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Effect of macronutrients and priming of micronutrients on growth parameter, yield and grain quality of linseed

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Abstract
A field experiment was conducted at the research of farm Oilseed Research Station, Latur under VNMKV, Parbhani during the period of *Rabi,* 2018 and 2019 to evaluate the "Effect of macro nutrients and priming of micronutrient on growth parameter, yield and grain quality of linseed." Replicated thrice the experiment was laid out in Randomized Block Design (RBD) with 12 treatments viz,T_1: absolute control,T_2: Only RDF,T_3:RDF + Zn@ 3g kg^{-1} seed,T_4 :RDF + B @ 3g kg^{-1} seed,T_5: RDF+ Fe@ 3g kg^{-1} seed.,T_6: RDF + S @ 3g kg^{-1} seed,T_7: RDF + *Zn*+ B each @ 3g/kg^{-1} seed,T_8: RDF + *Zn*+ B +Mo each @ 3g kg^{-1} seed,T_9:RDF + *Zn*+ B + Mo + Fe each @ 3g kg^{-1} seed,T_{10}: RDF + *Zn*+ B + Mo + Fe+ S each @ 3g kg^{-1} seed,T_{11}:RDF + *Rhizobium* + PSB each @ 10 ml kg^{-1} seed,T_{12}: Without RDF + *Zn*+ B + Mo + Fe + S each @ 3g kg^{-1} seed. The results showed that methods of micronutrient application through seed priming along with RDF treatment T_{10} proved its superiority over rest of treatments on growth and yield parameter characters. The results revealed that treatment T_{10} receiving *Zn*+ B + Mo + Fe+ S each@ 3g kg^{-1}seed application along with RDF recorded maximum germination percentage, plant height, leaf area, root density, number of pods, and final plant stand percentages as well as noticed highest grain yield, dry matter yield and total biological yield of linseed. Further, results indicated that test weight, protein and oil percentage were significantly improved with the application of treatment $T_{10.}$ The lowest values related to all parameters were obtained in control plot treatment.

Keywords: macronutrient, nutrient, priming, linseed yield, quality

Introduction
Linseed (*Linum usitatissimum*) is one of the important *rabi* oilseed crops of India grown for both seeds and fibers. Every part of the linseed plant is utilized commercially, either directly or after processing. Seed contains 33 to 47 per cent of oil. Linseed oil is used for human consumption and contains (> 66 percent) α- linolenic acid (ALA) and widely used as nutritional and functional food in the western world due to its high contents of therapeutic health promoting sustains such as omega-3 fatty acid, soluble and insoluble fiber and lignin. Omega -3fatty acid helps to reduce the risk of cardiovascular disease and cancer. Linseed is a cool season crop. The crop is well suited to tracts of low rainfall and is generally raised where the average annual rainfall ranges from 45 to 75 cm. India contributes about 14.88% and 6.57% of world's area and production respectively. The area under linseed in Maharashtra is 39 thousand ha, with an annual production of 10 thousand tones.

Micronutrients are known to play many complex roles in plant development and health. These include photosynthesis, chlorophyll synthesis, respiration, enzyme function and formation of hormones, metabolic processes, nitrogen fixation, cell division and development, regulation of water uptake. Produce higher yields and increase harvest quality maximizing a plant's genetic potential have a great impact on root development, fruit setting and grain filling, seed viability and plant vigor and health.

Nutrient seed priming is a technique in which seeds are soaked in a mineral nutrient solution with subsequent re-drying to the initial moisture content. Micronutrient seed treatment which includes seed priming and seed coating, are an attractive and easy alternative. Treating seeds with micronutrients potentially provides a simple inexpensive method for improving micronutrient plant nutrition (Farooq *et al*., 2012) [5] The success and effectiveness of seed priming with micronutrient depends on the nutrient used, coating material, soil type, moisture and fertility status and the nutrient seed ratio (Halmer, 2008) [7]. Seed priming is employed for better crop stand and higher yields in a range of crops.

