Original Research Article

YIELD ENHANCEMENT OF FIELD PEA *(Pisumsativum)* THROUGH ZINC SOLUBILIZING MICROORGANISM

Abstract

A field experiment was conducted during rabi season 2022at Instructional farm, School of Agriculture, SAGE University Bhopal (Madhya Pradesh) to evaluate the response of field pea to Zn and ZSB solubilizers. Results revealed that maximum plant height, dry matter accumulation (g), number of branches/plant, number of pods/plant, number of seeds/pod, seed (1060 kg/ha), straw (2130 kg/ha), biological yield (4243 kg/ha), Net return (1639rs/ha) and B:C Ratio (1.12) was obtained with application of 100 % Recommended dose fertilizer + Zinc and was found statistically at par to 100% ZSB. Thus, all treatments significantly increased growth, yield and economics of field pea over control.

Keywords: Field pea, Zinc, ZSB (Zinc solubilizing bacteria), Growth and yield. .

Introduction:

The main winter grain legume crop, field pea [*Pisum sativum*], is largely restricted to cooler temperate zones. This crop provides food, animal feed, and vegetables. It is also third-most-popular rabi crop after chickpea and arhar identified as significant pulse crop worldwide.

Indian chickpea and arhar are followed by the pulse. To increase productivity and production, field pea needs a proper and better nutrient management practice. Field pea has shown a positive response to fertilizer application. However, consistent use of chemical fertilizers in modern agricultural practices has a negative impact on the population of native beneficial soil microorganisms and health of the soil. We can use bio fertilizer on behalf of chemical because this bio-fertilizers are organic products which have a living cells. Bio-fertilizer plays a major role in unavailable to available form of nutrient (Itelima*et al.* 2018) [1]. Bio-fertilizers are organic solution that contains microorganisms and growth hormone which boost crop productivity through biological nitrogen fixation, zinc solubilization, and other growth regulators that are also necessary for plants growth and development. In this context, nutrient management combined with bio-fertilizers is emerging as a method of fertilization that is commercially viable and environmentally responsible (Kaur and Purewal, 2019)[2].

Material and Method

The present investigation was performs in experimental field small plots of SAGE University Bhopal (M.P.) For the purpose of this study find out the effect of Zn and Zn solubilizers on field pea plant growth and development were selected varieties of field pea: Prakash IPFD 1-1. It is characterised by large seeds and powdery mildew resistance. Its yellow ovoid shape grains are characterised by very high protein content. Field pea was sown on 23 November 2022. The field experiment was carried out in randomized block design with 6 treatments. The size of one plot was 6 square meter. The experiment was conducted at Instructional Cum Research Farm, School of Agriculture, SAGE University Bhopal (Madhya Pradesh) during rabi season of 2022. Geographically, Bhopal is situated at central region of India at 23.2599°' N latitude and 77.4126°' E longitude. Bhopal is known as city of lakes.The city is situated in the lowlands near the vindhya mountain range on the malwa plateau. Recommended dose of nitrogen, phosporus and potassium @16.6g at basal dose in four treatments and ZSB (Zinc solubilizing bacteria) are applied common to all treatments. The result revealed that use of recommended dose of zinc 30-40 mg /h. Sowing was done 23-11-22, harvesting was done manually on 24-03-2023. Observation was recorded at 30, 60, 90 DAS and at harvesting of crop. Several observations were taken from each plot randomly during entire growth period of field pea. Observed plants were tagged properly for further days. The following observations were taken on growth and yield attributes of field pea. That is are plant height (cm), number of branches/plant, number of pods/plant, number of seeds/pod,seed yield.Randomly five plant were selected for measuring height (cm) with the help of meter scale, number of branches/plant, number of pods/ plant,number of seeds/pods and mean value was calculated.1000 seed weight was taken in gram. Seed, straw and biological yield was observed in kg/ha and harvest index was computed. Net returns and B: C ratio were computed to evaluate the economics of the field experiment**.**

Result and Discussion

The observation of plant height was recorded at 60 and 90 DAS. The result revealed that plant height was minimum upto 30 DAS but it was increased during 60 DAS and at harvest due to increase in the age of crop. The plant height value ranges from 65.20 cm. to 84.34 cm. at Harvest. Significantly, maximum plant height value was 84.34 cm. recorded at harvest under T_2: recommended dose fertilizer + Zn 100% (9gm.) and found superior among the treatments. Under recommended dose fertilizer + Zn 100% (19.68 gm.) resulted in significantly higher dry matter accumulation (g/plant) in crop at harvest over rest of the treatments (Table 1). Data (Table 2) shows that application of Zn and ZSB Levels.Significantly increased branches/plant, pods/plant and seeds/pod. Treatment recommended dose fertilizer + Zn 100% resulted in maximum branches/plant (2.46), pods/plant (16.61) respectively) and seeds/pod (6.85) over rest of the treatments. Results revealed that application of recommended dose of fertilizer (RDF) + Zn (100%) T_2 resulted in significantly higher seed, straw and biological yield over control. Maximum seed (1060 kg/ha), straw (2130 kg/ha) and biological (4243 kg/ha) yield was recorded with application of recommended dose fertilizer + Zn 100% respectively (Table 2). Treatment recommended dose fertilizer + Zn 100% was statistically higher significant with Zinc solubilizing bacteria (ZSB) (100%). This might have increased number of pods/plant, seeds/pod, seed, straw and biological yield. The economical perusal of data (Table 2) showed that among Zn and ZSB

Solubilizer fertilizer Treatment recommended dose fertilizer + Zn 100% resulted in highest and significant followed by T3. These results confirm with the earlier finding of Venkatrao *et al*. (2017) [8] and Kuniya*et al*. (2018) [4]. The beneficial effect of zinc solubilizing bacteria on yield attributing characteristics have also been recorded by Kothyari*et al.* (2017) [3] and Raut (2018) [5] respectively. Test weight was found non significant with respect to various Zn fertilizers and their solubilizers levels. The economical perusal of data (Table 2) showed that among Zn fertilizer treatments Recommended dose of fertilizer + 100% Zinc resulted in highest and significant net return (1639 ₹ /ha) and B:C ratio (1.12). Similar findings were also reported by Serawat*et al.* (2018) [6] and Singh *et al*. (2018) [7].

