The Pharma Innovation Journal 2021; 10(4): 462-465

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2021; 10(4): 462-465

www.thepharmajournal.com
Received: 17-02-2021
Accepted: 29-03-2021

Md. Parwaiz Alam
Assistant Professor-cum- Junior Scientist, Department of Agronomy, Birsa Agricultural University, Jharkhand, India

Kumari Menka
M.Sc., Department of Agronomy, Birsa Agricultural University, Jharkhand, India

Sulochna
Ph.D., Scholar, Department of Agronomy, Birsa Agricultural University, Jharkhand, India

Corresponding Author:
Kumari Menka
M.Sc., Department of Agronomy, Birsa Agricultural University, Jharkhand, India

Effect of zinc and boron on growth, yield and economics of linseed (*Linum usitatissimum* L.) under medium land of Jharkhand

Md. Parwaiz Alam, Kumari Menka and Sulochna

DOI: https://doi.org/10.22271/tpi.2021.v10.i4g.5983

Abstract
An experiment was conducted during *Rabi* 2018-19 and 2019-20 at Research Farm of Birsa Agricultural University, Kanke, Ranchi, Jharkhand to study "The effect of Zinc and Boron on growth, yield and economics of Linseed (*Linum usitatissimum* L.) under medium land of Jharkhand". The experiment was laid out in randomized block design with three replications. The treatments comprised soil application of Zn @ 5 kg/ha, foliar application of $ZnSO_4$ @ 0.5% at 45 DAS, soil application of Zn @ 5 kg/ha + foliar application of $ZnSO_4$ @ 0.5% at 45 DAS, soil application of B @ 1.5 kg/ha, foliar application of Borax @ 0.3% at 45 DAS, soil application of B @ 1.5 kg/ha + foliar application of Borax @ 0.3% at 45 DAS, foliar application of $ZnSO_4$ @ 0.5% + foliar application of Borax @ 0.3% at 45 DAS, soil application of Zn @ 5 kg/ha + soil application of B @ 1.5 kg/ha compared with control treatment along with RDF (40:20:20 kg NPK/ha) common to all treatments. Foliar application of $ZnSO_4$ @ 0.5% + foliar application of borax @ 0.3% at 45 DAS found superior in terms of maximum plant height (53.75 cm and 55.14 cm), plant stand (201 and 216), dry matter accumulation (3.66 g/plant and 3.70 g/plant) yield attributing characters *viz.*, number of capsules per plant (29.02 and 38.67), number of seeds per capsule (6.00 and 8.57), 1000 seed weight (7.59 g and 7.64 g), seed yield (12.99 q/ha and 13.35 q/ha), net return (₹ 33230/ha and ₹38201/ha) and B:C ratio (1.82 and 2.19) in both years respectively.

Keywords: Linseed, zinc, boron, growth, yield attributes, yield and economics

Introduction
Next to rapeseed and mustard, linseed is a major *rabi* oilseed crop of the country. India is the fourth largest linseed growing country in the world (10.8%) after Kazakhistan, Canada and Russia but production wise it ranks fifth in the world after Canada, Russia, China and Kazakhistan. Linseed seed rich in protein (20%), oil (41%) and dietary fibre (28%). Each part of linseed has own economic importance. The seed of linseed contains 33-47 percent oil. Linseed oil is an excellent drying oil used in manufacturing paint and varnishes, oilcloth, waterproof fabrics (Matheson, 1976) [4]. At present linseed is cultivated in about 326.01 thousand ha and contribute 173.62 thousand tonnes to the annual oilseed production of the country with the productivity of 545 kg/ha While in Jharkhand it is cultivated over 52.07 thousand ha with production of 29.68 thousand tonnes (P.C. Report, 2018-19, AICRP on linseed). Linseed is generally grown under rainfed condition, however, its cultivation is widely extended in irrigated areas because of higher yield potential. Linseed has many industrial, medicinal properties and used for value added product. The productivity of linseed at national level is 1005 kg/ha (FAOSTAT, 2017) [2]. One of the limiting factors for low yield is due to poor management of inputs. The average yield of flax is very low in India due to many constraints like poor soil fertility, inadequate application of macro and micronutrients, competition with other crop and traditional crop management practices. Due to constantly increasing demand of the crop, there is a direct need to increase seed yield potential of flax crop. Its production can be increased by growing high yielding cultivators and by the uses of macro and micronutrients in balance quantity. Micronutrients especially zinc and boron play very important role in increasing growth and yield attributes. The deficiency of these two micronutrients in soil adversely affect the growth and development of linseed. Zinc is one of the essential micronutrients require for optimum crop growth and deficiency of it causes various adverse effect on growth and yield of linseed. Boron plays a significant role in enzyme

activation, protein synthesis, improves photosynthesis and is associated with calcium uptake and its utilization. Boron application imposed a positive trend in production of more dry matter, seed yield and oil content. The research was on zinc and boron application and its effect on growth and development of linseed is very meagre. Therefore, an experiment was conducted to find out the suitable dose of zinc and boron for linseed in sole as well as combined application.

