Assessment of Plant Growth Promoting Potential of Curd in *Vigna mungo (L.) Hepper* (Black Gram)

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Abstract- Agricultural production needs to be increased to fulfill the food demand for the increasing population, but with the consistent maintenance of soil fertility. For the past decades, the use of chemical inputs in agriculture has caused hazards in human health and also the loss of soil microflora. Nature provides compounds that exhibit biological activity useful for organic farming. Microbial inoculants can be used to maintain the soil ecosystem for sustainable agriculture. Earlier researches reported that biofertilizers improve nutritional properties, stimulate plant growth and increase yield with sustainable maintenance of human health and soil health. In this perspective, the present study focused on the growth-promoting activity of the curd with the black gram plant as a model system. A total of three types of milk were used to produce curd for sensory evaluation and one was selected to study the plant growth-promoting activity at different dilutions. The experimental setup was designed with four sets like Control, T1 (1:1 dilution), T2 (1:5 dilution) and T3 (1:10 dilution). The black gram (*Vigna mungo (L.) Hepper*) seedlings were treated with the curd for seven days and various parameters like germination percentage, vigor index, seedling length, root length and shoot length were measured for the analysis of plant growth. In conclusion, the present study showed that commercial milk with milk fat 6.0% and milk SNF 9.0% at T3 (1:10 dilution) was found to have optimized activity for enhanced plant growth.

Keywords – Curd, *Lactobacillus*, Black Gram, Plant growth, Manure

I. INTRODUCTION

Black gram (*Vigna mungo (L.) Hepper*) is one of India's main pulse crops. By symbiotic fixation to atmospheric nitrogen, this legume crop can fulfill its nitrogen requirements [1]. Studies of contact between plants and microbes have drawn attention to microbial communities that facilitate plant health [2]. To increase agricultural production the relationship between plants and Lactic acid bacteria (LAB) can be encouraged. LAB could be used as natural fertilizers, bio-control mediators and bio-inducers [3]. *Lactobacillu*s is Gram-positive and facultative anaerobic bacteria that produce organic acids by fermenting sugars [1]. Curd is a fermented dairy product produced by the coagulation of milk through the process of curdling by lactic acid bacteria [5, 6]. Hence, curd harbors various species of lactic acid bacteria such as *Lactobacillus spp.* that have more beneficial effects for humans and plants [3, 7]. *Lactobacilli* were found to be present in the phyllosphere, endosphere and rhizosphere of many plants and have a good ecological relationship [3]. A variety of anti-microbial compounds and effective substances such as lactic acid, bacteriocins as well as hydrogen peroxide and carbon dioxide were produced by LAB [8]. The replacement of fertilizers with manure supplemented with curd may give promising results.

In tomato plants, LAB segregated from dairy products functions as a biological regulator of *Fusarium oxysporum* [8]. Previous experiments have indicated *Lactobacillus sp.* isolated from milk products confirmed that there has been a rise in shoot growth, shoot branching and root growth [8]. Another tomato analysis has shown that *Lactobacillus sp*. isolated from milk products produces bacteriogenic metabolites, increases

germination and root growth [9]. LAB is also involved in plants growth as a biocontrol agent (BCA) by utilizing the following three recognized mechanisms, such as: through the production of anti-microbial compounds, reactive oxygen species and bacteriocins [10-12], eliminating pathogens by pre-emptively colonizing plant tissues vulnerable to infection [13, 14] and by modifying the plant immune response [15].

From various research studies, it was identified that LAB can be a potent Plant Growth Promoting Bacteria (PGPB). *Lactobacillus* is an essential form of green farming for pest management, soil quality and plant production [16-18]. Curd is one of the sources of LAB that can be used to enhance the growth-promoting activity in plants. In this perspective, the present study proposed the application of curd as a growth enhancer in the plant using *Vigna mungo* as a model system.

II. MATERIALS AND METHODS

2.1. Curd used for the Study

Three types of curd used were prepared using three different types of milk inoculated with the same commercial curd as a starter culture. The three types of milk are as follows: local cow's milk, Commercial milk with milk fat 4.5% and milk SNF 8.5% and commercial milk with milk fat 6.0% and milk SNF 9.0%. The curd to be used for this study was selected based on the sensory evaluation. The selected curd was used for further studies in plants at different dilutions.

2.2. Optimization of Curd Dilution for Growth Promoting Activity

The experiment was designed in paper cups filled one-third with red soil and three replicates were made for each test. Four sets of tests like Control, T1 (1:1 dilution), T2 (1:5 dilution) and T3 (1:10 dilution) were done. Black Gram (*Vigna mungo*) seeds were soaked in water overnight and sown on the next day with seven seeds per cup. All the test samples were added with 5mL of curd per cup and control with 5mL of water for seven days. The application is of soil drenching. All cups were irrigated with water twice a day. The seedling length was measured on the fourth day followed by shoot length and root length on the seventh day. Germination percentage and vigor index were also calculated with a sample size of N=3 to study the growth-promoting activity of the curd.

