed the maximum zone of inhibition (23 mm) against *Salmonella* and minimum zone (18 mm) against *E. coli*. The aqueous extract of leaf showed maximum zone of inhibition (20 mm) against *Pseudomonas* and minimum zone (14 mm) against *Salmonella*. Phytochemical analysis of different extract of plants showed the presence of various chemical constituents, such as alkaloids, phenols and tannins, flavonoids, saponins, carbohydrates which are responsible for its antimicrobial properties. Thereby, it has been used from centuries and continued search for new chemical compounds with potential medicinal properties.

From the present study it is concluded that the cow urine and plant extract showed a good activity and have been

used traditionally to cure the various diseases. The result thus obtained indicated the presence of potent antibacterial compounds in the plant extract. The extracts of the plants showed the presence of various phytochemicals. Thus, it serves as a source of therapeutic agents to control pathogenic infections.

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