Material and Methods

The experiment was conducted on Linseed variety (LSL-93) during the *Rabi* season of the year 2018 and 2019 at research farm of ORS, Latur. The land of the experimental site was prepared by one ploughing and two harrowing, leveling and layout was done. The experiment was laid out in randomized block design with three replications and twelve treatments of micronutrient priming. Five micronutrient elements i.e. Zinc *($ZnSO_4$)*, Iron *($FeSO_4$)* Boron (H_3BO_3) Elemental sulphur (S), and Ammonium *molybdenum (Mo)* were used for priming purpose *@3g kg^{-1} of seed and* bio fertilizer *Rhizobium* + *PSB* 10 ml *kg^{-1}* of seed. *In rabi* season sowing of linseed was carried out on 26th October 2018 and 10th November 2019 by dibbling method as randomly replicated plot having size 5.4× $4.5m^2$ maintained row to row spacing 30 cm and plant to plant 5 cm All the plots were fertilized with recommended dose of NPK (40:20:00 kg ha^{-1}) The crop was harvested at maturity on 09th February, 2019 and 5th March 2020. The observation recorded viz. plant height, leaf area, root density at flowering, pod formation and at harvest stage. The grain yield parameters viz., no. of pods per plant, seed yield, fodder yield, total biomass yield was recorded at harvest stage. Quality parameter like protein, oil content and test weight value were recorded. The data collected from the above observation were analysed statistically by the procedure prescribed by Panse and Sukhatme (1967) [19].

Result and Discussion

Plant height (cm)

Priming response of plant height is given in Table 1**.** Significantly highest plant height of linseed was recorded with priming micronutrients *Zn*+ B + Mo + Fe+ S each @ 3g kg^{-1} seed along with recommended dose of fertilizers and closely followed by treatments T_9, T_8, T_7, T_6, T_3 and which are at par with each other at flowering, pod development and at harvest stage of linseed. While minimum value of plant height of linseed was recorded in treatment T_1 absolute control at all growth stage of linseed respectively, during the years of 2018, 2019 and pooled data.

Table 1: Plant height (cm) at various growth stages of soybean as influenced by macronutrients treatments of and priming micronutrients

	Flowering stage			Pod development stage			Harvesting stage		
	2018	**2019**	**Pooled**	**2018**	**2019**	**Pooled**	**2018**	**2019**	**Pooled**
T_1	23.80	23.80	23.80	30.73	31.40	31.07	30.47	32.20	31.33
T_2	24.87	24.47	24.67	33.87	32.60	33.23	31.53	32.60	32.07
T_3	27.87	26.00	26.93	34.07	34.53	34.30	34.00	33.20	33.60
T_4	25.20	25.47	25.33	34.00	35.33	34.67	34.00	32.67	33.33
T_5	28.07	25.53	26.80	36.00	35.07	35.53	34.27	33.27	33.77
T_6	25.93	26.33	26.13	35.80	35.60	35.70	34.13	33.33	33.73
T_7	27.80	26.27	27.03	35.67	34.47	35.07	34.00	32.87	33.43
T_8	28.60	26.33	27.47	36.20	34.73	35.47	34.27	33.73	34.00
T_9	26.67	28.13	27.40	35.92	35.33	35.63	33.87	34.53	34.20
T_{10}	29.07	28.40	28.73	37.67	36.07	36.87	36.07	35.27	35.67
T_{11}	27.67	26.73	27.20	36.80	34.40	35.60	33.27	34.27	33.77
T_{12}	27.53	24.13	25.83	33.47	32.07	32.77	31.60	32.47	32.03
SE ±	1.007	0.847	0.676	0.976	0.774	0.513	0.630	0.589	0.430
CD at5%	2.973	2.484	1.984	2.861	2.269	1.504	1.860	1.727	1.260
GM	26.92	25.97	26.44	35.02	34.30	34.66	33.46	33.37	33.41

The magnitude of increase in plant height of linseed to the tune of 20.71, 18.02 and 13.85 per cent at flowering, pod development and harvest stage of linseed respectively over absolute control. Increase in plant height might be due to cell elongation, cell enlargement and more chlorophyll synthesis resulting in better plant growth due to nutrient seed priming with micronutrients treatment similar findings have been reported by Heidarian *et.al* (2019) [11] and Mahmood, *et.al.* (2019) [17] Dandoti *et. al.* (2017) [13] that showed coating of linseed seeds with the combination of Zn + B + Mo + Fe +Ca significantly higher plant height compared to all other treatments.

