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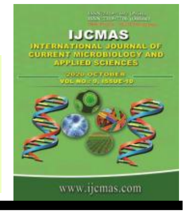

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Effect of Foliar Application of Zinc and Boron on Growth and Yield of Mungbean (wilczek) (*Vigna radiata* L.)

Narendra Pratap Verma[1], M. A. Khan[2], Pradip Kumar Saini[1*], Virendra Pratap Verma[3] and Shraddha Singh[1]

[1]Department of Crop Physiology, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya-224229 (U.P.), India
[2]Department of Crop Physiology, Chandra ShekharAzad University of Agriculture & Technology, Kanpur- 208002 (U.P.), India
[3]Department of Agronomy Narain College Shikohabad, Firozabad (U.P.), India

**Corresponding author*

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ABSTRACT

A Pot experiment was carried out entitled "Effect of foliar application of Zinc and Boron on growth and yield of Mungbean" (wilczek) (*Vigna radiata* L.) during Kharif season 2018 in the wire net house in pot in the Department of Plant Physiology, C. S. Azad University of Agriculture & Technology, Kanpur. The experiment consisted 7 treatments viz. T_1: Control, T_2: Zn @ 50ppm, T_3: Zn @ 100ppm, T_4: Zn @ 150ppm T_5: B @ 100ppm, T_6: @ B 200ppm and T_7: @ B 300ppm assigned in CRD with five replication during kharif season of 2018. The mungbean **cv**. Samrat was used in the experiment. The soil of the experimental plot was sandy loam in texture, medium in fertility and slightly alkaline in reaction. The weather during the experimental period was by and large normal and devoid of any extreme conditions. The results indicated that application of T_7 : B @ 300ppm resulted in significantly maximum plant height, No. of Pods plant^{-1}, number of seed Pods^{-1}, No. of seed Plant^{-1}, 1000- seed weight (g) and ultimately higher seed yield (g) (Plant^{-1}) as compared to other corresponding tested treatments. The treatment is also excellent under B @ 300ppm.

Introduction

Green gram locally called as moong or mung [*Vigna radiata* L.) It belongs to the family leguminaceae so it has the capacity to fix atmospheric nitrogen. It's one of the important *kharif* pulse crops of India which can be grown as catch crop between *rabi* and *kharif* seasons. India alone accounts for 65% of its world acreage and 54% of the total production. It is grown on about 3.50 m ha in the country mainly in Rajasthan, Maharashtra, Andhra Pradesh, Karnataka, Orissa and Bihar. A phenomenal increase in area, production and productivity has occurred since 1964-65. The area has increased from 1.99 million ha in 1964-65 to 3.54 million ha in 2010-2011. The production has increased from 0.60 million tonnes to 1.81 million tonnes during the same period. Throughout the India, the mungbean issued for different purposes. The major portion is utilized in making dal, soup, sweets and snacks. Mungbean is an excellent source of protein (25%) with high quality of lysine (460 mg g^{-1}) and tryptophan (60 mg g^{-1}). It also has remarkable quantity of ascorbic acid when sprouted and also have riboflavin (021 mg 100 g^{-1}) and minerals (3.84 W 100 g^{-1}). The total area under pulses is 23.63 m ha with an annual production of 14.76 M tonnes in the country. In India green gram occupies 3.4 million hectare area and contributes to 1.4 million tonnes in pulse production. Mungbean contributes 14% in total pulse area and 7% in total pulse production in India.

The low productivity of mungbean may be due to nutritional deficiency in soil and imbalanced external fertilization. Micronutrients are essential for plant growth; Zinc is one of the seven pillars of nutrition and is needed for the growth of plant, animals and humans. The amount of zinc in pasture and forage is very little and varies from 20 to 30 mg kg^{-1} in soil. Zinc is necessary to activate many enzymes, enzymes that are activated by the zinc are Tryptophan synthetase superoxide dismutase and dehydrogenases. Lack of zinc causes deficiency in formation of RNA and protein. Therefore, the plant with lack of zinc is poor in amount of protein. Foliar spraying of micronutrients for the growth of greengram and its quality in industry views is necessary for growth and quality of greengram.

Micronutrients like boron is one of the mineral nutrients required for normal plant growth. The most important functions of boron in plants are thought to be its structural role in cell wall development, cell division, seed development and stimulation or inhibition of specific metabolic pathways for sugar transport and hormone development. Furthermore, boron deficiency causes decrease in pollen grain count, pollen germination etc. It also influences growth parameters and filling up of seeds. It is usually accepted that boron availability is decreased under dry soil conditions.

Thus, boron deficiency is often associated with dry weather and low soil moisture conditions. This behaviour may the related to restricted release of boron from organic complexes which ultimately impaired ability of plants to extract B from soil due to lack of moisture in the rhi7osphere. Even of B levels in soil is high, then also low soil moisture impairs transport of B to absorbing root surfaces (Das *et al.*, 2016).

Materials and Methods

The field experiment was conducted in the pot culture during *Kharif* season 2018 in the wire net house in pot in the Department of Plant Physiology, C. S. Azad University of Agriculture & Technology, Kanpur. Geographically, the site of experiment is situated at Latitude of 80^0, 24^0 East and an Altitude 127 meter above mean Sea level in Genetic Alluvium soil in summer and severe cold winter. The experiment was conducted in complete randomized design with 7 treatment and 5 replications. The seed of mungbean variety of Samrat (PDM 139) were obtained from seed processing farm IIPR Kanpur. The experiment consisted treatments *viz.* T_1: Control, T_2: Zn @ 50ppm, T_3: Zn @ 100ppm, T_4: Zn @ 150ppm T_5: B @ 100ppm, T_6: @ B 200ppm and T_7: @ B 300ppm assigned in CRD with five replication during *kharif* season of 2018. Growths and Yields Parameter viz. Height /plant (cm), No. of leaves/plant, Leaf area/plant (cm^2), Relative growth rate (RGR) (mg/g/day), Total dry matter production (g), No. of branches/plant and No. of pods/plant, No. of seeds/pod, No. of seed/Plant, Seed weight/plant (g), 1000 seed weight (g).