Materials and Methods

The study was conducted during two consecutive year of 2018-19 and 2019-20 in *rabi* season at Crop Research Farm, Eastern Section of the Birsa Agricultural University, Ranchi-834006 (Jharkhand) to evaluate "The effect of Zinc and Boron on growth, yield and economics of linseed (*Linum usitatissimum* L.) Under medium land of Jharkhand". The variety of linseed taken for experimentation was "Priyam". The experiment was laid out in Randomized Block Design with three replications with nine treatments *viz.*, soil application of Zn @ 5 kg/ha, foliar application of $ZnSO_4$ @ 0.5% at 45 DAS, soil application of Zn @ 5 kg/ha + foliar application of $ZnSO_4$ @ 0.5% at 45 DAS, soil application of B @ 1.5 kg/ha, foliar application of Borax @ 0.3% at 45 DAS, soil application of B @ 1.5 kg/ha + foliar application of Borax @ 0.3% at 45 DAS, foliar application of $ZnSO_4$ @ 0.5% + foliar application of Borax @ 0.3% at 45 DAS, soil application of Zn @ 5 kg/ha + soil application of B @ 1.5 kg/ha with control along with RDF (40:20:20 kg NPK/ha) common to all treatments. The soil of the experimental site was sandy loam in texture, slightly acidic in reaction (5.84), low in organic carbon (0.41%) and available nitrogen (175.79 kg/ha), medium in available phosphorus (21.82 kg/ha) and potassium (186.54 kg/ha) with low in zinc (0.68 mg/kg) and boron (0.44 mg/kg). The growth, yield attributes and yield were recorded as per the standard procedure by sampling from three places in each plot. All data recorded were analyzed with the help of analysis of variance (ANOVA) technique (Gomez and Gomez 1984) [3].

Results and Discussion

Effect of Zn and B on growth parameters of linseed

Application of Zinc and Boron had not significant effect on plant stand of linseed in both the years of experimentation. At harvest the treatment with foliar application of $ZnSO_4$ @ 0.5% + foliar application of Borax @ 0.3% at 45 DAS had found significantly maximum plant stand (201 and 216) over control (183 and 197) during both years respectively. Effect of zinc and boron nutrition realized significant effect on plant height of linseed (Table 1). At harvest, the treatment with foliar application of $ZnSO_4$ @ 0.5% + foliar application of Borax @ 0.3% at 45 DAS attained significantly maximum plant height (53.75 cm and 55.14 cm) over control (42.18 cm and 43.53 cm) during both years. However, plant height was found significantly at par with soil application of Zn @ 5 kg/ha + foliar application of $ZnSO_4$ @ 0.5% at 45 DAS (50.54 cm and 52.30 cm), foliar application of Borax @ 0.3% at 45 DAS (48.92 cm and 51.41 cm), soil application of B @ 1.5 kg/ha + foliar application of Borax @ 0.3% at 45 DAS (52.81 cm and 53.77 cm) and soil application of Zn @ 5 kg/ha + soil application of B @ 1.5 kg/ha (47.30 cm and 50.89 cm). At harvest, treatment with foliar application of $ZnSO_4$ @ 0.5% + foliar application of Borax @ 0.3% at 45 DAS recorded significantly highest dry matter accumulation (3.66 g/plant and 3.70 g/plant) followed by soil application of B @ 1.5 kg/ha + foliar application of Borax @ 0.3% at 45 DAS (3.58 g/plant and 3.62 g/plant) respectively. The significantly increased plant height and dry matter accumulation observed in combined application of zinc and boron as foliar may be due to availability of these micronutrients to the crop at appropriate vegetative stage, which may have increased the nutrient uptake and chlorophyll content and resulted in increase in plant growth and it also might improve photosynthetic area of plants that cumulatively contribute to higher dry matter accumulation. The results are in accordance with Singh *et al.* (2020) [8], Eldaiem *et al.* (2016) [1], Mousa *et al.* (2010) [5]

