Original Research Article

Influence of boron and molybdenum seed priming and coating on growthand seed yield of groundnut (*Arachis hypogaea* L.)

ABSTRACT

A field experiment was conducted during *Rabi*season of 2018-19 and 2019-20 at the Experimental Farm, OUAT, Bhubaneswar to study the effect of boron and molybdenum seed priming and coating on growth and seed yieldof groundnut (*Arachis hypogaea*L.) with 21 different treatment combinations, laid out in Randomised Block Design (RBD) with three replications. The experimental findings revealed that the treatment (T_{17})seed priming with 0.5 g/l borax solution + 0.5 g/l sodium molybdate solution performed significantly higher than other treatment i.e.plant height of 11.61 cm, 29.73 cm and 39.91 cm at 30, 60 and 90 DAS, numbers of branches per plant, i.e., 5.84, 7.41 and 9.10, number of nodules per plant 44.66, 57.76, and 29.88 at 45 DAS, 60 DAS, and harvest time, least number of days to reach 50% flowering (25.57 days), least number of days to reach maturity i.e., 111.45 days and higher seed yield per hectare, i.e., 1565.70 kg ha^{-1}. In general, seed priming treatments either with borax or sodium molybdate proved to be more effective than the seed coating treatments.

Comment [D1]: Indicate the level of significance.

Keywords: boron, molybdenum, groundnut, seed priming, seed coating, growth parameters

1. INTRODUCTION

Groundnut (*Arachis hypogaea* L.) is a crop of global importance. Due to its high oil content, it is categorised as both a grain legume and an oilseed crop. It is cultivated worldwide on almost all types of soil. According to Fageria *et al.*(1997) it contains about 50% oil, 25–30% protein, 20% carbohydrate, 5% fibre and ash, making it a rich source of nutrition. It is a valuable cash crop farmed by millions of small farmers throughout the world, because of its economic and nutritional importance. Despite using the recommended amount of fertiliser (NPK, or nitrogen, phosphorus, and potassium), the yield is not as high as it could be (Sahu, 1999). Micronutrient insufficiency is one of the main reasons for the low yield of groundnuts. Intensification of agriculture, usage of straight fertilisers, rising crop requirements due to increasing productivity levels have increased the micronutrients demand in soil fertility management and are increasingly becoming major constraints to achieve agricultural production.

All India Coordinated Research Project (AICRP) on Micronutrients found that percentage of soil samples found to be deficient in micronutrients were: zinc 48.5%, boron 33%, molybdenum 13%, iron 12%, manganese 5% and copper 2.5% (Katyal and Vlek, 1985), indicating that the deficiencies of micronutrients in soils have become serious constraints for crop production. Now-a-days boron deficiency is basically an all India concern and in Odisha 80% of soils are B deficient, Dixit *et al*. (2020). In 1980 the extent of B deficiency was about 2% and it has increased to 18.3% in just 32years in India, Shukla *et al*. (2014).

Molybdenum is involved in enzyme systems relating to nitrogen fixation by bacteria growing symbiotically with legumes. Molybdenum also has an impact on protein synthesis, sulphur metabolism, and nitrogen metabolism. Because molybdenum has a significant impact on pollen production, plants lacking in molybdenum have problems producing fruit and grains. Molybdenum is also a component of the enzyme nitrogenase, which is required in N fixation and plays a role in P utilisation. Because of involvement of Mo in nitrogen fixation, legumes require more molybdenum than cereals and are hence more vulnerable to low molybdenum levels in soil. Molybdenum is also claimed to be crucial for absorption and transport of iron in plants (Subba Rao and Adinarayan, 1995).

Boron is one of the key micronutrient anions required for plant growth and development. It has been universally acknowledged as the most critical micronutrient for peanut production, however the boron demand for peanut is not as much as for some other leguminous oilseed crops. It is involved in improving the photosynthetic activity, enhances activity of enzymes and plays a significant role in protein and nucleic acid metabolism. Boron seems to be a crucial element for the maintenance of structural integrity and protects plasma membranes against peridoxidative damage (Ismail and Volkar, 1997). Besides transfer of sugar, boron helps in cell division and cell elongation, metabolism and hormone auxin transport in root cells and ATPase activity (Gupta, 2007). In addition to increasing a plant's capacity for photosynthetic and enzymatic activities, boron also promotes pollen grain germination, pollen tube growth, and pollen grain viability (Dugger, 1973). Therefore, the amount, method and timing of application of micronutrient fertiliser to the groundnut crop has a major impact on yield and quality (Veeramani and Subrahmaniyan, 2011).

