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Research Article

Influence of Different Levels of Nano Boron on Germination and Seedling Vigour of Groundnut

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ABSTRACT

A laboratory study was conducted at All India Co-ordinated Research Project on Agro forestry, Zonal Agriculture Research Station, University of agricultural sciences, GKVK, Bengaluru to study the influence of nano boron as boron nutrient source on groundnut seed germination and seedling vigour as well as to standardize the concentration of nano boron for seed priming. There were six treatments laid out in completely randomized design with four replications. The results showed that, The higher germination (96.7 %), root length (8.30 cm and 8.90 cm), shoot length (3.20 cm and 3.46 cm) and seedling vigour index (1112 and 1195) were recorded respectively at 10 and 20 DAS,when groundnut seeds primed with nano boron at 300 ppm for about 15 minutes.

Key words: *Micronutrients, Oilseeds, Groundnut, Vegetable protein*

INTRODUCTION

India is one of the largest producer of oilseeds in the world and occupies an important position in the Indian agricultural economy. Among oilseeds, Groundnut is an important oilseed crop of India. It is the fourth most important source of edible oil and third most important source of vegetable protein. Globally, the crop is raised on 26.4 million hectares with a total production of 37.1 million MT and average productivity of 1400 kg per hectare. Annual all-season coverage of about 70 lakh hectares, India ranks first in acreage and with an output of about 85 lakh MT of shell groundnuts, accounting for second in production[1]. The average yield of groundnut in India is about 1212 kg per hectare in India which is low compare to world average productivity. Several reasons attributed for low yield in groundnut, one of the reason for low yield is nutrient deficiencies. Introduction of high yielding varieties and adoption of agricultural technology for exploiting their potential have led to wide spread deficiencies of micronutrients, especially boron as it helps in root and nodule development which directly helps in nitrogen fixation in plant tissues acting as regulator for other substances.

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The deficiency of boron in soils and in groundnut plants leads to the formation of hollow heart, which results in poor quality and low yield of kernels. The deficiency of boron could be corrected by using ammonium molybdate, agricol, solubor, boric acid, borax *etc*. However, nanotechnology has provided the feasibility of exploiting nano scale or nano structured materials as fertilizer carriers, which control the release pattern of nutrients to match the uptake pattern of crop, enhances the nutrient use efficiency and reduce cost of environmental protection. So, the nano boron may acts as an alternate source of boron and which is being recommending recently, but its effect on growth and yield of crops in general and groundnut in particular is scanty. Keeping this in view, a lab experiment was carried out to optimize the dosage of nano boron for groundnut seed priming.

MATERIAL AND METHOD

A laboratory study was conducted at All India Co-ordinated Research Project on Agro forestry, ZARS, UAS, GKVK, Bengaluru to study the influence of nano boron as boron nutrient source on groundnut seed germination, seedling vigour and to standardize the concentration of nano boron for seed priming. There were six treatments, laid out in completely randomized design with four replications. The treatment consists of soaking of groundnut seeds in water (blank) and different concentration of nano boron solutions. The treatment details are: T_1: Blank (water), T_2: Nano boron at 300 ppm, T_3: Nano boron at 600 ppm, T_4: Nano boron at 900 ppm, T_5: Nano boron at 1200 ppm, T_6: Nano boron at 1500 ppm.

Nano boron commonly called as Boron nitride which is a source of boron micronutrient having particle size of 70 nm. Since boron nitride as nano fertilizer won't dissolve in water directly because of their small size so, the nano boron particles were suspended in the hot deionised water and they are dispersed by ultrasonic vibration (100 W, 40 KHz, 50 amplitude) using sonicator for 30 minutes. The pH of the prepared suspension was found to be neutral (6.5-7.0). Cultivar ICGV 91114 seeds were soaked in different concentrations of nano boron solutions (300, 600, 900, 1200, 1500 ppm) and with water as a control in different time period (15, 30, 60 minutes). Petri plates with germination papers were used for germination test. Seeds were treated according to the treatments. After treating, seeds were uniformly placed in petriplate, using a forceps and kept at room temperature (28 ± 2 °C).

Germinated seeds were counted after 10 days of sowing. Germination per cent was estimated using the formula.

$$\text{Germination (\%)} = \frac{\text{Total no. of seeds kept for germination}}{\text{No. of germinated seeds}} \times 100$$

Root and shoot lengths of seedling were measured at 10 and 20 DAS using a measuring scale. Seedling vigour index was worked out using the formula given by Hosseein and Kasra[3].

