Original Research Article

Effect of FYM and Zinc Nutrition on Growth and Productivity of Pea (*Pysumsativum* L.) in Kashmir Conditions

ABSTRACT

Present experiment carried out at Vegetable Farm,FOA(SKUAS-K) Wadura, Kashmir (India) to determine the influence of Farmyard manure (FYM) and Zinc nutrition on pea productivity. The experiment was set up in Factorial RBD with sixteen treatments and three replications.Pea variety PS-1100 was taken as experimental material. Growth height, yield attributing characteristics, and pod yield were recorded and statistically analysed. Both Zinc and FYM nutrition treatments showed a substantial impact on plant growth, yield and yield attributing characters in pea. Results revealed that treatment combinationof Zinc at 5kg ha^{-1} + FYM at 350q ha^{-1} outperformed than other treatment combinations in terms of maximum pods $plant^{-1}$ (20.8), length of pods (9.4 cm), grain pod^{-1} (9.8), pod weight (12.7g) and pod yield (71.2 q ha^{-1}). In conclusion, Zinc at 5kg ha^{-1}+ FYM at 350q ha^{-1} is an effective dosage for maximizing pea pod production about 11.0 per cent greater than the control in Kashmir conditions.

Keywords: FYM, Pea, Pisumsativum L., Plant Growth Zinc, Yield

1. INTRODUCTION

Pea [*Pisumsativum* L.; Family Leguminosae (Fabaceae)] is one of the important legume vegetablewidely throughout tropical, sub-tropical and temperate regions of the world.Peas are a popular vegetable all over the world, and they are used in a variety of ways, including green pea beans for vegetable cooking, preparation of various vegetable meals, and canning. Peas are rich in protein (21-25%), carbohydrates, vitamin A and C, calcium, and phosphorus, as well as the amino acids lysine and tryptophan. [1].Pea roots have symbiotic Rhizobium bacteria in root nodules that helps in nitrogen fixation and maintain soil fertility,thatfavour in encouraging the sustainable agricultural production[2].

Zinc is an essential micronutrient in plant nutrition. Zinc accelerates certain enzymes that are involved in the synthesis of some plant proteins. It aids in the production of chlorophyll and certain carbohydrates, the conversion of starches to sugars, and the resistance of plant tissue to low temperature stresses. Zinc deficiency has been found to be the most common micro-nutrient problem of agricultural crops around the world. Zn deficiency is a major nutritional constraint for successful crop production in many parts of India [3]. The distinct response of various crops to Zn treatment has been widely documented.The use of Zn-enriched organics increased soil nutrient status, nutrient availability, and crop output; also, the use of organic manures resulted in a significant increase in accessible Zn in the soil, as well as a residual effect of Zn treatment [4-7].

Chemical fertilizer application in vegetable crops are required for realizing high yields, but their impropriate use can be harmful to the environment, and high cost of fertilizers may casts negatively on production profitability[8]. The rising use of chemicals in intensive agriculture contaminate ground as well as surface water, and also have interference in the harmony in soil-plant-microbial flora [9]. Following the green revolution, indiscriminate use of inorganic fertilizer for enhancing crop output, including vegetable crops [10]but it has an impact on the environmental sustainability as well as human health. The utilization of organic nutrient sources such as farmyard manure (FYM), chicken manure, and cattle manure is becoming more popular in order to achieve higher yield and quality while also being environmentally and human health friendly. Bulky organic manures such as Cattle manure loosens the soil and promotes aeration while also supplying essential plant nutrients, organic matter [11].It alsoincreases soil microbial equilibrium and accumulating surplus humus content [11]. Therefore, the current experiment was aimed to determine the Zinc and Farmyard manure nutrition on plant growth and yield of pea.

