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EFFECT OF BIOENZYME SUPPLEMENTATION ON YIELD OF PRETREATED MUNG BEAN SEED

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ABSTRACT

The yield of the crop depends on the growth which is directly controlled by healthy seedling emergence. To get better quality product pretreatment of seed can be a good alternative. The study was designed to analyze the effect of seed pretreatment with silica and fungicide along with foliar spray of bioenzyme on the growth and biochemical parameters of mung bean. The work was undertaken with twelve different treatments given in blocks of 2× 2 m² area selected by randomized block design. The effect on growth was assessed with the help of different physical parameters and protein, carbohydrate content indicated as biochemical parameters. The concentration of bioenzyme used in the study along with the pretreatment of seeds with silica showed maximum increase in all the studied physical and biochemical parameters. The present work can be used to improve growth at early stage and to enhance biochemical parameters of mung bean.

Keywords: Carbohydrate, Fungicide, Pod length, Protein, Silica

1. INTRODUCTION

Germination and seedling emergence are the major factors that play role in healthy growth of a plant. Any abnormality during emergence of seedling can restraint yield and productions of a crop (Singh *et al.*, 2015). The global seed treatment market is projected to grow from \$11.32 billion in 2022 to \$26.01 billion by 2029, at a CAGR of 12.62% in forecast period, 2022-2029. Silicon (Si) is a most common metalloid element, founded in the earth's crust after oxygen (Luyckx *et al.*, 2017). Use of Silica is rapidly gaining attention in agriculture because of its many fruitful impacts on plants. Application of Si fertilizers has resulted in increased plant growth rate,

higher productivity, protection against a wide range of pathogens, and adaptation to unfavourable environmental conditions (Rao *et al.*, 2019).

Although chemical control with various product is well documented yet very few studies on seed treatment with silica powder for the protection of seed and their effect on quality are carried out in Madhya Pradesh and elsewhere in India (Lal *et al.*, 2016).

The bioenzyme is produced through fermentation of a mixture of fruit and vegetable peel waste, brown sugar, and water. It has been found to be highly effective in composting, reducing pest infestations, according to Saravan *et al.* (2013). Additionally, vegetable waste can generate volatile fatty acids and nitrogen compounds that are beneficial to plants (Bo *et al.*, 2007). The garbage enzyme performs similarly to enzymes in achieving high degradation levels in less time. Researchers suggest that this enzyme can be used in four categories: decomposition, composting, transformation, and catalysis (Oon J., 2008).

Mung bean stands out as a vital pulse crop cultivated across diverse regions, spanning from tropical to sub-tropical climates globally. Its versatility extends to serving as an effective component in crop rotation systems, particularly in arid agricultural regions, thriving under both dry and irrigated conditions. The significance of mung bean encompasses economic, nutritional, fodder, and agricultural spheres, where it also plays a crucial role as a green manure crop to enhance soil fertility.

The study was designed to evaluate the potential of pretreatment with fungicide and silica along with supplementation of bioenzyme in improving growth and biochemical parameters of mung bean.

2. MATERIALS AND METHODS

A field experiment was conducted at Loharpipliya village, district Dewas (M.P.) during March – June 2023 having mean temperature 33.8°C. Mung bean (*Vigna radiata*) seeds MI731-3 variety used for the study was purchased from Indian Agriculture Research Institute (IARI) Indore, Madhya Pradesh. Seeds were sowed in a block of area 2×2 m² in black soil. Mode of irrigation was flood irrigation and field was irrigated every 10th day after sowing. At the time of sowing and flowering NPK and urea mixer was applied. Pesticide was sprayed at the interval of 15 days twice after sowing. Randomized block design was used and each block represented a single treatment. To nullify the effect of other factors on the growth of mung bean, control was designed which was without any treatment of bioenzyme as well as silica. Following treatments were given at interval of fifteen days after sowing.

Table 1: Treatments given to mung bean crop

Treatment	
T1/ C	Without any treatment
T2	1ml bioenzyme/L water
T3	2ml bioenzyme/L water
T4	3ml bioenzyme/L water
T5	Fungicide pretreated seed only
T6	Fungicide pretreated seed + 1ml bioenzyme/L water
T7	Fungicide pretreated seed + 2ml bioenzyme/L water
T8	Fungicide pretreated seed + 3ml bioenzyme/L water
T9	Silica pretreated seed only (silica will be used in powder form)
T10	Silica pretreated seed + 1ml bioenzyme/L water
T11	Silica pretreated seed + 2ml bioenzyme/L water
T12	Silica pretreated seed + 3ml bioenzyme/L water

For pretreatment, fungicide (Vitavax) and silica powder (Agribooster™) at the rate of 2g/100 g and 5 g/ 100g respectively were given for duration of 3 hrs before sowing mung seeds. Foliar spray of Bioenzyme was given at the vegetative, flowering and fruiting stage after sowing.