Seedling vigor index = [Root length (cm) + Shoot length (cm)] x Germination per cent

RESULTS AND DISCUSSION

Per cent germination of groundnut recorded at 10^{th}day after sowing differed significantly due to different treatments. Seed priming of groundnut for 15 min. recorded higher per cent germination as compared to 30 and 60 min. Among different treatments, groundnut seed priming with nano boron @ 300 ppm to 600 ppm and water soaking recorded significantly higher germination per cent of 96.7 per cent over other treatments and lowest was recorded in the treatment received nano boron @ 1200 ppm and 1500 ppm (83.3 % and 76.7 % to 80.0 %, respectively with 15 and 30 min. priming). Beyond 600 ppm nano boron showed lethal effect on germination of seeds.

The results on root shoot length and seedling vigour also followed the similar trend. At 10 DAS seed priming with water for about 15 min. recorded significantly higher root length (8.5 cm) and it was on par with nano boron seed priming at 300 ppm (8.3 cm). Significantly lower root length (4.0 cm) was observed in seed priming with nano boron at 1500 ppm.

Similarly, at 20 DAS seed priming with water for 15 to 60 min. recorded significantly higher root length (8.6 to 9.1 cm) over other treatments and it was on par to nano boron seed priming at 300 ppm for 15 to 30 min. (8.8 to 8.9 cm). Significantly lower root length of 5.1 cm was recorded in groundnut seeds priming with nano boron at 1500 ppm for 30 min.

Shoot growth of groundnut as influenced by different concentration of nano boron and time intervals are presented in table 1 and 2. At 10 DAS, groundnut seeds priming with nano boron at 300 ppm for 60 min. recorded significantly higher shoot length (3.50 cm) and it was on par to nano boron @ 600 ppm and water soaking (3.3 and 3.3 cm, respectively). Significantly lower shoot length of 0.5 cm was recorded in seed priming with nano boron @ 1500 ppm for 60 minutes.

At 20 DAS, nano boron priming to groundnut seeds @ 600 ppm for 15 to 60 min.recorded significantly higher shoot length (4.1 to 4.3 cm) and was on par with water soaking for 30 to 60 minutes (3.9 to 4.6 cm).Whereas, lowest shoot length of 1.5 to 2.96 cm was recorded when seeds were primed with nano boron @ 900 to 1500 ppm for 15 to 60 minutes presented in plate 1. This may be due to role of boron in cell division, cell wall development andits extension. The similar were findings reported by Dubey[2], Naiknaware *et al.*[4] and Ravichandra *et al.*[5].