2. MATERIAL AND METHODS

Present experiment carried out at Vegetable Farm at Division of Horticulture, FOA (SKUAS-K) Wadura, Kashmir (India) during 2019/2021. The experiment wasconducted on pea variety PS-1100 with 16 combinations of Zinc and FYM and Factorial randomized block design with three replications was used for laying out the trial.There was four levels of Zinc (0, 2.5, 5, 7.5 kg ha^{-1}) and four level of FYM (0, 150, 250 and 350 t ha^{-1}).The doses of Zinc and FYM as per treatment were applied in mid-Octoberand experimental plots were well pulverized before planting of seeds. Planting of seeds was carried out in last week of October. The plant spacing was maintainedat 30 x 10 cm. Other cultural practicesadapted to each treatment plots were as per recommendations of SKUAST-Kashmir for pea cultivation in Kashmir valley.Data on plant height (cm), number of pods ($plant^{-1}$), pod length (cm), grains (pod^{-1}) pod weight (g) and pod yield (q ha^{-1}) were ere collected. Two years data recorded on aforementioned parameters were pooled and analysed statistically and mean significance difference was performed on the basis of criticaldifference (CD) at the 5% level of significance[12].

3. RESULTS AND DISCUSSION

Zinc and FYM nutrition had significant influence on the plant height (Fig 1). The highest plant height was noted with Zn at 7.5 kg ha^{-1} (59.0 cm).But it was at par with Zincat 7.5 kg ha^{-1} (58.1 cm). FYM at 350 q ha^{-1} resulted the highest plant height (56.7 cm) but at par with FYM at 350 q ha^{-1}. Treatment combination of zinc at5kgha^{-1}+ 350 q ha^{-1} resulted the highest plant height (59.4cm), followed by Zinc at 7.5kgha^{-1} + FYM at 250 q ha^{-1}(59.2cm) and lowest was recorded in Control (42.1). Furthermore, it was shown that all of the other treatments outperformed the control treatment in terms of plant height.

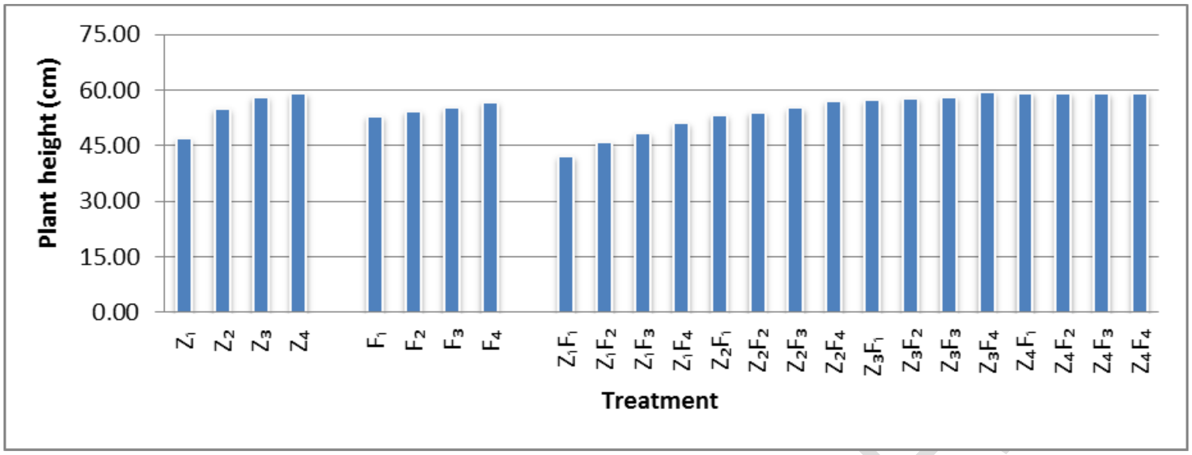

Fig. 1. Plant height of pea cv. PS-1100 as affected by different levels of Zinc and FYM

Zinc and FYM nutrition showed significant effect of yield attributing characters of pea i.e. number of pods per plant, length of pod, and number of grains per pod and weight of pod (Table 1). The maximum number of pods per plant (20.3), length of pod (9.1 cm), number of grains per pod (9.2) and weight of pod (12.2 g) recorded with the application of Zinc at 7.5 kg ha^{-1} but it was statistically at par with the level of Zinc at 5.0 kg ha^{-1} (19.8, 8.8 cm, 9.1 and 11.4 cm, respectively). The FYM application also significantly affected the yield attributing characters (Table 1). The maximum number of pods per plant (20.3), length of pod (8.3 cm), and number of grains per pod (9.0) and weight of pod (10.5 g) recorded with the application of FYM at 350 q ha^{-1} but it was statistically at par with the level of 250 q ha^{-1} (18.5 cm, 8.1 cm and 8.8 and 9.9 cm, respectively). The interaction effect of the Zinc and FYM was noted significant (Table 1). Treatment combination of Zinc at 5 kg ha^{-1} + FYM at350 q ha^{-1} resulted the highest plant height maximum number of pods per plant (20.8), length of pod (9.4 cm), number of grains per pod (9.8) and weight of pod (12.7 g) followed by Zinc at 7.5 kg ha^{-1} + FYM at 250 q ha^{-1}while lowest in Control.