After harvesting various physical parameters viz pod length(cm), weight of pod (g), plant height (cm), fresh weight of 10 grains (g), dry weight of 10 grains (g) and yield (1000 seeds in g) were taken.

Protein and carbohydrate content was determined in seeds of mungbean by the method given below

Protein content: The estimation of protein was done using Folin Ciocalteau reagent at 660 nm (Lowry *et al.*, 1951). The standard curve prepared with 40-200 µg of BSA was used for calculation.

Carbohydrate Content: It was determined by the method of Hedge and Hofreiter (1962). Carbohydrates form blue green color complex with anthrone on dehydration by conc. H₂SO₄ which is measured colorimetrically at 630nm.

3. RESULT AND DISCUSSION

Results are expressed as mean \pm SD. P value was calculated to determine significant change. p value < 0.05 indicates significant difference, p value < 0.01 indicates highly significant difference and p value < 0.001 indicates extremely significant difference.

Table 2: Physical observation of mung bean at the time of harvesting

S.No	Treatment	Pod length (cm)	Pod weight (g)	Fresh weight in g (10 grain)	Dry weight in g (10 grain)	Final plant height (cm)
1	T1	7.26 \pm 0.2	9.34 \pm 0.37	1.68 \pm 0.2	1.32 \pm 0.02	27.2 \pm 0.2
2	T2	7.46 \pm 0.3 ^{ns} (2.75%)	9.65 \pm 0.11 ^{ns} (3.33%)	1.80 \pm 0.04 ^{ns} (7.14%)	1.58 \pm 0.03*** (19.69%)	34.7 \pm 0.1** (27.5%)
3	T3	7.81 \pm 0.3** (8.02%)	9.92 \pm 0.26 ^{ns} (6.2%)	1.75 \pm 0.2 ^{ns} (4.1%)	1.60 \pm 0.02*** (21.21%)	31.2 \pm 0.3* (14.7%)
4	T4	8.13 \pm 0.1* (11.98%)	10.12 \pm 0.12* (8.35%)	1.88 \pm 0.1 ^{ns} (11.9%)	1.68 \pm 0.05*** (27.27%)	35.3 \pm 0.6*** (29.7%)
5	T5	7.43 \pm 0.2 ^{ns} (2.34%)	9.42 \pm 0.10 ^{ns} (0.85%)	1.86 \pm 0.07 ^{ns} (10.7%)	1.48 \pm 0.005*** (12.12%)	32.6 \pm 0.9* (19.8%)
6	T6	8.2 \pm 0.6*** (13.41%)	10.33 \pm 0.19* (10.59%)	2.06 \pm 0.13* (22.6%)	1.93 \pm 0.04*** (46.21%)	40.9 \pm 0.6*** (50.3%)
7	T7	8.8 \pm 0.4** (21.71%)	10.43 \pm 0.30* (11.67%)	2.63 \pm 0.2** (56.54%)	2.48 \pm 0.05*** (87.87%)	35.06 \pm 0.3*** (30.88%)
8	T8	9.16 \pm 0.3*** (26.69%)	10.20 \pm 0.09* (9.20%)	2.40 \pm 0.2* (42.8%)	2.03 \pm 0.03*** (53.78%)	39.5 \pm 0.1*** (45.2%)
9	T9	8.8 \pm 0.4** (21.71%)	9.52 \pm 0.13 ^{ns} (1.92%)	2.23 \pm 0.2* (32.7%)	2.01 \pm 0.03*** (52.27%)	33.6 \pm 0.1** (23.5%)
10	T10	9.06 \pm 0.1*** (25.31%)	10.56 \pm 0.09** (13.06%)	1.78 \pm 0.04 ^{ns} (5.9%)	1.66 \pm 0.03*** (25.75%)	33.4 \pm 0.6** (22.7%)
11	T11	10 \pm 0.3*** (38.31%)	10.30 \pm 0.03* (10.27%)	2.80 \pm 0.13* (66.6%)	2.60 \pm 0.06*** (96.96%)	46.6 \pm 0.1*** (71.3%)
12	T12	11.06 \pm 0.3*** (52.97%)	11.85 \pm 0.03** * (26.87%)	1.71 \pm 0.02 ^{ns} (1.78%)	1.47 \pm 0.04*** (11.36%)	38.9 \pm 0.1*** (43.01%)