Results and Discussion

Plant height

The data recorded on plant height and the result is given in Table 1, and depleted in Fig. 1. It is clear from the data that plant height was increasing with increasing days after sowing. The height was remarkably increased in between 25 to 50 days after sowing and significant differences were observed at all stages of crop growth. The tallest plants were observed in the treatment of T_7 with application of B @ 300ppm followed by T_4 Zn @ 150ppm, whereas minimum values were obtained in control. In 25 DAS treatment B @ 300ppm was found to be highest plant height (18.47 cm) statistically superior and at par to treatment Zn @ 50ppm, Zn @ 100ppm, Zn @ 150ppm, B @ 100ppm, B @ 200ppm. Minimum plant height was obtained in control (13.75 cm). At 50 DAS treatment B @ 300ppm was found to be highest plant height (36.38 cm) statistically superior and at par to treatment Zn @100ppm, Zn @ 150ppm, Zn @ 50ppm, B @ 100ppm, B @ 200ppm. Minimum plant height was obtained in control (31.26 cm). At Maturity treatment B @ 300ppm was found to be highest plant height (37.52 cm) statistically superior and at par to treatment Zn @ 150ppm, Zn @ 100ppm, B @ 200ppm, Zn @ 50ppm, B @ 100ppm. Minimum plant height was obtained in control (32.40cm) (Salinas *et al.,* 1985).

No. of leaves plant^{-1}

The data on No. of leaves plant^{-} and the result is given in Table 2 and depleted in Fig. 2. The data clear indicate that number of leaves plant^{-1} was significantly affected due to different treatments. It increased up to 50 days after sowing thereafter at maturity substantial reduction was observed. The maximum value is found it $T_{7:}$ B @ 300ppm. The lowest and highest values were observed in control and T_1: Control, respectively. At 25 DAS treatment Zn @ 150ppm was found to be highest no ofleavesplant^{-1} (13.85) statistically superior and at par to treatment B @ 300ppm, Zn @ 100ppm, B @ 200ppm, Zn @ 50ppm followed by B @ 100ppm. Minimum no of leaves plant^{-1} was obtained in control (9.85). At 50 DAS treatment Zn @ 150ppm was found to be highest no of leaves plant^{-1} (19.90) statistically superior and at par to treatment B @ 300ppm, Zn @ 100ppm, B @ 200ppm followed by Zn @ 50ppm, B @ 100ppm. Minimum no of leaves plant^{-1} was obtained in control (14.15). At Maturity treatment B @ 300ppm was found to be highest no of leaves plant^{-1} (20.76) statistically superior and at par to treatment Zn @ 150ppm, Zn @ 100ppm, B @ 200ppm followed by Zn @ 50ppm, B @ 100ppm. Minimum no of leaves plant^{-1} was obtained in control (15.55).

Leaf area

The data on Leaf area and the result is given in Table 3 and depleted in Fig. 3. It is obvious from the data that Leaf area were significantly affected due to different treatments. Leaf area 1were substantially increased up to maturity. The maximum were recorded in the treatment of T_7B @ 300ppm. The control treatment showed minimum Leaf area notwithstanding, the increasing trend was observed with increasing doses of foliar application. AT 25 DAS treatment B @ 300ppm was found to be highest leaf area (161.52) statistically superior and at par to treatment Zn @ 150ppm followed by Zn @ 100ppm, B @ 200ppm, Zn @ 50ppm, B @100ppm. Minimum leaf area was obtained in control (139.35). AT 50 DAS treatment B @ 300ppm was found to be highest leaf area (621.50) statistically superior and at par to treatment Zn @ 150ppm followed by Zn @ 100ppm, B @ 200ppm, Zn @ 50ppm, B @100ppm. Minimum leaf area was obtained in control (536.75). At Maturity treatment B @ 300ppm was found to be highest leaf area (969.74) statistically superior and followed by Zn @ 150ppm, Zn @ 100ppm, B @ 200ppm, Zn @ 50ppm, B @100ppm. Minimum leaf area was obtained in control (837.45) (Shamsuddoha *et al.,* 2011).

Relative Growth Rate

The data on Relative Growth Rate and the result is given in Table 4, and depleted in Fig. 4. The critical examination of the data reveal that thickest plants were observed in the treatment of T_7 when B @ 300ppm was applied as compared to minimum relative growth rate in control at all stages of crop growth. The relative growth rate was increasing up to 50 DAS to at maturity thereafter rate of growth become slower in all the treatments. 25 DAS to 50 DAS treatment B @ 300ppm was found to be highest relative growth rate (32.59) statistically superior and at par to treatment Zn @ 150ppm followed by Zn @ 100ppm, B @ 200ppm Zn @ 50ppm, B @ 100ppm. Minimum relative growth rate was obtained in control (28.15). 50 DAS to Maturity treatment B @ 300ppm was found to be highest relative growth rate (16.73) statistically superior and at par to treatment Zn @ 150ppm, Zn @ 100ppm, B @ 200ppm followed by Zn @ 50ppm, B @ 100ppm. Minimum relative growth rate was obtained in control (14.44) (Patra *et al.,* 2009).