Root density (g/cm^3)

During the year 2018, 2019 and pooled data, root density at flowering, pod development and at harvest stage of linseed pertaining in Table 2 was recorded significantly maximum in seed priming treatment T_{10} due to the application of treatment receiving RDF + Zn+ B + Mo + Fe+ S each @ 3g kg^{-1}seed priming and closely followed by treatments T_9, T_8,T_7,T_6,T_5,T_{11} which were found at par with each other and minimum root density of linseed was recorded in treatment T_1 absolute control respectively. However, in pooled mean increment in root density was noted up to the extent of 40.90, 30.76 and 44.82 percent at flowering, pod development and harvest stage of linseed respectively. Our results are also correlated with the findings of Gandhi *et.al.* (2017) [6] found maximum root length where boron was used at the lowest concentration Munawar *et.al* (2013) [14] found seed priming with Zn., Mn and Mn (1.5,1.5 and 2 per cent) solution showed highest root length in carrot respectively.

Table 2: Root density (g/cm^3) at various growth stages of soybean as influenced by macronutrients and priming treatments of micronutrients

	Flowering stage			Pod development stage			Harvesting stage		
	2018	2019	Pooled	2018	2019	Pooled	2018	2019	Pooled
T_1	0.21	0.22	0.22	0.28	0.24	0.26	0.28	0.30	0.29
T_2	0.22	0.23	0.23	0.31	0.25	0.28	0.32	0.33	0.33
T_3	0.23	0.24	0.23	0.34	0.33	0.33	0.33	0.36	0.34
T_4	0.24	0.25	0.25	0.32	0.31	0.31	0.36	0.35	0.36
T_5	0.25	0.24	0.24	0.31	0.32	0.31	0.40	0.37	0.38
T_6	0.26	0.27	0.26	0.33	0.33	0.33	0.40	0.38	0.39
T_7	0.27	0.28	0.27	0.30	0.32	0.31	0.41	0.39	0.40
T_8	0.28	0.28	0.28	0.33	0.33	0.33	0.42	0.40	0.41
T_9	0.30	0.29	0.29	0.34	0.33	0.34	0.43	0.41	0.42
T_{10}	0.32	0.31	0.31	0.35	0.32	0.34	0.43	0.42	0.42
T_{11}	0.24	0.27	0.25	0.34	0.31	0.33	0.42	0.36	0.39
T_{12}	0.22	0.22	0.22	0.29	0.26	0.27	0.31	0.32	0.32
SE ±	0.01	0.01	0.014	0.01	0.02	0.012	0.03	0.01	0.023
CD at5%	0.04	0.04	0.041	0.04	0.05	0.036	0.09	0.05	0.067
GM	0.25	0.26	0.26	0.32	0.30	0.31	0.38	0.37	0.37

Leaf area (sq. cm per plant)

Significantly highest leaf area at flowering, pod development, harvesting stage of linseed, recorded in treatment T_{10} due to application of RDF and *Z*n+ B + Mo + Fe+ S each @ 3g kg^{-1} seed, priming during the year 2018,2019 and pooled data and followed by treatments T_9, T_8,T_7which were found at par with each other and minimum leaf area value in treatment T_1 absolute control. These results opined that the inclusion of micronutrients like *Z*n+ B + Mo + Fe+ S seed @ 3g kg^{-1} each along with RDF has synergetic effect. Micronutrient elements play a critical role in plants that lead to increase of leaf area. The increase in leaf area per plant in present investigation is in accordance with the finding of Dandoti *et.al.* (2017) [13] showed coating of linseed seeds with the combination of Zn + B + Mo + Fe+ Ca recorded significantly higher leaf area and Badiri *et.al* (2014) [2] who reported priming the plantain seeds with Zn, Mn and Fe significantly increased leaf area.