*, **, *** significant at 0.05, 0.01 and 0.001 probability level, respectively

Table 3: Yield and biochemical parameters in harvested mung bean

S.No	Treatments	Protein(mg/gm)	Carbohydrate (mg%)	Yield (1000 grain wt. in g)
1	T1(control)	69.35± 0.6	381.4±1.9	168.4±.2
2	T2	90.86± 1.0*** (31.01%)	413.3±1.0*** (8.36%)	182.2±.2*** (+8.19%)
3	T3	91.86± 0.07*** (32.45%)	438.9±.1.2*** (15.07%)	176.3±.3*** (+4.6%)
4	T4	94.21± 0.04*** (35.84%)	427.06±2.6*** (11.97%)	188.2±.3*** (11.7%)
5	T5	81.26± 0.88*** (17.17%)	398.7±1.2*** (4.53%)	172±.1ns (+2.38%)
6	T6	98.9± 1.35*** (42.60%)	456.8±1.8*** (19.76%)	206.1±.3*** (+22.3%)
7	T7	94.92± 4.6*** (36.87%)	468.9±2.7*** (22.94%)	263.5±.5*** (+56.4%)
8	T8	102.6± 0.6*** (47.94%)	472.7±2.0*** (23.93%)	242±.5*** (+56.4%)
9	T9	82.22± 0.84*** (18.55%)	401.3±1.0**** (5.21%)	223.6±.2*** (+32.77%)
10	T10	102.9± 1.52*** (48.37%)	471.3±1.7*** (23.57%)	178.2±.1*** (+5.8%)
11	T11	117± 1.2*** (68.70%)	468.7±3.6*** (22.88%)	281.2 ±.2*** (66.9%)
12	T12	103± 3.2*** (48.20%)	493.2±2.5*** (29.31%)	172.2 ±.2*** (+2.25%)