Table.1 Effect of plant height (cm) under different treatments

Treatments	Plant heights (cm)		
	25 DAS	50 DAS	At maturity
T_1: Control	13.75	31.26	32.40
T_2: Zn 50ppm	17.24	33.95	35.09
T_3: Zn 100ppm	17.73	35.12	36.26
T_4: Zn 150ppm	18.27	35.99	37.13
T_5: B 100ppm	17.00	33.49	34.63
T_6: B 200ppm	17.58	34.64	35.78
T_7: B 300ppm	18.47	36.38	37.52
SE ± (d)	1.45	1.67	1.71
CD at (0.05%)	2.66	3.25	3.34

Table.2 Effect of No. of leaves plant^{-1} under different treatments

Treatments	No. of leaves plant^{-1}		
	25 DAS	50 DAS	At maturity
T_1: Control	9.85	14.15	15.55
T_2: Zn 50ppm	12.35	17.74	19.49
T_3: Zn 100ppm	12.97	18.63	20.05
T_4: Zn 150ppm	13.85	19.90	20.66
T_5: B 100ppm	12.25	17.60	19.22
T_6: B 200ppm	12.90	18.53	19.88
T_7: B 300ppm	13.62	19.56	20.76
SE ± (d)	0.89	0.92	1.02
CD at (0.05%)	1.56	1.89	2.05

Table.3 Effect of Leaf area under different treatments

Treatments	Leaf area (cm^2)		
	25 DAS	50 DAS	At maturity
T_1: Control	139.35	536.75	837.45
T_2: Zn 50ppm	150.94	581.38	907.08
T_3: Zn 100ppm	155.97	600.76	937.32
T_4: Zn 150 ppm	159.70	615.14	959.76
T_5: B 100 ppm	148.92	573.61	894.96
T_6: B 200 ppm	153.88	592.71	924.76
T_7: B 300 ppm	161.52	621.50	969.74
SE ± (d)	2.34	2.89	3.69
CD at (0.05%)	4.67	5.76	7.02

Table.4 Effect of Relative Growth Rate under different treatments

Treatments	Relative Growth Rate ($mgg^{-1}day^{-1}$)	
	25 to 50 DAS	50 DAS to At maturity
T_1: Control	28.15	14.44
T_2: Zn 50ppm	30.49	15.66
T_3: Zn 100ppm	31.51	16.17
T_4: Zn 150 ppm	32.26	16.56
T_5: B 100 ppm	30.08	15.44
T_6: B 200 ppm	31.08	15.96
T_7: B 300 ppm	32.59	16.73
SE ± (d)	0.56	0.45
CD at (0.05%)	1.07	0.98

Table.5 Effect of No. of Pods plant^{-1}under different treatments

Treatments	No. of Pods plant^{-1}	
	50 DAS	At maturity
T_1: Control	6.69	8.71
T_2: Zn 50ppm	7.49	10.02
T_3: Zn 100ppm	7.77	10.47
T_4: Zn 150 ppm	7.93	10.71
T_5: B 100 ppm	7.42	9.99
T_6: B 200 ppm	7.67	10.34
T_7: B 300 ppm	8.09	10.85
SE ± (d)	1.01	1.56
CD at (0.05%)	2.03	2.76

Table.6 Effect of Leaf dry weight (g) plant^{-1} under different treatments

Treatments	Leaf dry weight (g) plant^{-1}		
	25 DAS	50 DAS	At maturity
T_1: Control	1.156	1.245	2.295
T_2: Zn 50ppm	1.330	1.432	2.641
T_3: Zn 100ppm	1.389	1.496	2.758
T_4: Zn 150 ppm	1.421	1.530	2.820
T_5: B 100 ppm	1.325	1.428	2.632
T_6: B 200 ppm	1.372	1.478	2.724
T_7: B 300 ppm	1.440	1.550	2.858
SE ± (d)	0.08	0.12	0.23
CD at (0.05%)	0.16	0.25	0.47

Table.7 Effect of Dry weight of stem (g) plant^{-1} under different treatments

Treatments	Dry weight of stem (g) plant^{-1}		
	25 DAS	50 DAS	At maturity
T_1: Control	0.885	0.979	1.297
T_2: Zn 50ppm	1.018	1.126	1.492
T_3: Zn 100ppm	1.064	1.177	1.559
T_4: Zn 150 ppm	1.088	1.202	1.594
T_5: B 100 ppm	1.015	1.123	1.487
T_6: B 200 ppm	1.051	1.162	1.540
T_7: B 300 ppm	1.102	1.219	1.615
SE ± (d)	0.78	0.83	0.91
CD at (0.05%)	1.67	1.74	1.89

Table.8 Effect of Dry weight of whole plant^{-1} (g) under different treatments

Treatments	Dry weight of whole plant^{-1} (g)		
	25 DAS	50 DAS	At maturity
T_1: Control	2.201	2.224	3.603
T_2: Zn 50ppm	2.348	2.559	4.133
T_3: Zn 100ppm	2.456	2.673	4.318
T_4: Zn 150 ppm	2.509	2.733	4.414
T_5: B 100 ppm	2.340	2.510	4.119
T_6: B 200 ppm	2.423	2.640	4.264
T_7: B 300 ppm	2.542	2.769	4.473
SE ± (d)	0.36	0.39	0.67
CD at (0.05%)	1.02	1.23	1.56

Table.9 Effect of No. of branches plant^{-1} under different treatments

Treatments	No. of branches plant^{-1}		
	25 DAS	50 DAS	At maturity
T_1: Control	1.845	3.675	3.592
T_2: Zn 50ppm	2.116	3.871	4.097
T_3: Zn 100ppm	2.211	4.045	4.260
T_4: Zn 150 ppm	2.260	4.135	4.387
T_5: B 100 ppm	2.109	3.858	4.084
T_6: B 200 ppm	2.183	3.994	4.228
T_7: B 300 ppm	2.290	4.190	4.435
SE ± (d)	0.09	0.15	0.23
CD at (0.05%)	0.20	0.32	0.48