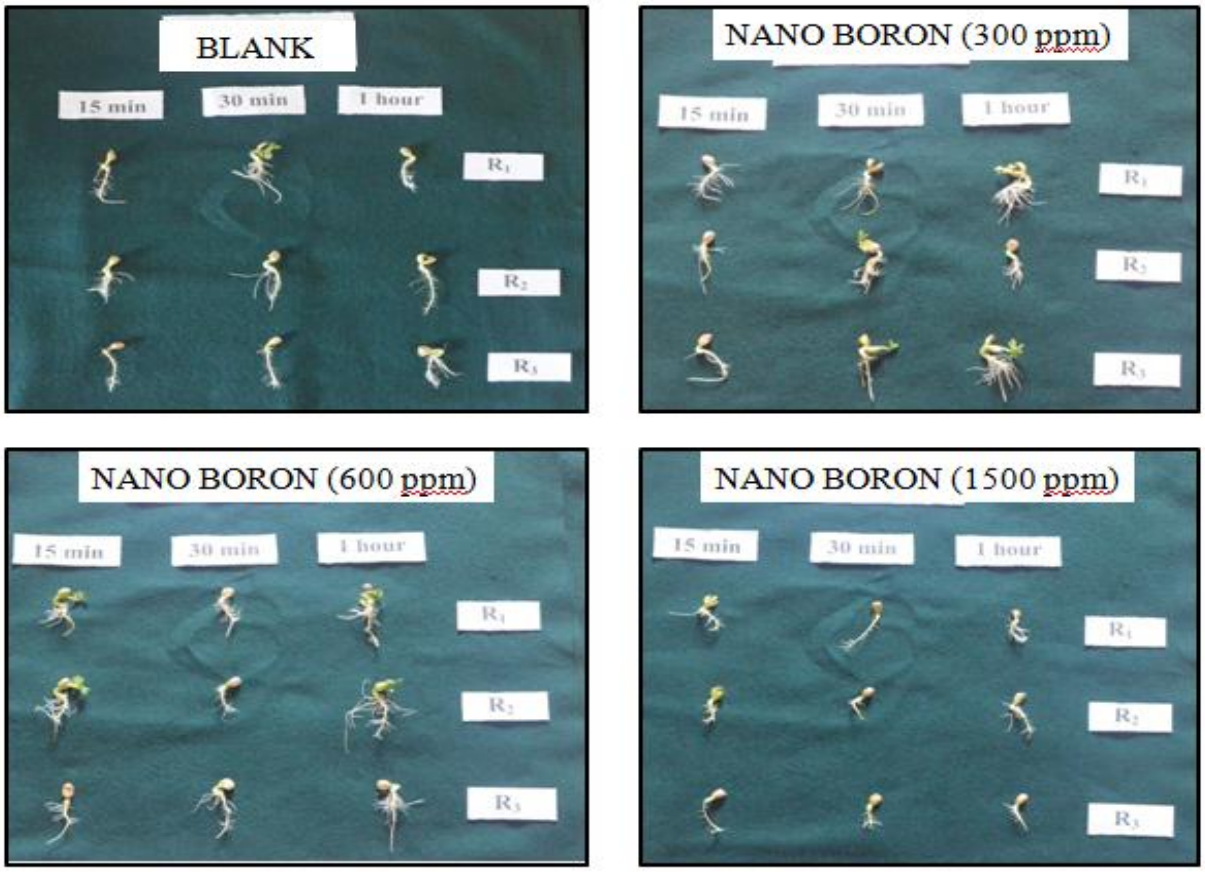

Plate 1: Influence of nano boron levels on root and shoot growth of groundnut at 20 DAS

Table 1: Germination, root length, shoot length and seedling vigour index of groundnut as influenced by nano boron levels

Treatments	Germination (%)			10 DAS								
				Root length (cm)			Shoot length (cm)			Seedling vigour index		
	15 min.	30 min.	1hr.	15 min.	30 min.	1hr.	15 min.	30 min.	1hr.	15 min.	30 min.	1hr.
Blank (water)	96.7	93.3	93.3	8.50	8.20	8.50	3.20	3.20	3.30	1131	1064	1101
Nano boron @ 300ppm	96.7	93.3	90.0	8.30	8.20	8.10	3.20	3.10	3.50	1112	1054	1044
Nano boron @ 600 ppm	96.7	90.0	90.0	7.20	8.30	7.50	3.30	3.20	3.80	1015	1035	1017
Nano boron @ 900ppm	90.0	86.7	90.0	8.00	7.20	7.00	1.80	1.60	1.00	882	763	720
Nano boron @ 1200 ppm	83.3	76.7	86.7	8.00	6.20	5.90	1.50	1.50	0.80	792	590	581
Nano boron @ 1500 ppm	83.3	80.0	83.4	4.00	4.00	4.20	1.20	1.20	0.50	433	416	392
SEm±	**1.78**	**1.49**	**1.17**	**0.12**	**0.19**	**0.15**	**0.07**	**0.09**	**0.07**	**18**	**21**	**17**
CD (*p*=0.05)	**6.34**	**5.65**	**4.67**	**0.40**	**0.61**	**0.49**	**0.26**	**0.29**	**0.26**	**58**	**64**	**55**

Table 2: Root length, shoot length and seedling vigour index of groundnut seedlings as influenced by nano boron levels

Treatments	20 DAS								
	Root length (cm)			Shoot length (cm)			Seedling vigour index		
	15 min.	30 min.	1hr.	15 min.	30 min.	1hr.	15 min.	30 min.	1hr.
Blank (water)	8.60	9.10	8.80	3.80	3.90	4.10	1199	1213	1204
Nano boron @ 300ppm	8.90	8.80	8.30	3.46	3.26	3.10	1195	1125	1026
Nano boron @ 600 ppm	8.10	8.70	8.30	4.10	4.10	4.30	1180	1152	1134
Nano boron @ 900ppm	8.40	8.70	8.10	2.96	2.93	2.94	1022	1008	994
Nano boron @ 1200 ppm	8.10	8.60	7.50	2.80	2.85	2.26	908	878	846
Nano boron @ 1500 ppm	5.20	5.10	5.50	1.50	2.10	2.14	558	576	637
SEm ±	**0.22**	**0.25**	**0.21**	**0.13**	**0.16**	**0.14**	**23**	**25**	**22**
CD (*p*=0.05)	**0.65**	**0.73**	**0.62**	**0.41**	**0.52**	**0.46**	**74**	**79**	**69**

CONCLUSION

Groundnut seeds priming with nano boron @ 300 ppm for 15 minutes would help in improving the germination, root length, shoot length and seedling vigour.

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