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Department of Botany, Babu Jagjivan Ram Government Degree College (Autonomous), Hyderabad, Telangana, India

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# Efficacy of Plant Growth Promoting Potential of Curd in Green Gram

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**ABSTRACT:** Green gram is an excellent source of high quality protein, having high digestibility and a good source of riboflavin, thiamine and vitamin C (Ascorbic acid). Sprouted green gram seeds synthesize remarkably high quality of ascorbic acid and it is used as green manure for crops to fix the atmospheric nitrogen. Lactic Acid Bacteria (LAB) could be used as natural fertilizers, bio-control mediators and bio-inducers. *Lactobacillus* is a gram positive and facultative anaerobic bacteria and also a part of the human gut microbiome. The curd is explored as a low-cost input for plant growth promotion. The replacement of chemical fertilizers with manure supplemented with curd give promising results in plant growth activity. In this experiment, green gram plants were grown with four different treatments i.e., T1, T2, T3 and T4 where T1 is the control, T2, T3 and T4 treatments are cow curd, commercial buffalo curd and buffalo curd respectively. Among all the treatments, T2 treatment showed more growth of root length and shoot length than other treatments at different intervals. Seed germination is 90% in all the treatments. Thus, *Lactobacillus* in the form of curd can be used as biofertilizer to enhance plant growth instead of chemical fertilizers.

**KEYWORDS**: LAB (curd), Green gram, Seed germination, Root length, Shoot length.

## I. INTRODUCTION

Green gram (*Vigna radiata*) is cultivated in the countries of India, Burma, Sri Lanka, Pakistan, China, Fiji, Africa. India is the major producer of green gram in the world. In India, it grows in almost all the states, particularly in Orissa, Maharashtra, Andhra Pradesh, Telangana, Madhya Pradesh, Gujarat, Rajasthan and Bihar. It is cultivated in both kharif and summer seasons and in south India it is also cultivated in Rabi season. Green gram is an excellent source of high quality protein having high digestibility. It is also a good source of Riboflavin, Thiamine and Vitamin C (Ascorbic acid).The sprouted green gram seeds synthesizes remarkably high quality of ascorbic acid. Recent research advances in plant-microbe interaction have drawn the attention to the importance of microbial communities in promoting plant growth and resilience. Plant growth promoting microorganisms (PGPMs) promote plant growth, act as biocontrol agents, and improve the host plant ability to withstand biotic and abiotic stress *etc.* Most of the research has focused on few PGPMs such as *Rhizobium*, *Bacillus*, *Pseudomonas*, *Streptomyces*, *Trichoderma*, and Mycorrhizal fungi. Some of these potential microorganisms are recognized as Biocontrol agents (Alexander and Phin, 2014; Haryadi*et al*., 2019; Lim *et al.,* 2019; Alexander *et al.,* 2021).However, the functional roles of other groups of potential PGPMs, including lactic acid bacteria (LAB), have yet to be explored. Lactic acid bacteria are ubiquitous members of many plant microbiomes, but little is known about LAB-plant interactions in contrast to the knowledge about LAB in food processing.

Lactic acid bacteria (LAB) are gram positive, facultative anaerobic bacteria that typically reside in substrates rich in carbohydrates, which they ferment into organic acids. The ability of LAB to produce organic acids and other antimicrobial substances has made them indispensable in the preservation of plant and animal-based foods as diverse as sauerkraut, cheese, sausage, sourdough bread and animal silage (de Vuyst and Vandamme, 1994). Furthermore, the efficiency with which LAB convert carbohydrates into organic acids has prompted interest in industrial applications of LAB in bioreactors, to produce organic acids; especially lactic acid, an important precursor for biodegradable plastics (Konings *et al.,* 2000). The benefits of *Lactobacillus* strains on human health also make them valuable probiotic (Naidu

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*et al.,* 1999).The widespread use of LAB in food processing has generated a great deal of knowledge about their physiology and the bioactive compounds they produce (Garsa *et al.,* 2014; de Vuyst and Vandamme, 1994). This usage has also resulted in the designation of LAB as generally regarded as safe (GRAS) with few exceptions (Goldstein *et al.,* 2015) and would pose no risks for applications in edible crop production, exempting it from costly and time consuming regulatory approval processes. (Lutz *et al.,* 2012). There is a great potential to use LAB as biofertilizers, biocontrol agents and biostimulants to aid in producing food. Studies on relationship between plants and microbes have drawn attention to microbial communities that facilitate in enhancing plant growth. To increase agricultural production the relationship between plants and Lactic Acid Bacteria (LAB) can be encouraged under different conditions and treatments.

*Lactobacilli* were found to be present in the phyllosphere, endosphere and rhizosphere of many plants and have a good ecological relationship. A variety of antimicrobial compounds and effective substances such as lactic acid, bacteriocins as well as hydrogen peroxide and carbon dioxide were produced by LAB. Various studies on the efficacy of curd on the plant growth identified that LAB can be a potent Plant Growth Promoting Bacteria (PGPB). Replacement of chemical fertilizers, with manure supplemented with curd may give promising results. In order to reduce the usage of chemical fertilizers and to increase the use of biofertilizers, this study was undertaken to know the efficacy of curd as a biofertilizer on the growth of green gram plants.