Table.10 Effect of No. of seed Pods^{-1} and No. of seed Plant^{-1} under different treatments

Treatments	No. of seed Pods^{-1}	No. of seed Plant^{-1}
T_1: Control	8.91	91.33
T_2: Zn 50ppm	10.21	104.72
T_3: Zn 100ppm	10.62	108.88
T_4: Zn 150 ppm	10.94	112.13
T_5: B 100 ppm	10.18	104.39
T_6: B 200 ppm	10.54	108.08
T_7: B 300 ppm	10.66	113.37
SE ± (d)	0.23	0.26
CD at (0.05%)	0.49	0.57

Table.11 Effect of Grain weight plant^{-1} (g) and 1000- seed weight (g) under different treatments

Treatments	Grain weight plant^{-1} (g)	1000- seed weight (g)
T_1: Control	3.45	27.93
T_2: Zn 50ppm	3.96	30.51
T_3: Zn 100ppm	4.11	30.73
T_4: Zn 150 ppm	4.24	30.93
T_5: B 100 ppm	3.95	29.88
T_6: B 200 ppm	4.08	30.03
T_7: B 300 ppm	4.28	31.01
SE ± (d)	0.56	1.78
CD at (0.05%)	1.27	3.68

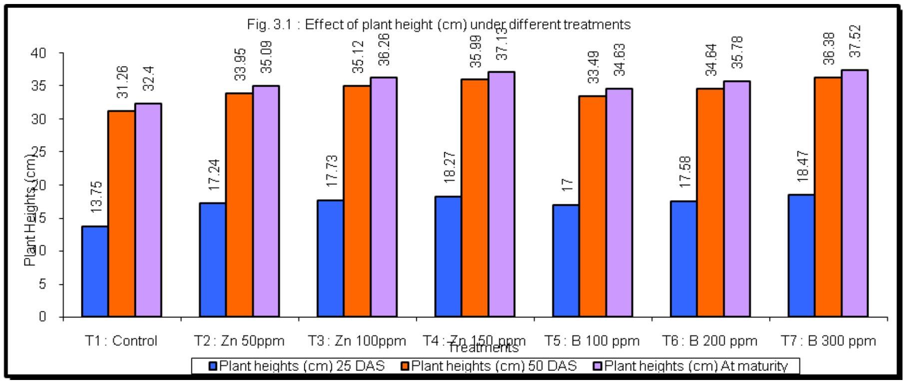


Fig. 3.1 : Effect of plant height (cm) under different treatments
Plant Heights (cm)
13.75 31.26 32.4
17.24 33.95 35.09
17.73 35.12 36.26
18.27 35.99 37.13
17 33.49 34.63
17.58 34.64 35.78
18.47 36.38 37.52
T1 : Control
T2 : Zn 50ppm
T3 : Zn 100ppm
T4 : Zn 150 ppm
T5 : B 100 ppm
T6 : B 200 ppm
T7 : B 300 ppm
Treatments
Plant heights (cm) 25 DAS
Plant heights (cm) 50 DAS
Plant heights (cm) At maturity

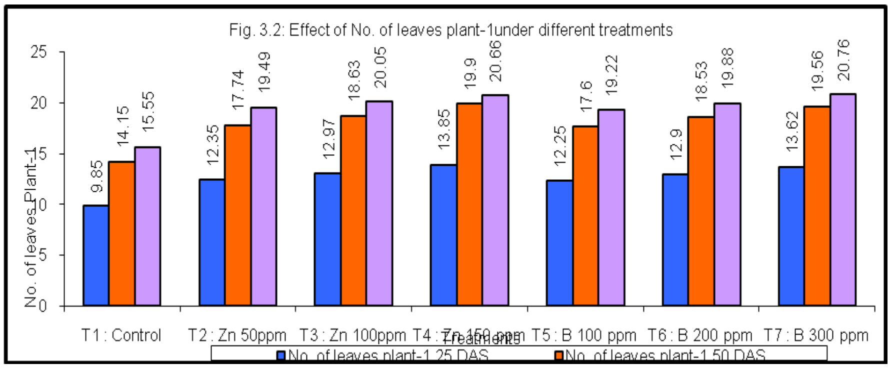


Fig. 3.2: Effect of No. of leaves plant-1under different treatments
No. of leaves Plant-1
9.85 14.15 15.55
12.35 17.74 19.49
12.97 18.63 20.05
13.85 19.9 20.66
12.25 17.6 19.22
12.9 18.53 19.88
13.62 19.56 20.76
T1 : Control
T2 : Zn 50ppm
T3 : Zn 100ppm
T4 : Zn 150 ppm
T5 : B 100 ppm
T6 : B 200 ppm
T7 : B 300 ppm
Treatments
No. of leaves plant-1 25 DAS
No. of leaves plant-1 50 DAS