Table 1.Effect of Zinc & FYM on yield attributing characters of pea cv. PS-1100.

Treatment	Number of pods (plant^{-1})	Pod length (cm)	Number of grains (pod^{-1})	Pod weight (g)
Zinc				
Z_1 - Control	14.9	6.2	6.9	6.0
Z_2 - 2.5 kg ha^{-1}	17.6	7.4	8.9	8.8
Z_3 - 5 kg ha^{-1}	19.8	8.8	9.1	11.4
Z_4 - 7.5 kg ha^{-1}	20.3	9.1	9.3	12.2
SEm±	0.11	0.04	0.03	0.03
CD	0.24	0.08	0.07	0.06
FYM				
F_1 – Control	17.4	7.4	8.4	8.6
F_2 – 150 q ha^{-1}	17.9	7.8	8.6	9.3
F_3 – 250 q ha^{-1}	18.5	8.1	8.8	9.9
F_4 – 350 q ha^{-1}	18.8	8.3	9.0	10.5
Sem±	0.11	0.04	0.04	0.03
CD	0.24	0.08	0.08	0.06
Zinc x FYM				
Z_1F_1	13.9	5.3	6.0	4.5

Z_1F_2	14.7	6.2	6.6	5.7
Z_1F_3	15.2	6.6	7.0	6.6
Z_1F_4	15.8	6.8	8.0	7.2
Z_2F_1	16.6	7.0	8.6	7.8
$Z2F_2$	17.1	7.3	8.7	8.6
Z_2F_3	18.2	7.6	9.0	9.1
Z_2F_4	18.5	7.9	9.3	9.7
Z_3F_1	18.8	8.2	9.4	10.0
Z_3F_2	19.6	8.6	9.6	11.0
Z_3F_3	20.1	9.1	9.7	12.0
Z_3F_4	20.8	9.4	9.8	12.7
Z_4F_1	20.4	9.3	9.4	12.4
Z_4F_2	20.2	9.2	9.3	12.2
Z_4F_3	20.3	9.1	9.4	12.1
Z_4F_4	20.2	9.1	9.2	12.3
Sem	0.11	0.08	0.05	0.06
CD	0.24	0.17	0.11	0.13

Zinc and FYM nutrition significantly influenced the pod yield of pea cv. PS-1100 (Fig 2). The highest pod yield was with Zn at 5 kg ha^{-1} (70.8 q ha^{-1}) which was at par with Zn at 7.5 kg ha^{-1} (70.6 q ha^{-1}). FYM at 350 q ha^{-1} resulted significantly highest pod yield (68.8 q ha^{-1}) than other FYM treatments. Interaction effect of zing and FYM on pod yield was also significant (Fig 2). Treatment combination of zinc at 5kg ha^{-1} + 350 q ha^{-1} resulted the highest pod yield (71.2 q ha^{-1}). All other treatments were also shown to be significantly superior in terms of pod yield when compared to the control.