*, **, *** significant at 0.05, 0.01 and 0.001 probability level, respectively

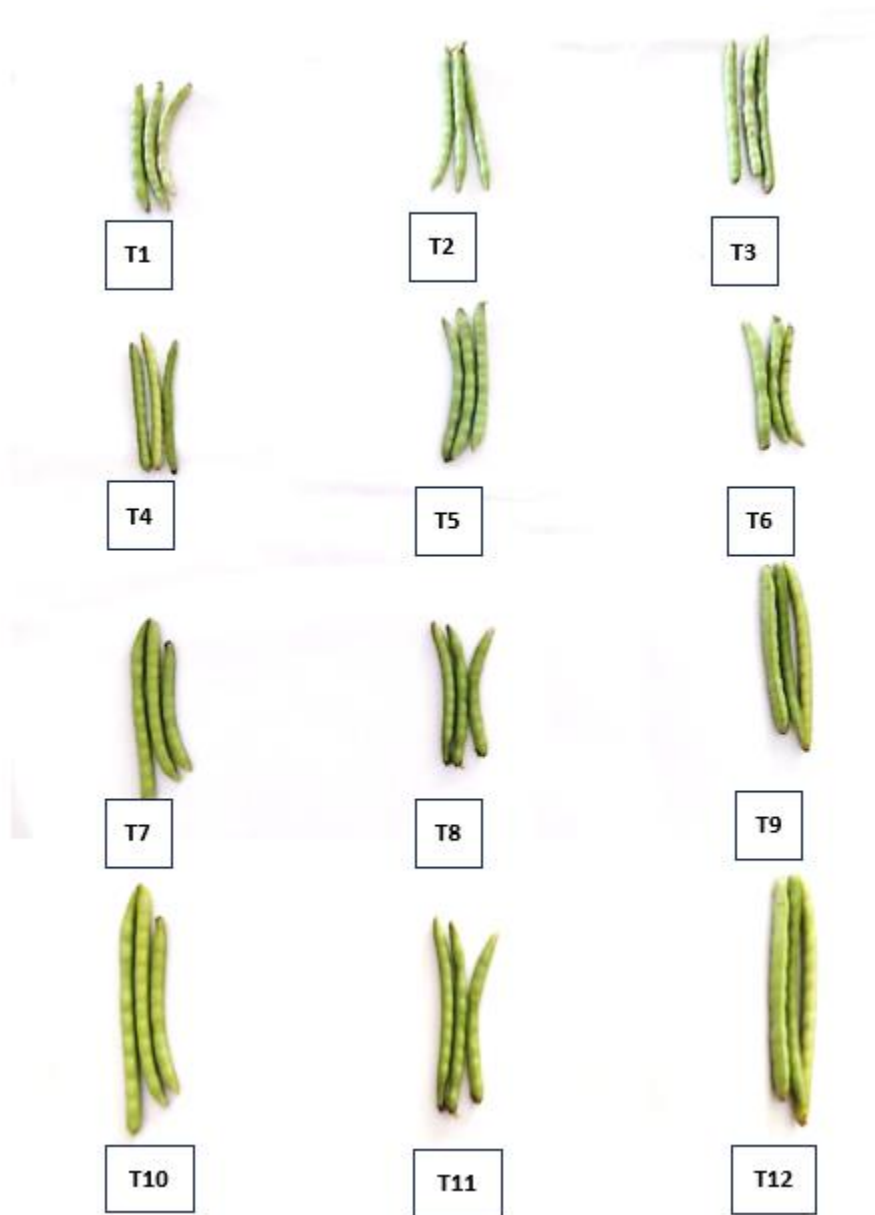


Fig 1: Pod length after harvesting

3.1 Physical parameters and Yield: As shown in figure 1 and 2, the pod length and weight showed increase with increasing concentration of bioenzyme. Fungicide pretreatment alone or with bioenzyme resulted in significant improvement in pod length and weight of harvested mung bean. Pretreatment of mung seed with soluble silica alone showed increase in pod length. However, pretreatment with soluble silica along with highest concentration bioenzyme showed the best result in case of pod length and weight of harvested mung bean. Manna *et al.*, 2012

found increment in growth, yield and quality of chilli by application of biozyme. According to them different components of biozyme viz. precursors of hormone, enzymes, protein and other micronutrients proved beneficial in enhancing growth and productivity of chilli.

The fresh weight of mung seeds showed no significant change on application of bioenzyme alone. However, seed pretreated with soluble silica or fungicide along with foliar spray of bioenzyme caused significant increase in fresh weight. The dry weight of mung seed showed highly significant increment in all the applied treatment collated to control. Increment in fresh and dry weight was reported in chick pea leaves supplemented with samples containing bioenzymes (Singh *et al.*, 2020). Foliar application of seaweed extracts also resulted in enhanced dry mass of green gram as reported by Pramanik *et al.*, 2013. The present study results are supported by the work of Gore *et al.*, 2007 who showed that biozyme application on green chilli improved its growth and yield significantly. Application of bioenzymes at the concentration 3 ml/L resulted in highest increase in growth and Yield of Rose as reported by Naik *et al.*, 2009.

Fungicide seed pretreatment proves to be beneficial for plant by enhancing seedling emergence, plant vigor, root mass by providing protection against various pathogens (Da Silva *et al.*, 2017). Rodriguez-Brljevich 2010, reported that seed dressing with fungicide resulted in increased photosynthesis and plant vigour. Some fungicides have shown to direct crop enhancement even in the absence of fungal infection by reducing oxidative stress (Testa *et al.*, 2015), increasing photosynthesis (Amaro., 2020).

Pretreatment of seed with silicon dioxide nanoparticles have shown to stimulate pre germination metabolic events like water imbibition, cell elongation, division, activation of reserve mobilizing enzymes etc (Ali *et al.*, 2021)). The seed nanopriming with suitable concentration of nSiO₂ resulted in increased weight of root, shoot and seedling collated to control which indicates enhancement in seed vigour (Hasanaklou *et al.*, 2023). Jiang 2022 concluded from the study on rice that use of silicon-based material used for seed treatment can affect seed germination at various rates depending upon concentration.

According to Begam *et al.*, 2020, increment in yield of rice on application of biozyme obtained from seaweed may be due to optimum absorption of minerals and other essential elements which results in enhanced translocation of products from source to sink. Deepika and Tiwari, 2021 showed increased yield of capsicum by supplementation of biozyme might be attributed to increased use of macro and micronutrient and other growth stimulating substances present in biozyme.

3.2 Biochemical Parameters: All the treatments used in the present study resulted in significant enhancement in protein content of mung bean. The seed treatment with either fungicide or

soluble silica was seen to increase protein content of mung seed significantly with further increment on foliar application of bioenzyme. Similar results were obtained by supplementation of bioenzyme in the study conducted on fenugreek by Patel *et al.*, 2023. Mitra and Mandal 2010 reported enhancement in uptake of nutrients was positively correlated with supplementation of biozyme granule. Bioenzyme prepared from citrus fruits contain macro and micronutrients which are necessary for formation of complex molecules required to enhance growth and development of plants (Rungta *et al.*, 2022). The pretreatment of seed alone or with foliar spray of bioenzyme resulted in significant increment in carbohydrate content of mung bean. Sau *et al.*, 2015 also reported increment in total sugar in guava on application of bioenzyme. Similar results were seen in pear by Inomata *et al.*, 1992.

4. CONCLUSION

The present work concludes that seed pretreatment can be a good way to control seedling emergence at early stage. The seed treatment with silica gave better results than fungicide. The foliar application of bioenzyme in continuation with seed pretreatment resulted in the best outcome both in the terms of growth and biochemical parameters for mung bean. So, the use of silica for seed pretreatment along with foliar spray of bioenzyme is suggested for the farmers to improve yield along with quality of mung bean. However, changing climatic conditions pose a challenge in the above work. In the future, effect of silica on pretreated seed can be assessed on different crop and different soil type.

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