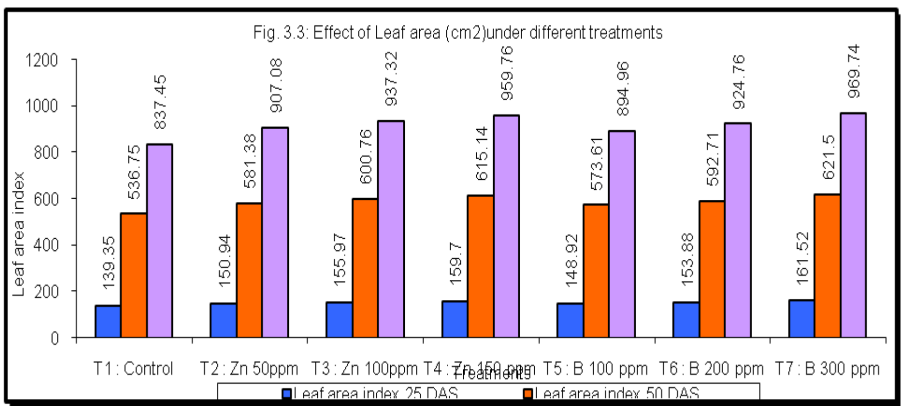


Fig. 3.3: Effect of Leaf area (cm2)under different treatments
Leaf area index
139.35 536.75 837.45
150.94 581.38 907.08
155.97 600.76 937.32
159.7 615.14 959.76
148.92 573.61 894.96
153.88 592.71 924.76
161.52 621.5 969.74
T1 : Control
T2 : Zn 50ppm
T3 : Zn 100ppm
T4 : Zn 150 ppm
T5 : B 100 ppm
T6 : B 200 ppm
T7 : B 300 ppm
Treatments
Leaf area index 25 DAS
Leaf area index 50 DAS

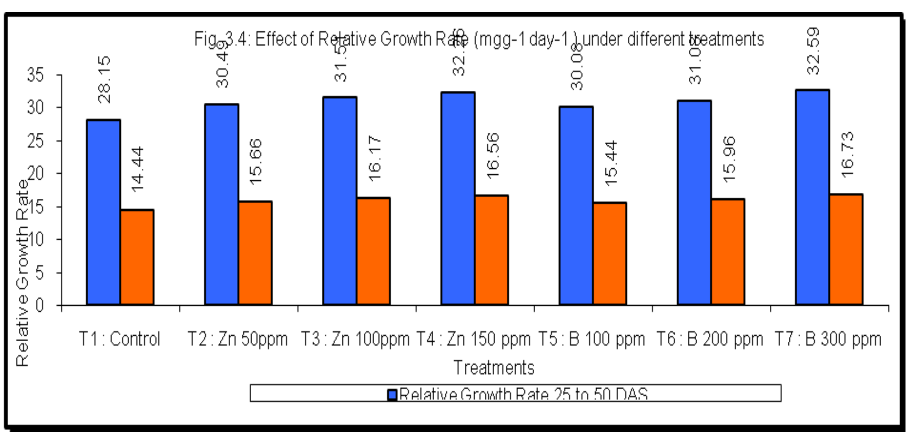


Fig. 3.4: Effect of Relative Growth Rate (mgg-1 day-1) under different treatments
Relative Growth Rate
28.15 14.44
15.66
16.17
16.56
15.44
15.96
32.59 16.73
T1 : Control
T2 : Zn 50ppm
T3 : Zn 100ppm
T4 : Zn 150 ppm
T5 : B 100 ppm
T6 : B 200 ppm
T7 : B 300 ppm
Treatments
Relative Growth Rate 25 to 50 DAS