## II. MATERIALS AND METHODS

**Curd used for the study:** Curd prepared from three different types of milk was used as treatments. The three types of curds used *viz.*, local cow curd, local buffalo curd and commercial buffalo curd.
**Optimization of curd dilutions for growth promoting activity:** The experiment was carried out in plastic pots filled with red soil, compost and neem cake in 2:1 ratio. Experiment is designed with the following treatments:
T1-Control (without curd)
T2-Cow curd
T3-Commercial buffalo curd
T4- Buffalo curd
Three replicates were taken for each treatment. Green gram seeds were soaked in these curds overnight and in each treatment 10 seeds were sown. Five ml of curd was added according to their treatments and results were taken on 4$^{th}$ day, 7$^{th}$ day, and 10$^{th}$day. In control, seeds were soaked in water and treated with water only. All the pots were watered regularly along with the treatments designed. Seed germination, root length and shoot length was observed on 4$^{th}$ day, 7$^{th}$ day, 10$^{th}$ day and 15$^{th}$ day in all the treatments. The main objectives designed for the experiments are to evaluate the seed germination of green gram in the presence and absence of curd, secondly to evaluate the root length of green gram in the presence and absence of curd and lastly to evaluate the shoot length of green gram in the presence and absence of curd.

## III. RESULT AND DISCUSSION

To assess the growth-promoting activity of the curd, parameters like seed germination, shoot length and root length were estimated. The experimental results indicated that, 90% of the seeds were germinated in all the treatments (Fig 1a & b).

Green gram seeds were soaked in different curds which were used as treatments after 2 days of sowing showed emergence of seedlings and the germination percentage in different treatments was calculated. The germination percentage increased in the following order: Control>T2>T3>T4. Further, the root and shoot length were measured on the 4$^{th}$, 7$^{th}$, 10$^{th}$and 15$^{th}$ day after sowing. The increased rate of germination, root and shoot length in curd treated plants may be due to the increase in lactic acid interaction with the seeds and soil. Studies on relationship between plants and microbes have drawn attention to microbial communities that facilitate plant health. In curd treated plants, the germination percentage was high for T3 treatment when compared to other treatments.

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**Root and Shoot Length Growth Promoting Activity of different Curds:**

*Lactobacillus* is Gram-positive and facultative anaerobic bacteria that produce organic acids by fermenting sugars. The cow curd (T2), commercial buffalo curd (T3) and buffalo curd (T4) treated pots showed a positive effect on the plant growth of green gram. Compared to control *i.e.,* without curd treatment, the other treatments with curd showed improved plant growth. Among all the treatments, the commercial buffalo curd treated plants showed maximum plant growth. On the 4$^{th}$ day of treatments, there is an increase in root and shoot length particularly in T3 treatment that is with commercial buffalo milk curd (Table 1 and Figure 2). There was an increase in root length with 6.5 cm and shoot length with 17.3 cm on the 7$^{th}$ day of the growth of green gram plants with the same treatment showing the highest growth (Table 2 and Figure 3). After 10 days of growth of green gram plants, control was showing the least root and shoot length (Table 3 and Figure 4). There was a tremendous increase in the seedling growth after 15$^{th}$ day in T3 treatment with root length of 10.4 cm and shoot length of 25.0 cm followed by T4 treatment which showed root and shoot length of 6.2 cm and 23.0 cm respectively (Table 4 and Figure 5).


**(a)** **(b)**

**Fig: 1a & b Seed germination in different treatments of curd along with control**

**Table 1: Effect of different treatments of Curd on the root length and shoot length after 4$^{th}$ day of sowing**

| Treatments | Root Length (cm) | Shoot Length (cm) |
|---|---|---|
| T1 | 2.0 | 8.0 |
| T2 | 2.5 | 11.0 |
| T3 | 2.0 | 13.8 |
| T4 | 2.8 | 14.5 |

**Table 2: Effect of different of Curd on the root length and shoot length after 7$^{th}$ day of sowing**

| Treatments | Root Length (cm) | Shoot Length (cm) |
|---|---|---|
| T1 | 2.7 | 10.4 |
| T2 | 3.5 | 12.0 |
| T3 | 6.5 | 17.3 |
| T4 | 3.0 | 17.0 |