III. RESULT AND DISCUSSION

3.1. Selection of Curd based on Sensory Evaluation

Based on the sensory evaluation made from 20 people of different age groups, the curd prepared with the commercial full cream milk with milk fat 6.0% and milk SNF 9.0% was selected by people and hence chosen for plant studies. Smooth and creamy texture and less sourness were taken as a major parameter by the people for the selection of curd.

3.2 Growth Promoting Activity of Curd at different dilutions

To assess the growth-promoting activity of the curd, the parameters like germination percentage, seedling length, vigor index, shoot length and root length were estimated. The germination percentage increased in the following order: Control>T3>T2>T1. Further, the seeding length was measured on the fourth day of sowing. The seedling length was obtained in the following order: Control>T3>T2>T1 and the mean seedling length were shown in Figure 1. Next, the vigor index was calculated and the results were in the following order: Control>T3>T2>T1**.** This decreased rate of germination percentage, seedling length and vigor index in treated plants may be due to the increase in lactic acid interaction with the seeds and also the increase in soil pH than the ideal level. In treated plants, the germination percentage was high for T3 when compared to T1 which implies that the dilution played a major role in germination percentage. Due to lactic acid interaction and acidic pH, the seeds taken for control remain more vigorous than the treated ones. But plants treated with curd at higher dilution were vigorous than the plants treated with curd at lower dilutions because of the optimal conditions. After seven days of treatment, the plants were uprooted to measure the shoot length and root length. The morphological differences in the growth of control and treated plants were shown in Figure 2. Based on the measurements taken, the shoot length and root length varied in a uniform pattern as T3>T2>T1>Control (Figure 3). After the good establishment of seedling, the application of curd showed ideal growth. In the case of treatment, an increase in dilution shows the increase in growth and vice versa. In tomato, *Lactobacillus sp.* isolated strains of milk products were found to contribute increased branching, shooting and rooting [18].

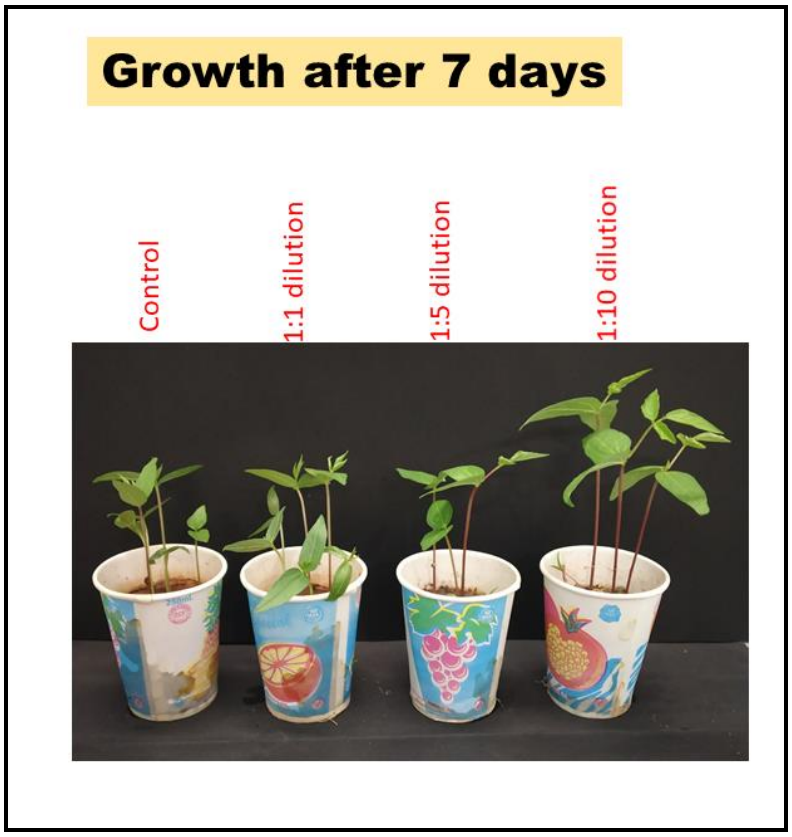

Figure 1. Growth of Black Gram (*Vigna mungo*) Plants after 7 days of Treatment with Different Dilutions of Fermented Curd