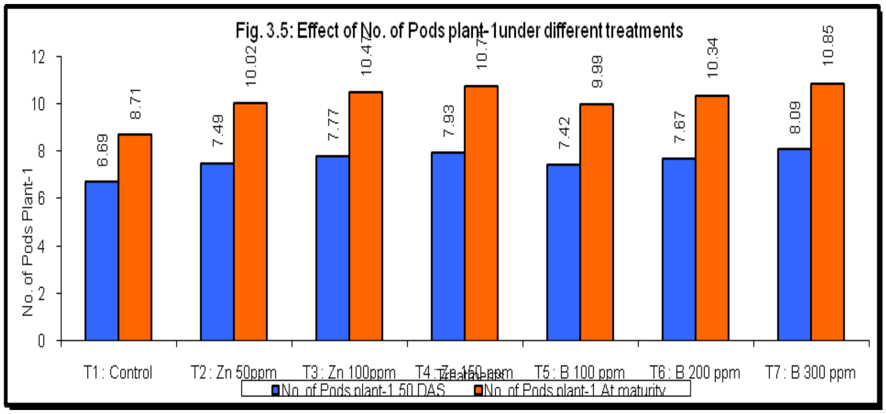


Fig. 3.5: Effect of No. of Pods plant-1under different treatments

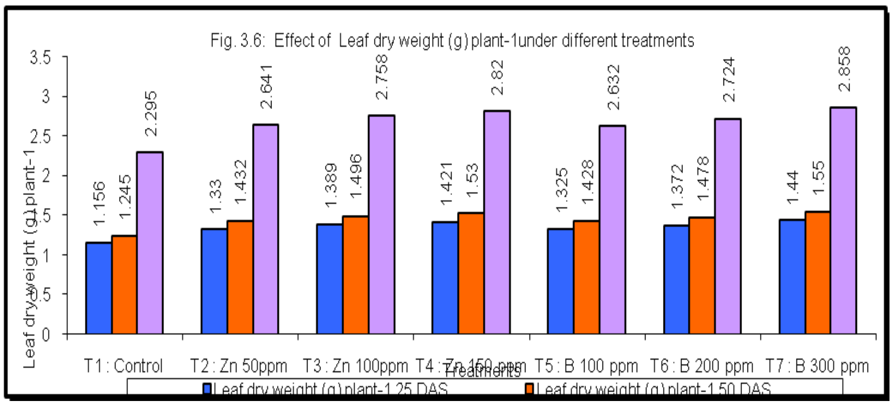


Fig. 3.6: Effect of Leaf dry weight (g) plant-1under different treatments

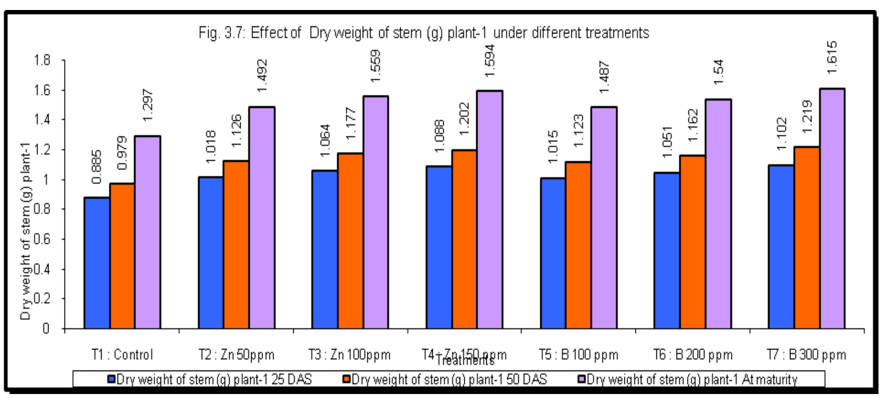


Fig. 3.7: Effect of Dry weight of stem (g) plant-1 under different treatments

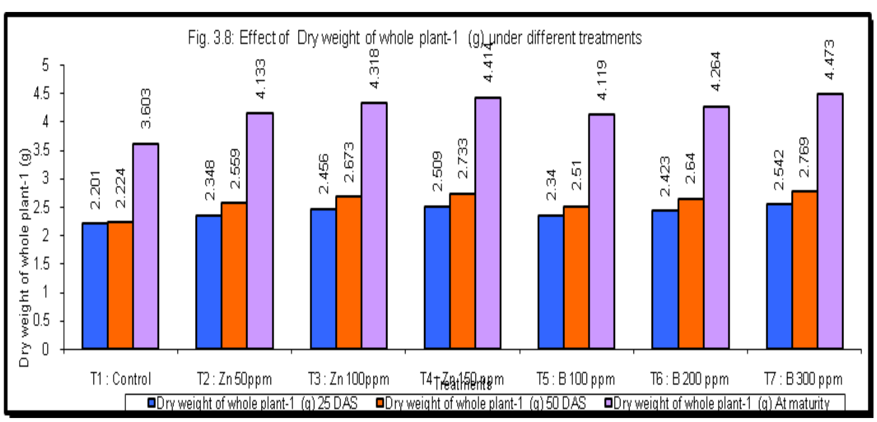


Fig. 3.8: Effect of Dry weight of whole plant-1 (g) under different treatments

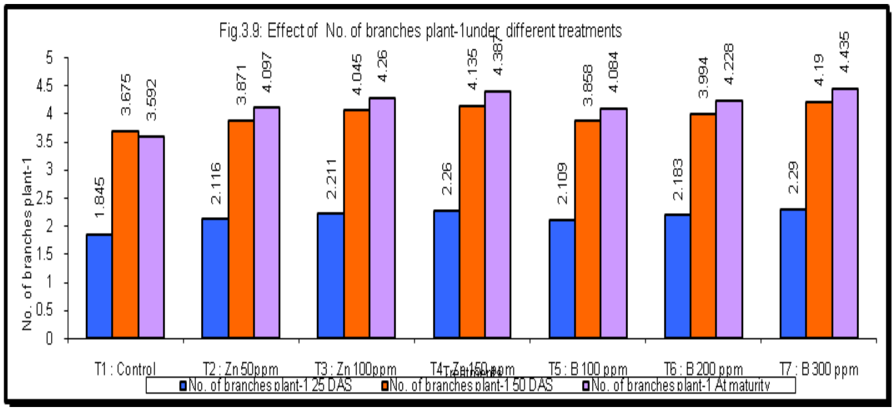


Fig.3.9: Effect of No. of branches plant-1under different treatments

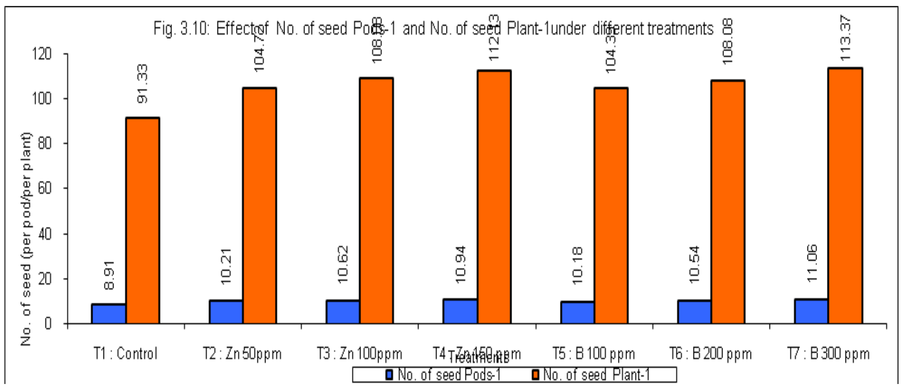
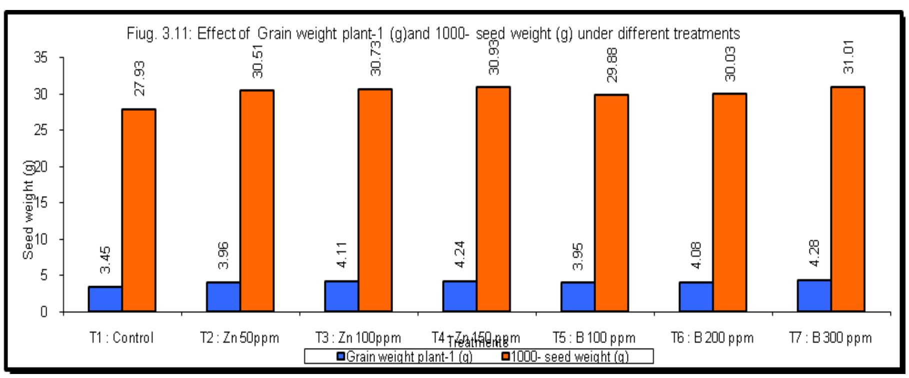