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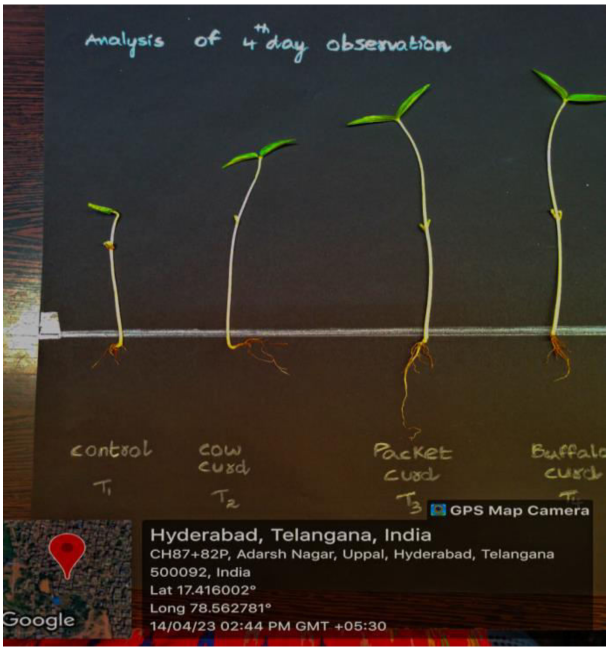


Fig 2: Effect of different treatments of Curd on the root length and shoot length after 4th day of sowing

Table 3: Effect of different Curds on the root length and shoot length after 10th day of sowing

| Treatments | Root Length (cm) | Shoot Length (cm) |
|---|---|---|
| T1 | 3.7 | 16.0 |
| T2 | 5.5 | 20.4 |
| T3 | 7.5 | 22.3 |
| T4 | 5.0 | 21.0 |


Fig 3: Effect of different of Curd on the root length and shoot length after 7th day of sowing

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**Table 4: Effect of different Curds on the root length and shoot length after 15th day of sowing**

| Treatments | Root Length (cm) | Shoot Length (cm) |
|---|---|---|
| T1 | 4.5 | 18.5 |
| T2 | 7.5 | 22.0 |
| T3 | 10.4 | 25.0 |
| T4 | 6.2 | 23.0 |

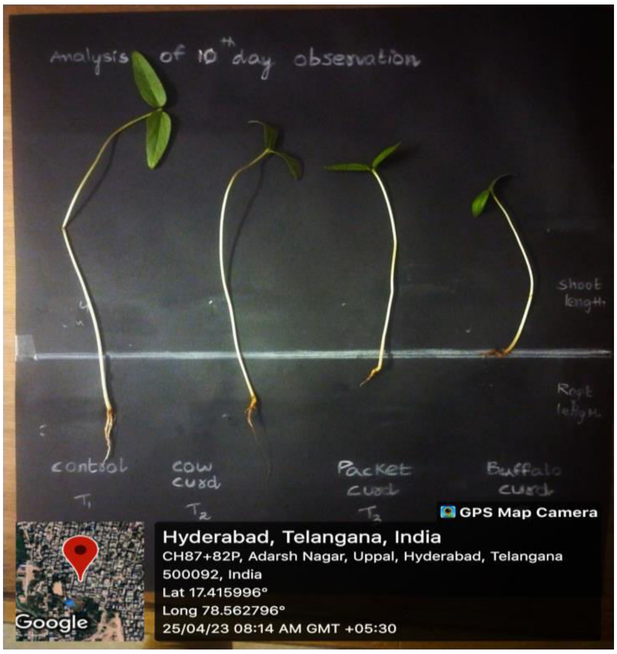


**Fig 4: Effect of different Curds on the root length and shoot length after 10th day of sowing**

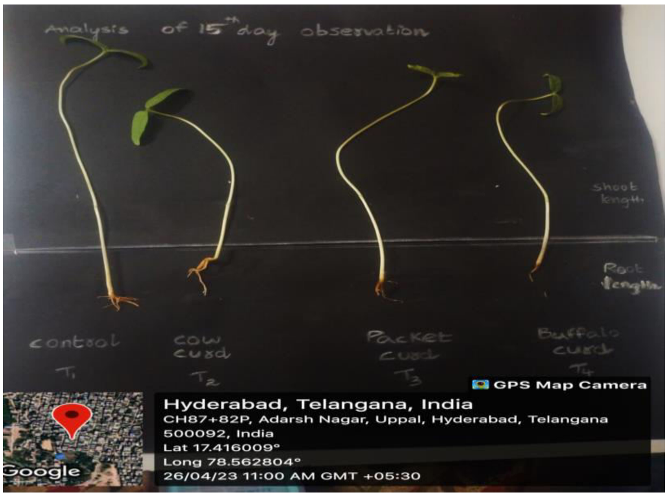


**Fig 5: Effect of different Curds on the root length and shoot length after 15th day of sowing**

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## IV. CONCLUSION

It can be concluded that the supplementation of curd enhanced the growth of treated plants compared to the control plants. Metabolites secreted by lactic acid bacteria (LAB) strains might have played a role in enhancing the growth of the green gram plants. LAB can be used as natural fertilizer, bio-control mediators and bio-inducers rather than use of chemical fertilizers which shows negative impact on environment. In order to reduce chemical fertilizers and to increase the use of biofertilizers, different types of curds were taken for study to know the efficacy of curd as a fertilizer on the plant growth. Results showing more growth in root and shoot length in commercial buffalo curd treated plants than other treatments led to the conclusion that compost manure supplemented with curd can be used to replace the chemical fertilizers and thus promoting organic farming.

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