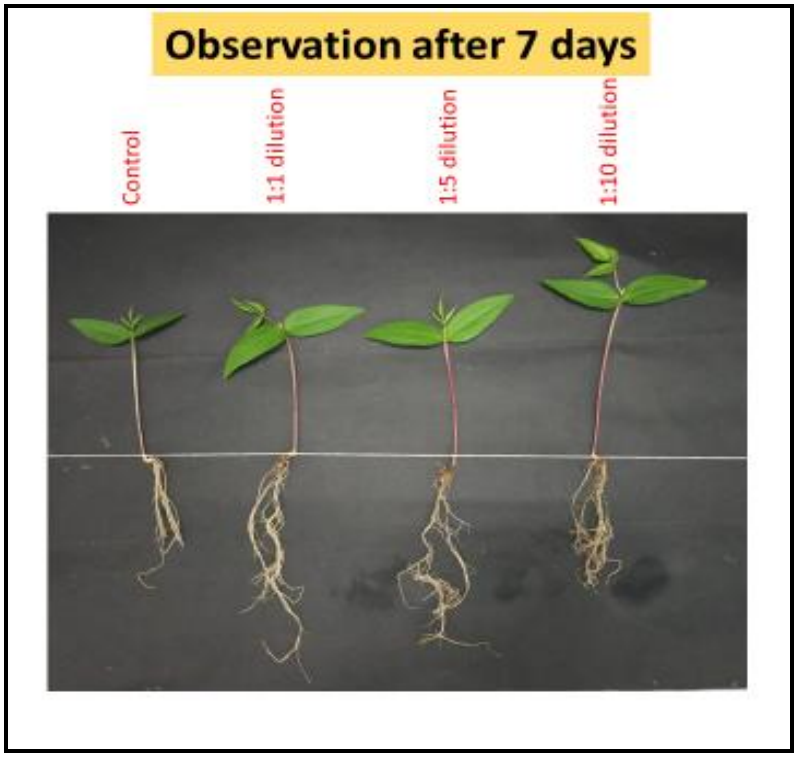

Figure 2. Morphological Observation of *Vigna mungo* Plantlets after 7 days of Treatment with Curd

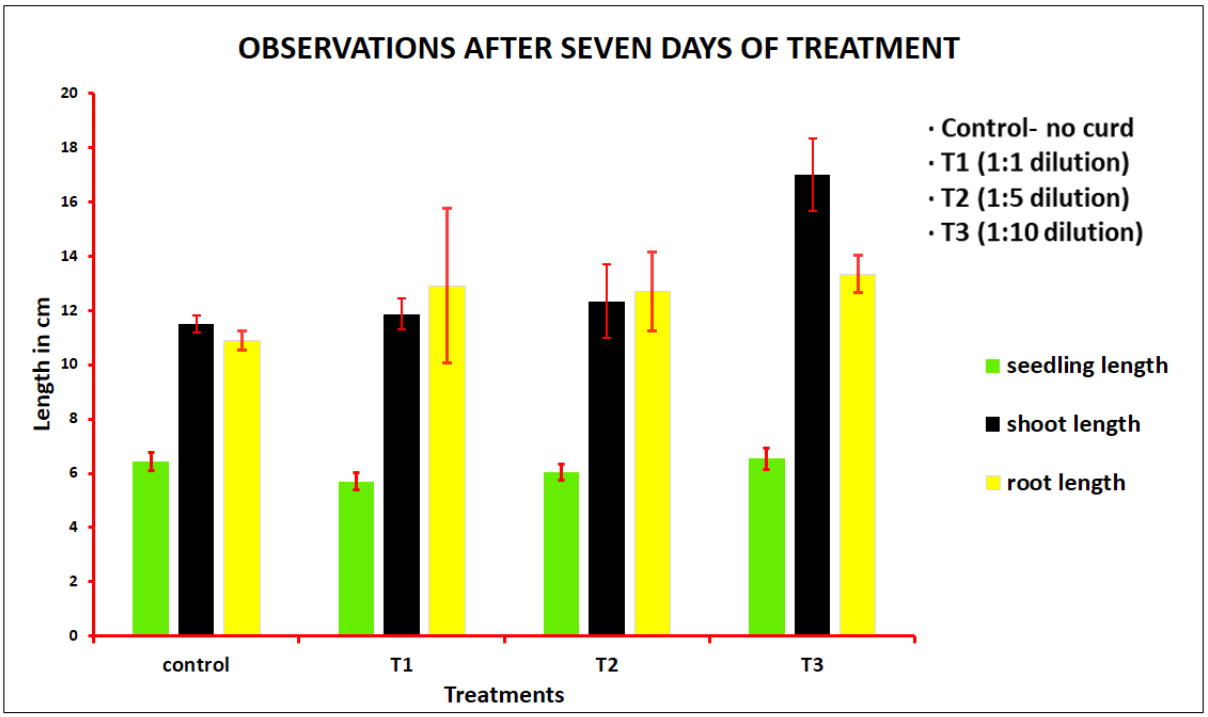

Figure 3: Seedling length, Shoot length and Root length of Control and Treated Plants

Black Gram being a leguminous crop usually fixes nitrogen due to its symbiotic relationship with a host-specific strain of nitrogen-fixing bacteria known as rhizobia. This was also enhanced by the addition of curd to plants. The number and size of the root nodules were larger in treated plants than in control (Figure 4) leading to improved nitrogen content in the soil due to nitrogen fixation.