Fig. 3.10: Effect of No. of seed Pods-1 and No. of seed Plant-1under different treatments



Fiug. 3.11: Effect of Grain weight plant-1 (g)and 1000- seed weight (g) under different treatments

Leaf dry weight (g) plant^{-1}

The Leaf dry weight (g) plant^{-1} and the result is given in Table 5, and depleted in Fig. 5. A perusal of the data indicates that leaf dry weight (g) plant^{-1}was substantially and significantly affected due to different treatments. Leaf dry weight (g) plant^{-1} ranged from 1.156 to 2.858 (g) in control and T_7, respectively. At 25 DAS treatment B @ 300ppm was found to be highest leaf dry weightplant^{-1}(1.44 g) statistically superior and at par to treatment Zn @ 150ppm, Zn @ 100ppm, B @ 200ppm, Zn @ 50ppm, B @ 100ppm. Minimum leaf dry weight plant^{-1}was obtained in control (1.156 g). At 50 DAS treatment B @ 300ppm was found to be highest leaf dry weight plant^{-1}(1.550 g) statistically superior and at par to treatment Zn @ 150ppm, Zn @ 100ppm, B @ 200ppm, Zn @ 50ppm, B @ 100ppm. Minimum leaf dry weight plant^{-1}was obtained in control

(1.245 g). At Maturity treatment B @ 300ppm was found to be highest leaf dry weight plant^{-1}(2.858 g) statistically superior and at par to treatment Zn @ 150ppm, Zn @ 100ppm, B @ 200ppm, Zn @ 50ppm, B @ 100ppm. Minimum leaf dry weight plant^{-1}was obtained in control (2.295 g) (Saha *et al.,* 1996; Gowthami *et al.,* 2014)

Dry weight of stem (g) plant^{-1}

The Dry weight of stem (g) plant^{-1} and the result is given in Table 6, and depleted in Fig. 6. A perusal of the data indicates that dry weight of stem (g) plant^{-1}was substantially and significantly affected due to different treatments. Dry weight of stem (g) plant^{-1}ranged from 0.885 to 1.615 (g) in control and T_7, respectively. At 25 DAS treatment B @ 300ppm was found to be highest stem dry weight plant^{-1}(1.102 g) statistically superior and at par to treatment Zn @ 150ppm, Zn @ 100ppm, B @ 200ppm, Zn @ 50ppm, B @ 100ppm. Minimum stem dry weight plant^{-1}was obtained in control (0.885 g). At 50 DAS treatment B @ 300ppm was found to be highest stem dry weight plant^{-1}(1.219 g) statistically superior and at par to treatment Zn @ 150ppm, Zn @ 100ppm, B @ 200ppm, Zn @ 50ppm, B @ 100ppm. Minimum stem dry weight plant^{-1} was obtained in control (0.979 g). At Maturity treatment B @ 300ppm was found to be highest stem dry weight plant^{-1} (1.615 g) statistically superior and at par to treatment Zn @ 150ppm, Zn @ 100ppm, B @ 200ppm, Zn @ 50ppm, B @ 100ppm. Minimum stem dry weight plant^{-1} was obtained in control (1.297 g) (Novoselova *et al.,* 1977; Valenciano *et al.,* 2001; Chatterjee *et al.,* 2015).

Dry weight of whole plant^{-1} (g)

The Dry weight of whole plant^{-1} (g) and the result is given in Table 7 and depleted in Fig. 3.7. It is evident from the data that dry weight of whole plant^{-1} (g) ranged from 2.201 to 4.473 g under different treatments. The minimum and maximum values were obtained from control and treatment of T_7 which received B @ 300ppm. Furthermore, it is apparent heal their seeds were obtained with higher doses of Zn foliar application as compared to control. Therefore, it was found significantly in increasing trend, more precisely 4.414 percent in treatment of T_4. At 25 DAS treatment B @ 300ppm was found to be highest whole dry weight plant^{-1}(2.542 g) statistically superior and at par to treatment Zn @ 150ppm, Zn @ 100ppm, B @ 200ppm, Zn @ 50ppm, B @ 100ppm. Minimum whole dry weight plant^{-1} was obtained in control (2.201 g). At 50 DAS treatment B @ 300ppm was found to be highest whole dry weight plant^{-1}(2.769 g) statistically superior and at par to treatment Zn @ 150ppm, Zn @ 100ppm, B @ 200ppm, Zn @ 50ppm, B @ 100ppm. Minimum whole dry weight plant^{-1}was obtained in control (2.224 g). At Maturity treatment B @ 300ppm was found to be highest whole dry weight plant^{-1} (4.473 g) statistically superior and at par to treatment Zn @ 150ppm, Zn @ 100ppm, B @ 200ppm, Zn @ 50ppm, B @ 100ppm. Minimum whole dry weight plant^{-1}was obtained in control (3.603 g) (Bellaloui *et al.,* 2009).