Table 3: Leaf area (sq. cm per plant) at various growth stages of soybean as influenced by macronutrients and priming treatments of micronutrients

Tr.	Flowering stage			Pod development stage			Harvesting stage		
	2018	2019	Pooled	2018	2019	Pooled	2018	2019	Pooled
T_1	23.31	20.31	21.81	28.83	30.23	29.53	13.84	11.97	12.91
T_2	31.59	28.59	30.09	33.03	34.45	33.74	16.95	13.44	15.19
T_3	29.77	26.77	28.27	36.09	37.15	36.62	17.72	15.05	16.39
T_4	34.59	31.59	33.09	36.95	36.12	36.54	16.81	15.21	16.01
T_5	37.61	34.61	36.11	42.25	40.80	41.52	17.12	14.76	15.94
T_6	37.31	34.31	35.81	46.70	43.41	45.05	17.52	15.72	16.62
T_7	36.79	33.79	35.29	42.78	43.82	43.30	17.19	16.53	16.86
T_8	45.34	42.34	43.84	48.19	42.79	45.49	17.51	16.18	16.85
T_9	43.22	40.22	41.72	44.07	47.37	45.72	18.42	17.08	17.75
T_{10}	48.36	45.36	46.86	52.62	46.81	49.72	18.82	17.25	18.04
T_{11}	27.62	24.62	26.12	38.81	38.64	38.73	16.08	15.41	15.75
T_{12}	29.24	26.24	27.74	34.80	34.27	34.54	15.08	13.89	14.48
SE ±	2.53	1.340	2.24	2.24	1.85	1.888	0.85	0.83	0.720
CD at 5%	7.42	3.931	6.61	6.61	5.42	5.539	2.50	2.43	2.112
GM	35.40	32.40	33.90	40.43	39.66	40.04	16.92	15.21	16.06

No. of pods per plant

From the data year 2018, 2019 and pooled analysis presented table no 4, revealed that highest number of pods per plant at harvest stage of linseed in treatment T_{10} (40.73, 37.47 and 39.10) due to application of RDF and Zn+ B + Mo + Fe+ S each @ 3g kg^{-1} seed priming and followed by treatments T_9, and T_8 and at par with each other. While minimum number of pods per plant was recorded in treatment T_1 (28.20, 23.67 and 95.93) absolute control. Moreover, 50.79 per cent increase number of pods per plant at harvest stage of linseed due to nutrient priming with *Z*n+ B + Mo + Fe+ S each @ 3g kg^{-1}seed along with recommended dose of fertilizer. Inclusion of micronutrients through priming with recommended dose of fertilizer has synergistic effect. Similar results were obtained by Harris *et al*., (2007) [9] Ali *et.al*. (2018) [15] Barangule.*et.al*. (2018) [3] reported maximum pods branch^{-1} was obtained from those seeds that were primed with boron Dandoti *et.al.* (2017) [13] found coating of linseed seeds with the combination of Zn + B + Mo + Fe +Ca of seed recorded significantly maximum number of capsules per plant, compared to all other treatments.

Table 4: No of pods, Weight of pods per plant (gm) and final plant stand percentage at harvest stages of soybean as influenced macronutrients and priming treatments of micronutrients

Tr.	No of pods			Weight of pods			Final plant stand (%)		
	2018	2019	Pooled	2018	2019	Pooled	2018	2019	Pooled
T_1	28.20	23.67	25.93	3.04	3.73	3.39	85.30	83.55	84.42
T_2	31.33	26.00	28.67	3.20	3.89	3.54	90.29	89.89	90.09
T_3	33.73	29.53	31.63	4.25	4.34	4.30	95.45	94.60	95.03
T_4	34.33	27.13	30.73	4.47	4.31	4.39	95.08	94.51	94.79
T_5	35.47	26.53	31.00	4.41	4.05	4.23	96.00	94.27	95.13
T_6	37.47	29.00	33.23	4.64	4.37	4.51	96.71	95.24	95.98
T_7	38.47	30.00	34.23	4.54	4.77	4.66	96.57	93.51	95.04
T_8	37.40	34.80	36.10	4.75	5.11	4.93	97.51	96.35	96.93
T_9	38.13	35.53	36.83	5.15	5.29	5.22	97.73	94.79	96.26
T_{10}	40.73	37.47	39.10	5.05	5.44	5.25	98.41	96.97	97.69
T_{11}	35.33	33.20	34.27	4.51	4.92	4.72	98.27	92.97	95.62
T_{12}	29.33	25.60	27.47	3.98	4.08	4.03	92.31	91.71	92.01
SE ±	2.442	1.77	1.484	0.293	0.305	0.243	1.490	1.624	1.374
CD at 5%	7.161	5.19	4.353	0.860	0.894	0.713	4.369	4.763	4.030
GM	34.99	29.87	32.43	4.33	4.52	4.43	94.97	93.20	94.08