Table 1: Effect of zinc and boron nutrition on growth of linseed

Treatments	Plant stand at harvest (000/ha)		Plant height (cm) at harvest		Dry matter at harvest (g/plant)	
	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20
T_1:(control)	183	197	42.18	43.53	2.28	2.30
T_2: Soil application Zn@ 5 Kg/ha	185	200	43.23	46.57	3.29	3.34
T3:Foliar application $ZnSO_4$ @ 0.5% at 45 DAS	186	205	44.86	47.90	3.32	3.39
T_4: Soil application Zn@ 5Kg/ha + Foliar application of $ZnSO_4$ @ 0.5% at 45 DAS	188	209	50.54	52.30	3.51	3.56
T_5:Soil application B @ 1.5 kg/ha	190	211	45.67	48.92	3.33	3.41
T_6:Foliar application Borax @ 0.3% at 45 DAS	196	213	48.92	51.41	3.45	3.51
T_7: Soil application B @ 1.5 kg/ha+ Foliar application Borax @ 0.3% at 45 DAS	198	214	52.81	53.77	3.58	3.62
T_8: Foliar application $ZnSO_4$ @ 0.5% at 45 DAS + Foliar application Borax @ 0.3% at 45 DAS	201	216	53.75	55.14	3.66	3.70
T_9: Soil application Zn@ 5 Kg/ha+ Soil application B @ 1.5 kg/ha	192	212	47.30	50.89	3.39	3.44
SEm±	7.27	9.01	2.18	1.77	0.09	0.12
CD (P=0.05)	NS	NS	6.55	5.31	0.28	0.37
CV (%)	6.6	7.5	7.9	6.1	4.8	6.35

Effect of Zn and B on yield attributes and yield of linseed

The data indicated that zinc and boron had significant effect on yield attributing characters of linseed *viz.*, number of capsules per plant, number of seeds per capsule, 1000 seed weight and seed yield of linseed (Table 2). The significantly higher number of capsules per plant (29.02 and 38.67), number of seeds per capsule (6.00 and 8.57) and test weight (7.59g and 7.64g) were registered with foliar application of $ZnSO_4$ @ 0.5% + foliar application of Borax @ 0.3% at 45 DAS as compared to control during both the years of experimentation. Seed yield is the results of synchronized interplay of various yield attributes like number of capsules per plant, number of seeds per capsule and test weight. An appraisal of data revealed that foliar application of $ZnSO_4$ @ 0.5% + foliar application of Borax @ 0.3% at 45 DAS recorded significantly superior seed yield (12.99 q/ha and

13.35q/ha) as compared to rest of the treatments except the treatment where soil application of Zn @ 5 kg/ha + foliar application of $ZnSO_4$ @ 0.5% at 45 DAS (11.82 q/ha and 12.04 q/ha) and soil application of B @ 1.5 kg/ha + foliar application of Borax @ 0.3% at 45 DAS (12.12 q/ha and 12.28 q/ha) was applied. The optimal and balanced supply of nutrient (macro and micronutrient) led to higher growth and development of plants resulted in higher yield attributes and yield of crops. This might be because of foliar and soil application of micronutrients which effectively fulfill the nutrient requirements of the linseed crop as compared to other treatments. The plant of these treatments have got better nutrient availability of specially zinc and boron at branching stage for their growth and development. Similar results on linseed were also reported by Singh *et al.* (2020) [8], Eldaiem *et al.* (2016) [1], Mousa *et al.* (2010) [5].

Table 2: Effect of zinc and boron nutrition on yield attributes and seed yield of linseed

Treatments	Number of capsules/plant		Number of seeds/capsule		1000 seed weight (g)		Seed yield (q/ha)	
	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20
T_1:(control)	20.17	25.86	3.45	6.57	6.87	7.20	7.92	8.85
T_2: Soil application Zn@ 5 Kg/ha	22.68	28.74	4.47	7.18	7.18	7.36	10.15	10.72
T3:Foliar application $ZnSO_4$ @ 0.5% at 45 DAS	23.19	29.86	4.90	7.36	7.25	7.41	10.43	10.94
T_4: Soil application Zn@ 5Kg/ha + Foliar application of $ZnSO_4$ @ 0.5% at 45 DAS	27.00	36.92	5.62	8.23	7.53	7.62	11.82	12.04
T_5:Soil application B @ 1.5 kg/ha	23.34	30.95	5.22	7.52	7.32	7.49	10.74	11.03
T_6:Foliar application Borax @ 0.3% at 45 DAS	25.74	34.25	5.49	8.04	7.41	7.54	11.32	11.55
T_7: Soil application B @ 1.5 kg/ha+ Foliar application Borax @ 0.3% at 45 DAS	28.05	37.89	5.85	8.41	7.48	7.56	12.12	12.28
T_8: Foliar application $ZnSO_4$ @ 0.5% at 45 DAS + Foliar application Borax @ 0.3% at 45 DAS	29.02	38.67	6.00	8.57	7.59	7.64	12.99	13.35
T_9: Soil application Zn@ 5 Kg/ha+ Soil application B @ 1.5 kg/ha	24.17	32.73	5.37	7.89	7.38	7.53	10.82	11.06
SEm±	1.63	0.84	0.23	0.39	0.24	0.21	0.46	0.49
CD (P=0.05)	4.89	2.52	0.69	1.17	0.71	NS	1.37	1.48
CV (%)	11.4	4.43	7.8	8.70	5.57	4.9	7.24	7.5

Effect of Zn and B on economics of linseed

The data on economics of linseed cultivation as affected by different treatments is presented in Table 3. The gross return obtained by yield of crop varied significantly due to different treatments, which ultimately influenced the net return and benefit: cost ratio.