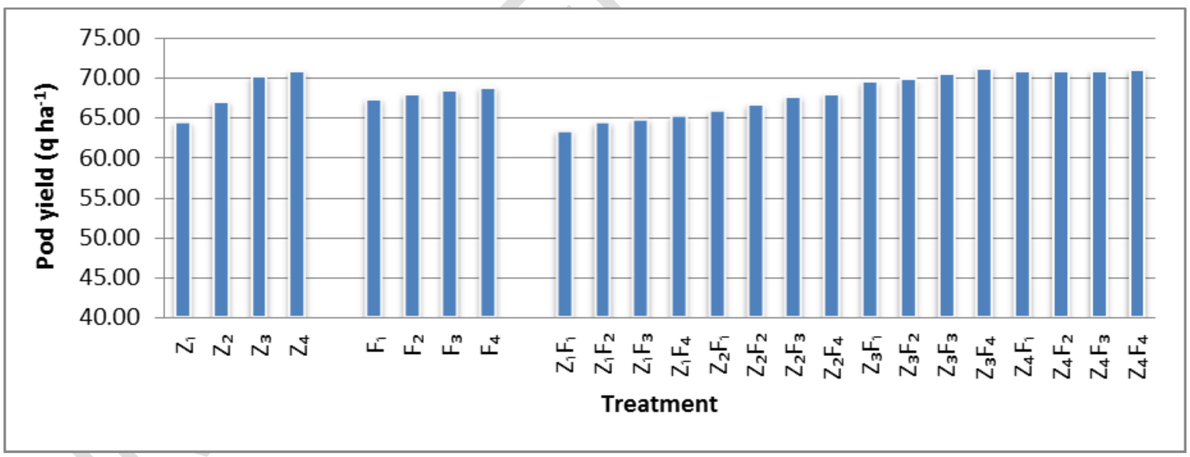

Fig. 2. Pod yield of pea cv. PS-1100 as affected by different levels of zinc and FYM

In our study, increased plant height was found, which can be related to the fact that zinc modulates the regulation of auxin synthesis, a well-known growth promoting hormone that stimulates cell division and enlargement [32]. The enhanced plant height seen in our trial is consistent with Toga *et al.* [14], Pandey *et al.* [15], and Nadergoli*et al.* [16], who all reported a significant influence of Zinc on plant growth. According to Sanyal [7], this could be owing to the joint application of organic manures. Pandey et al. [18] found comparable results for increased crop growth and production metrics of garden pea. Different treatments resulted in significant differences in yield contributing variables including number of grains per pod and yield per hectare. This is because zinc therapy is essentially very beneficial to the crop's reproductive productivity, since it stimulates male and female gametogenesis, which increases the number of flowers per plant.

Zinc nutrition may benefit pea pod yield as noted in our study might be attributed to the facts that Zinc increases stigma receptivity and function, as well as pollen viability, all of which contribute to healthy pollen grain germination and development, as well as an increase in yield metrics like the quantity, size, and weight of pods and seeds [19]. Furthermore, the incorporation of organic and zinc may be the cause of increased crop plant development and nodulation, resulting in increased pod production [20]. FYM and zinc integration for plant nutrition increased nutrient concentration and helped mobilize the unavailable fractions of nutrients in soil, prompting the acquisition of optimal nutrient supply across important crop stages [18].

The higher efficiency of organic matter could be attributed to the fact that organic manure, particularly FYM, would have given micronutrients at optimal levels. Plant nutrients play a vital part in chlorophyll creation, which increases the rate of photosynthesis and, as a result, the plant's growth and economic yield. These findings are consistent with those of Navrang and Tomar [21]. The beneficial response of the pigeon pea to zinc fertilization, either soil or foliar, with and without FYM has previously been documented by many researchers [22,23]. The accumulation of dry matter in the plant at various stages is a reasonable assessment of growth as a cumulative expression of various growth factors. The beneficial benefits of zinc spraying on crop productivity could be attributed to the Zinc promotes mineral absorption in the roots and the production of the plant growth regulator. Indole acetic acid, glucose, and nitrogen metabolism result in high yield and yield components, and eventually improved plant nutrition, which boost photosynthetic efficiency, assimilation, and yield [24].

4. CONCLUSION

Zinc and FYM nutritionaffects the plant growth and yield attributing parameters and pod yield of pea var. PS-1100. Application of Zinc at 5kg ha-^{1} + FYM at 350 q ha^{-1} is determined thesuitable dose for increasinghigher pod yield in pea.Itmay be effective in sustaining crop productivity and improving soil health in Kashmir valley.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

AUTHORS' CONTRIBUTIONS

All authors read and approved the final manuscript.

CONSENT

Not Applicable.

ETHICAL APPROVAL

Not Applicable.

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