Weight of pods per plant (gm)
It is evident from table no. 4, weight of pods per plant of linseed during the year 2018,treatment T_9 (5.15 gm per plant) receiving RDF + *Z*n+ B + Mo + Fe each @ 3g kg^{-1} seed priming was significantly superior over rest of all treatment and at par with treatments T_{10},T_8,T_7,T_6,T_5,T_4,T_3 and T_{11}.In the year 2019 and pooled analysis, Highest weight of pods per plant was registered due to application of RDF and *Z*n+ B + Mo + Fe+ S each @ 3g kg^{-1} seed, (5.44 and 5.25 gm per plant) seed priming and found significantly superior over rest of all treatments and at par with treatments T_9,T_8,T_7,and T_{11} and lowest value of weight of pods per plant in absolute control (3.04,3.73 and 3.39 gm per plant). Similar results were also observed by Kalpana *et.al.* (2013) [12] Dandoti *et.al* (2017) [13].

Final plants stand (per cent)
Studied in the year 2018, 2019 and pooled mean date and evident from table no.4, final plants stand percentage of linseed. The priming treatment of micronutrient *Z*n+ B + Mo + Fe+ S each @ 3g kg^{-1} seed along with NPK was significantly superior over rest of all treatment and was found at par with treatments T_9, T_8, T_7, T_6, T_5, T_4, T_3 and T_{11} and minimum final plant stand percentage was recorded in treatment T_1 absolute control

Grain yield (q ha^{-1})
The result recorded in table no. 5 for both years and pooled data during the experimental findings, among all treatments seed priming treatment T_{10} receiving RDF(40:20:00 NPK kg ha^{-1}) + *Z*n+ B + Mo + Fe+ S each @ 3g kg^{-1} seed, produced highest grain yield (12.21,8.54 and 10.38 ha^{-1} q ha^{-1}) which was significantly superior over T_9 (11.44, 7.73 and9.58 q ha^{-1}),T_8 (10.56, 8.48 and 9.52 q ha^{-1}), T_7 (11.38,7.64 and 9.51 q ha^{-1}), T_6 (9.58, 8.22and 8.90 q ha^{-1}) and T_5 (10.76 7.63and 9.19 q ha^{-1}) further observed that the seed treatment T_{10} recorded at par yield with treatments T_8, T_9, T_7, T_6, T_5,T_3 and T_{11}.The lowest seed yield of linseed was observed in treatment absolute control**.** However, in the year 2018, 2019 and pooled data increment in grain yield of linseed was noted up to the extent of 93.80, 39.08 and 66.88percentin T_{10} over T_1 absolute control respectively. These results are in compliance with the findings of Barangule.*et.al*. (2018) [03] Ali *et.al*.(2018) [15] Tahir *et al*., (2014) [24] Nutrient priming has been shown to improve crop stand establishment, drought tolerance, reduced pest damage and increased crop yield Harris *et al*., (1999) [8] Harris *et al*. (2008) [10] Patil *et.al* (2018) [20] noticed application of S increase grain yield in linseed, Diwan *et.al.* (2019) [4] found synergetic effect of sulphur and Zinc application on growth and linseed yield. This may be due to supply of nutrients from diversified sources and prolonged availability of nutrients to the growing plants.

Table 5: Grain yield, dry matter yield and total biological yield (q ha^{-1}) at harvest stages of soybean as influenced macronutrients and priming treatments of micronutrients