No. of branches plant^{-1}

The No. of branches plant^{-1} and the result is given in Table 8 and depleted in Fig. 8. It was observed that increasing levels of foliar application significantly influenced the No. of branches plant^{-1}. Successive increase in different doses of foliar application treatments significantly enhanced the No. of branches plant^{-1}. The treatment T_7 is getting B @ 300ppm. The corresponding lowest values were obtained under control. At 25 DAS treatment B @ 300ppm was found to be highest no of branches plant^{-1}(2.290) statistically superior and at par to treatment

Zn @ 150ppm, Zn @ 100ppm, B @ 200ppm,, Zn @ 50ppm, B @ 100ppm. Minimum no of branches plant^{-1}was obtained in control (1.845). At 50 DAS treatment B @ 300ppm was found to be highest no of branches plant^{-1}(4.190) statistically superior and at par to treatment Zn @ 150ppm, Zn @ 100ppm, B @ 200ppm, Zn @ 50ppm followed by B @ 100ppm. Minimum no of branches plant^{-1}was obtained in control (3.675). At Maturity treatment B @ 300ppm was found to be highest no of branches plant^{-1}(4.435) statistically superior and at par to treatment Zn @ 150ppm, Zn @ 100ppm, B @ 200ppm,, Zn @ 50ppm, B @ 100ppm. Minimum no of branches plant^{-1}was obtained in control (3.592) (Singh, 2012a; Singh *et al.,* 2014; Alam *et al.,* 2017).

No. of Pods plant^{-1}

The number of pods plant^{-1} and the result is given in Table 9, and depleted in Fig. 9. The scrutiny of the data clearly indicates that number of pods plant^{-1}occurred in between 50 and at maturity days after sowing. Significant variations were observed under different treatments. Simultaneously, number of pods plant^{-1}maximum treatment of T_7 when B @ 300ppm was applied as compared to control. Similarly, Zn were observed in between 50 DAS to at maturity lowest T_1: Control and highest values being under control and T_7 respectively. At 50 DAS treatment B @ 300ppm was found to be highest No of pod plant^{-1} (8.09) statistically superior and at par to treatment Zn @ 150ppm, Zn @ 100ppm,B @ 200ppm, Zn @ 50ppm, B @ 100ppm. Minimum no of pod plant^{-1} was obtained in control (6.69). At maturity treatment B @ 300ppm was found to be highest No of pod plant^{-1}(10.85) statistically superior and at par to treatment Zn @ 150ppm, Zn @ 100ppm, B @ 200ppm, Zn @ 50ppm, B @ 100ppm. Minimum no of pod plant^{-1} was obtained in control (8.71) (Balachander *et al.,* 2003; Shil *et al.,* 2007; Quddus *et al.,* 2012).

No. of seed Pods^{-1} and No. of seed Plant^{-1}

The No. of seed pods^{-1} and No. of seed Plant^{-1} and the result is given in Table 10 and depleted in Fig. 10. A critical review of the data showed that the different mungbean treatments under the test differ significantly in No. of seed pods^{-1}. The maximum No. of seed pods^{-1} was observed in treatment of T_7: B @ 300ppm (11.06) followed by treatments of T_4: Zn @ 150ppm (10.94) and it was latest in treatment of T_1: Control (8.91). In respect of No. of seed Plant^{-1}M_1: Without mulch was observed significantly maximum No. of seed Plant^{-1} (113.37) followed by T_7: B @ 300ppm and was latest with the T_1: Control (91.33) during the experimentation. No of Seed Pods^{-1}treatment B @ 300ppm was found to be maximum no of seed pods^{-1} (10.66) statistically superior and at par to treatment Zn @ 150ppm, Zn @ 100ppm followed by B @ 200ppm, Zn @ 50ppm, B @ 100ppm. Minimum no of seed pods^{-1} was obtained in control (8.91). No of seed Plant^{-1}treatment B @ 300ppm was found to be maximum no of seed Plant^{-1}(113.37) statistically superior and followed by treatment Zn @ 150ppm, Zn @ 100ppm, B @ 200ppm, Zn @ 50ppm, B @ 100ppm. Minimum no of seed Plant^{-1}was obtained in control (91.33) (Chakraborty, 2005).

Grain weight plant^{-1} (g) and 1000- seed weight (g)

The Grain weight plant^{-1} (g) and 1000- seed weight (g) and the result is given in Table 11 and depleted in Fig. 11. A critical review of the data showed that the different mungbean treatments under the test differ significantly in Grain weight plant^{-1} (g). The maximum Grain weight plant^{-1} (g) was observed in treatment of T_7: B @ 300ppm (4.28) followed by treatments of T_4: Zn @ 150ppm (4.24) and it was latest in treatment of T_1: Control (3.45). It is evident from the data that 1000 seed weight ranged from 27.93 to 31.01 g under different treatments. The minimum and maximum values were obtained from control and treatment of T_7 which received B @ 300ppm (Bharti *et al.,* 2002).

Grain weight plant^{-1} (g)treatment B @ 300ppm was found to be highest grain weight plant ^{1}(4.28) statistically superior and at par to treatment Zn @ 150ppm, Zn @ 100ppm, B @ 200ppm,, Zn @ 50ppm, B @ 100ppm. Lowest grain weight plant^{-1}was obtained in control (3.45) (Konthoujam *et al.,* 2009), Mondal *et al.*, 2012).

Test Weight or Weight of 1000 seed treatment B @ 300ppm was found to be highest test weight (31.01) statistically superior and at par to treatment Zn @ 150ppm, Zn @ 100ppm, B @ 200ppm, Zn @ 50ppm, B @ 100ppm. Lowest test weight was obtained in control (27.93) (Mondal *et al.*, 2005; Rahman *et al.*, 2005).

It can be concluded that foliar application of boron @ 300ppm incorporated as foliar application have fetched highest plant height, higher no of branches plant$^{-1,}$ higher no leaf plant$^{-1,}$ higher leaf area index plant$^{-1,}$ maximum dry matter production plant^{-1} (g), maximum value of RGR (mg/g/day) plant^{-1}, high no of pod plant$^{-1,}$ high no of seed plant$^{-1,}$ maximum seed weight (g) plant^{-1} , maximum value of 1000 seed weight (g) for higher productivity along with seed production.

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