Table.1 Yield enhancement of fieldpea through Zinc solubilizing microorganisms on growth and yield attributes (at harvest).

Treatments	**Plant Height (cm) at harvesting**	**Dry matter Accumulation (g/plant)**	**Branches/ plant**	**Pods/plant**	**Seed/pods**	**Test weight (g)**
Zn and ZSB Levels						
control (T_1)	65.20	13.12	1.04	9.94	4.42	175.36
Recommended Dose Fertilizer + Zn (100%) (T_2)	84.34	19.68	2.46	16.61	6.85	189.54
Zinc solubilizing bacteria (ZSB) (100%) (T_3)	80.53	19.61	2.15	15.53	6.24	185.62
Recommended dose fertilizer + Zn +ZSB (75%) (T_4)	75.20	17.82	1.78	13.78	5.78	182.41
Recommended dose fertilizer + Zinc +ZSB (50%)	71.48	15.7	1.70	12.63	5.23	179.45
Recommended dose fertilizer + Zinc +ZSB (25%) (T_6)	69.91	14.9	1.25	11.5	4.5	176.69
SE(m)	1.52	0.46	0.07	0.31	0.18	3.84
CD at 5%	4.65	1.34	0.23	0.95	0.57	NS

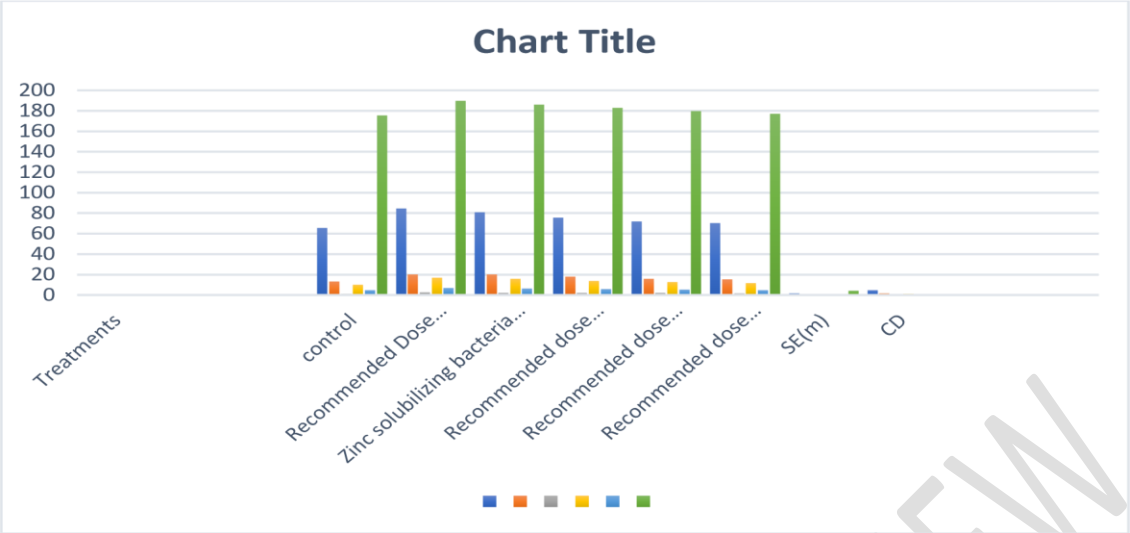

Fig 1: Graphical representation of the treatments

Table.2 Yield enhancement of field pea through zinc solubilizing microorganism on Seed, straw, biological yield and harvest index.

Treatments	**Seed yield (kg/ha.)**	**Straw Yield (kg/ha.)**	**Biological yield (kg/ha.)**	**Harvest index (%)**	**Net return (Rs./ha)**	**B:C ratio**
Zn and ZSB Levels						
Control (T_1)	250	560	1005	30.06	820	0.52
Recommended Dose fertilizer + Zn (100%) (T_2)	1060	2130	4243	32.26	1639	1.12
Zinc solubilizing bacteria (ZSB) (100%) (T_3)	830	1655	3298	32.09	1460	1.03
Recommended dose fertilizer + Zn +ZSB (75%) (T_4)	700	1390	2680	31.45	1234	1.01
Recommended dose fertilizer + Zn +ZSB (50%) (T_5)	480	940	1860	31.15	1140	0.95
Recommended dose fertilizer + Zn +ZSB (25%) (T_6)	380	735	1438	30.62	960	0.76
SE(m)	20.4	40.7	95.3	0.29	161.34	0.02
CD	61.1	120.3	285.4	0.86	484.05	0.07

Conclusion

Therefore, it can be concluded from the following experiment that compared to control plot various treatment which was T2 (Zn + 100 RDF) was found a higher significant followed T3 (Zinc

solubilizing bacteria 100%) Zn and ZSB Solubilizes treatment shown resulted in significant increase in the growth parameters, yield attributes and yields of field pea crop and ultimately resulted in higher net return and B:C ratio. Recommended Dose fertiliser + Zn (100%) recorded significantly higher growth, yields, net return and B: C ratio of field pea crop over rest of the treatments.

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