Tr.	Grain yield			Dry matter yield			Total biological yield		
	2018	2019	Pooled	2018	2019	Pooled	2018	2019	Pooled
T_1	6.30	6.14	6.22	7.74	9.73	8.74	14.04	15.87	14.95
T_2	7.43	6.75	7.09	8.62	10.60	9.61	16.05	17.35	16.70
T_3	9.46	8.40	8.93	9.57	12.06	10.82	19.03	20.46	19.74
T_4	9.39	8.03	8.71	10.32	11.08	10.70	19.71	19.11	19.41
T_5	10.76	7.63	9.19	10.27	11.38	10.82	21.02	19.01	20.02
T_6	9.58	8.22	8.90	9.89	12.59	11.24	19.46	20.81	20.14
T_7	11.38	7.64	9.51	9.79	11.96	10.87	21.17	19.60	20.38
T_8	10.56	8.48	9.52	10.08	11.52	10.80	20.64	20.01	20.32
T_9	11.44	7.73	9.58	10.46	11.31	10.89	21.90	19.04	20.47
T_{10}	12.21	8.54	10.38	11.92	12.62	12.27	24.13	21.17	22.65
T_{11}	9.31	8.14	8.73	9.53	11.29	10.41	18.85	19.43	19.14
T_{12}	6.39	7.05	6.72	8.65	10.46	9.56	15.04	17.51	16.28
SE ±	0.737	0.453	0.502	0.617	0.523	0.404	1.049	0.859	0.742
CD at 5%	2.163	1.328	1.471	1.811	1.534	1.184	3.077	2.520	2.175
GM	9.52	7.73	8.62	9.74	11.39	10.56	19.25	19.11	19.18

Dry matter yield (q ha^{-1})

It was observed that in the year 2018, 2019 and pooled data dry matter yield of linseed recorded highest in treatment T_{10}due to application of RDF + Zn+ B + Mo + Fe+ S each @ 3g kg^{-1} seed priming and followed by treatments T_9, T_8, T_7, and T_6which are at par each other and lowest dry matter yield of linseed was recorded in treatment T_1 absolute control. The magnitude of increase in dry matter yield of linseed with T_{10} was increased to the tune of 40.38 per cent over absolute control T_1This increase in seedling dry weight was due to better seedling length and also due to enhanced lipid utilization through glyoxylate cycle Dandoti *et.al* (2017) [13] Experimental results are in corroborate with the findings of (Badiri *et al.,* 2014) [2] reported time to emergence shortened by priming with Fe, Zn and Mn, increased total biomass and enhanced the shoot length and root length of seedlings in plantain. Ajouri *et al*. (2004) [1] observed in barley seed priming with zinc caused marked increase in accumulation of dry matter. Arif *et al*. (2007) [1] also reported that seed priming in Zinc solution had pronounced effect on dry matter yield of wheat and chickpea.

Total biological yield (q ha^{-1})

During the year 2018, 2019 and pooled mean of two years data presented in table no.5 and revealed that total biological yield of linseed, treatment T_{10} receiving RDF + Zn+ B + Mo + Fe+ S each @ 3g kg^{-1} seed, priming was significantly superior over remaining all treatments and at par with the treatment T_9, T_8, T_7 and observed low total biological yield in T_1 absolute control. Pooled mean results indicated that 28.02 per cent increase total biological yield of linseed due to priming with Zn+ B + Mo + Fe+ S each @ 3g kg^{-1}seed along with recommended dose of fertilizer. These results also coincide with the finding of Badiri *et al*. (2014) [2] who reported that total biomass significantly increased due to seed priming with Zn, Fe, Mn. Arif *et al*. (2007) [9] also reported that seed priming in zinc solution significantly affected biological yield of wheat and chickpea.

Test weight of 1000 seeds (gm)

The test weight value (gm) of linseed seeds presented in table no.6 shown that the, application of RDF + Zn+ B + Mo + Fe+ S each @ 3g kg^{-1} seed, seed priming (8.72, 8.71 and 8.72 gm) was significantly superior over remaining all treatments and at par with the treatment T_9,T_8 and T_7. While minimum test weight value observed in absolute control in the experimental year 2018, 2019 and pooled analysis. Moreover, pooled mean results indicated that, as compared to control treatment 16.26 per cent increased test weight 1000 seeds (gm) of linseed due to nutrient priming with Zn+ B + Mo + Fe+ S each @ 3g kg^{-1}seed along with recommended dose of fertilizer. These results are in conformity with the findings of Arif *et al*. (2007) who reported that seed priming increased thousand grain weights in chickpea. Greater mobilisation of photosynthes to the developing seeds by application of micronutrients might be the reason for increase in seed weight. Dandoti *et.al* (2017) [13] in linseed, Pawel (2013) [21] in soybean reported similar of effect on crops.