The magnitude of increase in gross return and net return with treatment where, foliar application of $ZnSO_4$ @ 0.5% + foliar application of Borax @ 0.3% at 45 DAS were applied to the tune of 39.34% and 58.43% respectively over control in the year 2018-19 whereas in the year 2019-20 the increase in gross and net return over control were 34.46% and 48.01% respectively.

The benefit cost ratio was observed maximum (1.82 and 2.19) with treatment where, foliar application of $ZnSO_4$ @ 0.5% + foliar application of Borax @ 0.3% at 45 DAS was applied and was followed by treatment where soil application of B @ 1.5 kg/ha + foliar application of Borax @ 0.3% at 45 DAS (1.51 and 1.80). The lowest benefit cost ratio was obtained with control (0.83 and 1.19) in both the years of experimentation. These finding are in the close vicinity with those reported by Singh *et al.* (2020) [8] and Tahir *et al.* (2014) [9].

Table 3: Effect of zinc and boron nutrition on economics of linseed

Treatments	Cost of cultivation		Gross return (₹/ha)		Net return (₹/ha)		B: C ratio	
	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20
T_1:(control)	17404	16604	31217	36464	13813	19860	0.83	1.19
T_2: Soil application Zn@ 5 Kg/ha	18404	17604	40662	45050	22258	27446	1.21	1.56
T3:Foliar application $ZnSO_4$ @ 0.5% at 45 DAS	18034	17234	41840	46064	23806	28830	1.32	1.67
T_4: Soil application Zn@ 5Kg/ha + Foliar application of $ZnSO_4$ @ 0.5% at 45 DAS	19034	18234	46996	50426	27962	32192	1.47	1.77
T_5:Soil application B @ 1.5 kg/ha	18444	17644	42835	46296	24391	28652	1.32	1.62
T_6:Foliar application Borax @ 0.3% at 45 DAS	18112	17312	44786	48121	26674	30809	1.47	1.78
T_7: Soil application B @ 1.5 kg/ha+ Foliar application Borax @ 0.3% at 45 DAS	19152	18352	48042	51299	28890	32947	1.51	1.80
T_8: Foliar application $ZnSO_4$ @ 0.5% at 45 DAS + Foliar application Borax @ 0.3% at 45 DAS	18232	17432	51462	55634	33230	38201	1.82	2.19
T_9: Soil application Zn@ 5 Kg/ha+ Soil application B @ 1.5 kg/ha	19444	18644	43349	46627	23905	27983	1.23	1.50
SEm±			1286.14	1551.08	1329.03	1551.18		
CD (P=0.05)			3855.44	4649.64	3984.02	4649.95		
CV (%)			5.1	5.7	9.2	9.1		

Conclusion

Based on the findings of two years of experimentation it may be concluded that foliar application of $ZnSO_4$ @ 0.5% along with foliar application of Borax @ 0.3% at 45 DAS was found most effective for increasing growth, yield and economics of linseed.

References

1. Abd Eldaiem MAM, El- Sherief MAB. Effect of organic, phosphorus and zinc fertilization on yield and quality of flax. Int. J Adv. Res. Biol. Sci 2016;3(1):161-173.
2. FAOSTAT. Food and Agricultural Organization of the United Nations, FAO Statistical Databases 2017. http://www.fao.org/faostat/
3. Gomez KA, Gomez AA. Statistical Procedures for Agricultural Research. John Wiley & Sons 1984.
4. Matheson EM. Linseed. Vegetable Oil Seed Crops in Australia. Holt, Rinehart and Winston, Sydney 1976, 111-121.
5. Mousa MA, El-Kady EA, Zedan ZS. Effect of nitrogen fertilizers and some micro-nutrients on flax yield and chemical composition characters. Journal of Plant Production 2010;1(5):713-720.
6. PC. Report, AICRP on Linseed 2018-19.
7. Rowland GG, McHughen A, Gusta LV, Bhatty RS, MacKenzie SL, Taylor DC. The application of chemical mutagenesis and biotechnology to the modification of linseed (*Linum usitatissimum* L.). Euphytica 1995;85(1):317-321.
8. Singh A, Singh D, Verma VK, Pyare R, Hussain MF. Studies on the effect of zinc and boron on growth and yield of linseed (*Linum usitatissimum* L.) under limited irrigation. International Journal of Chemical Studies 2020;8(5):1964-1966.
9. Tahir M, Irfan M, Rehman AU. Effect of foliar application of zinc on yield and oil contents of flax. Pakistan J Agric. Res 2014;27(4):287-295.