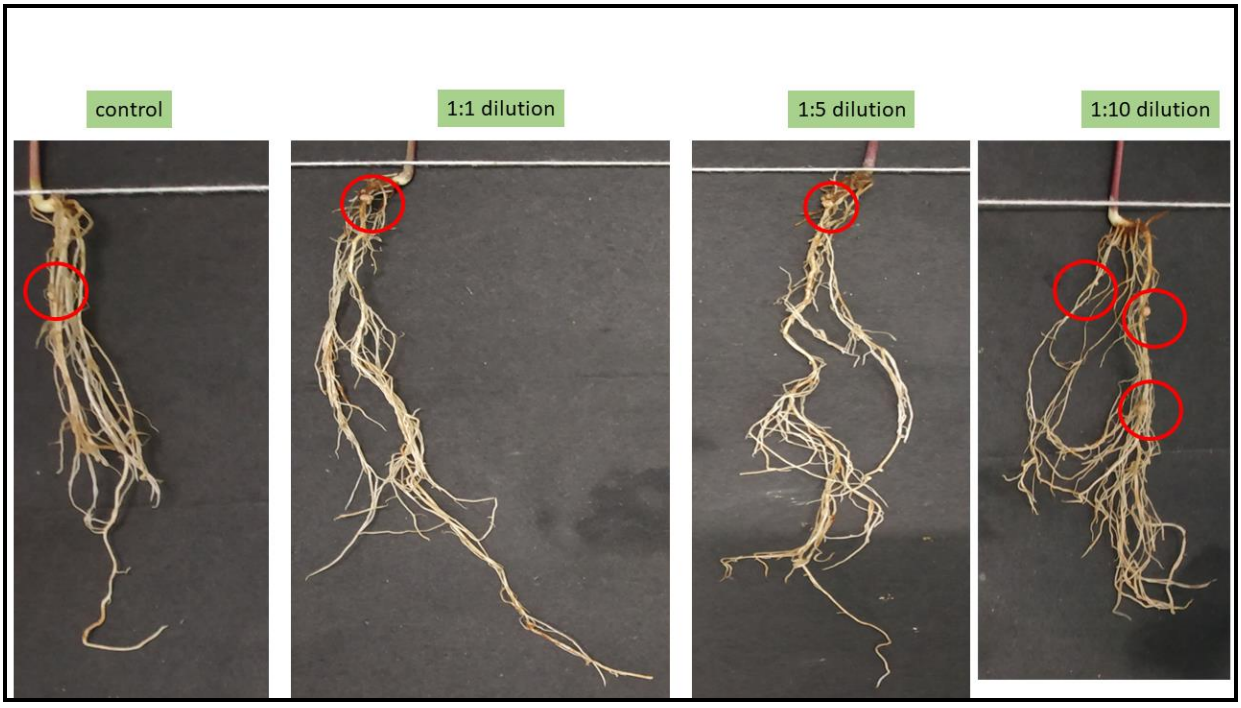

Figure 5. Observation of Root nodules in Black Gram Plant Treated with Curd after 7 days

3.3 Optimization of curd that exhibits potential growth enhancer activity

As a leguminous plant, black gram requires near neutral pH for its ideal growth. From the study, it was inferred that an increase in dilution of curd showed increased plant growth for treated plants. Less diluted curd may pose acidity issues due to lactic acid that can interfere with the growth of plants. Curd at a dilution of 1:10 was found to be the optimal dilution for enhanced plant growth.

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 strains might play a role in enhancing the growth of the black gram plant. Further studies are essential to identify the metabolites released by LAB and other microbes present in curd leading to the growth promotion of plants. Compost manure supplemented with curd can be used to replace the chemical fertilizers and enhance organic farming. Further studies with field trials will help the human community to increase sustainable agriculture with organic farming rather than using chemicals for crop improvement.

ACKNOWLEDGEMENT

Ms. Abisha Dharmaraj would like to acknowledge CSIR-North East Institute of Science and Technology for providing traineeship under the CSIR-Summer Research Training Programme-2020 to carry out this work.

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