Protein content (per cent)

During the year 2018, 2019 and pooled analysis protein content in linseed grain recorded highest in treatment T_{10} (27.01, 27.07 and 27.04 per cent) receiving RDF + Zn+ B + Mo + Fe+ S each @ 3g kg^{-1} seed priming was significantly superior over rest of all treatments and at par with treatments T_9,T_8,T_7,T_6,and T_{11} and minimum protein content was recorded in treatment (T_1) (24.62, 23.45 and 24.03 per cent) absolute control respectively, Per cent increase over absolute control due to application of RDF and Zn+ B + Mo + Fe+ S each @ 3g kg^{-1}seed priming protein content of linseed was noted up to 12.52 per cent in pooled analysis. Increase in protein content might be due to iron and zinc which are two important elements of structure of enzymes involved in amino acids synthesis ultimately protein synthesis and there by protein content increased with the application of these micronutrients. Our results corresponds to the findings of Sarker *et al*. (2002) [23] Mirshekari *et.al* (2012) [18] and Rehman *et al.* (2012) [22] who reported priming enhanced seed performances are related to the repair and the buildup of nucleic acid, enhanced synthesis of protein.

Table 6: Test weight (1000 seeds), protein content (percent) and oil content (per cent) at harvest stages of soybean as influenced macronutrients and priming treatments of micronutrients

Tr.	Test weight (1000 seeds) gm			Protein content (percent)			Oil content (per cent)		
	2018	2019	Pooled	2018	2019	Pooled	2018	2019	Pooled
T_1	7.71	7.29	7.50	24.62	23.45	24.03	37.19	36.16	36.68
T_2	7.99	7.35	7.67	25.32	25.08	25.20	36.86	37.41	37.14
T_3	8.19	8.18	8.18	25.55	25.38	25.46	36.43	37.68	37.06
T_4	8.10	8.06	8.08	25.55	25.73	25.64	36.22	36.98	36.60
T_5	8.28	8.13	8.21	26.31	25.26	25.78	37.35	36.86	37.10
T_6	8.26	8.29	8.28	25.78	25.38	25.58	36.90	37.56	37.23
T_7	8.53	8.22	8.38	25.96	25.14	25.55	36.96	37.20	37.08
T_8	8.56	8.57	8.56	26.60	26.43	26.51	36.88	37.15	37.02
T_9	8.51	8.66	8.58	26.72	26.54	26.63	37.32	36.90	37.11
T_{10}	8.72	8.71	8.72	27.01	27.07	27.04	37.98	38.19	38.08
T_{11}	8.39	8.16	8.28	26.48	26.43	26.45	36.11	37.49	36.80
T_{12}	7.91	7.29	7.60	25.20	24.85	25.03	36.17	37.69	36.93
SE ±	0.170	0.19	0.145	0.401	0.52	0.349	0.333	0.32	0.226
CD at 5%	0.499	0.55	0.425	1.177	1.52	1.024	0.976	0.94	0.663
GM	8.26	8.08	8.17	25.92	25.56	25.74	36.86	37.27	37.07

Oil content (per cent)

The maximum oil content in linseed grain was recorded with the application of T_{10} (37.98, 38.19 and 38.08per cent) RDF and Zn+ B + Mo + Fe+ S each @ 3g kg^{-1} seed priming and at par with treatments T_9, and T_6 and noticed minimum oil content in linseed grain in treatment T_2 (36.86 per cent) only RDF in the year 2018 and also noticed minimum oil content in linseed grain (36.16 and 28.70 per cent) T_1 absolute control in year. 2019 and pooled analysis. The magnitude of increase oil content (per cent) in linseed grain with T_{10} was increased to the tune of 3.81 per cent over absolute control. The results are in conformity with the findings of Tahir (2014) [24] reported application of zinc, flax produced oil contents of flax. Nofal *et.al*.(2011) [16] induced a positive effect increasing Zn fertilization caused significant increases oil percentage. These results are in accordance with Pawel (2013) [21] in soybean.

Conclusion

Priming treatments of micronutrients Zn + B + Mo + Fe+ S each@ 3g kg1seed with recommended dose of NPK (40:20:00 kg ha-1) to linseed was better in improving growth attributes, yield attributes and quality of linseed and seed priming has been found attractive and cost effective technology that can enhance the yield associated benefits in linseed crops

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