The most common ways to supply micronutrients are through soil and foliar applications, but in underdeveloped nations, both approaches are limited by high-quality micronutrient fertiliser availability and expense. Micronutrient seed treatments, which include seed priming and seed coating, are an attractive and easy alternative. Micronutrient application through seed treatments improves the stand establishment, promotes phenological events, and boosts yield and micronutrient grain contents in most situations. In most cases, micronutrient application through seed treatment performed better or similar to other application methods. The delivery of micronutrients through seed treatments is simple and affordable, making it a desirable choice for farmers with limited resources, according to Farooq *et al.* (2012). The knowledge on various Mo and B concentrations and their combinations in groundnuts, however, is scant. Keeping in mind these factors, a study was conducted to determine how growth parameters and seed yield of groundnut were affected by the delivery of micronutrients through seed.

2. MATERIALS AND METHODS

2.1 Seed priming and coating treatment

The present analysis was undertaken to examine the effect of micronutrient delivery to groundnut by seed priming and coating procedures for increasing the crop growth characteristics and seed yield. Seeds of groundnut cultivar ICGV-91114 (Devi) was taken for the experiment. After initial germination test, the seeds were subjected to various seed priming and coating treatments using borax and sodium molybdate as the sources of the micronutrients, boron and molybdenum. After priming and coating procedures, seeds were dried back to original moisture content, followed by germination tests. The treated seeds were sown in the field to study their field performance.

Comment [D2]: study

2.2 Experimental site, design and treatments

The field experiment was conducted during *Rabi* season of 2018-19 and 2019-20 at the Experimental Farm of Odisha University of Agriculture and Technology, Bhubaneswar. The details of the materials used and methods adopted during the course of the investigation are presented in this chapter. The field experiment was laid out in Randomised Block Design with three replications. For comparison, the micronutrients were also applied as basal soil application and foliar sprays to the crop, along with an untreated Control. There were 21 treatments in total. The treatments included: seed priming with borax 0.1 g/l (T_1), seed priming with borax 0.5 g/l (T_2), seed priming with borax 1 g/l (T_3), seed coating with borax 100 mg/kg seed (T_4), seed coating with borax 200 mg/kg seed (T_5), seed coating with borax 300 mg/kg seed (T_6), foliar application of borax 100 ppm, 2 sprays, (T_7), soil application of borax 10 kg/ha (T_8), seed priming with sodium molybdate 0.25 g/l (T_9), seed priming with sodium molybdate 0.50 g/l (T_{10}), seed priming with sodium molybdate 0.75 g/l (T_{11}), seed coating with sodium molybdate 2 g/kg seed (T_{12}), seed coating with sodium molybdate 4 g/kg seed (T_{13}), seed coating with sodium molybdate 6 g/kg seed (T_{14}), foliar application of sodium molybdate 50 ppm, 2 sprays, (T_{15}), soil application of sodium molybdate 1.5 kg/ha (T_{16}), T_2 + T_{10} (T_{17}), T_5 + T_{13} (T_{18}), T_7 + T_{15} (T_{19}), T_8 + T_{16} (T_{20}) and Control (T_{21}). Observations on various plant growth and yield parameters, such as, plant height, number of branches per plant, number of nodules per plant, days to 50% flowering, days to maturity and seed yield per hectare were taken.

Major issues

Comment [D3]: Kindly include the following in the methodology
1. Indicate the instruments used for the measurements, the brand name, the country of origin
2. Explain how the measurements were carried out.
3. Describe the statistical software used for data analysis, the version and the year.
4. Indicate how treatment means were separated from each other.

3. RESULTS

3.1 Plant height

Plant height was recorded at 30, 60 and 90 days after planting and the pooled mean values are provided in Table 1. Irrespective of treatments, the plant height increases with the age of the plant. In general, seed priming treatments either with borax solutions or sodium molybdate solutions recorded higher plant height than seed coating treatments with borax or sodium molybdate. Among the treatments, seed priming with 0.5 g/l borax solution + 0.5 g/l sodium molybdate solution (T_{17}) recorded maximum plant height of 11.61 cm, 29.73 cm and 39.91 cm, followed by seed priming with 0.50 g/l sodium molybdate solution (T_{10}), i.e., (10.70, 27.63 and 39.88) cm at 30, 60 and 90 DAS, respectively. The treatment T_{17} was considerably superior than other treatments for 30 DAS and 60 DAS, however for 90 DAS, treatments such as (T_{10}), (T_{11}), (T_9), (T_{19}) and (T_{15}) also recorded greater plant height, which were statistically at par with the best treatment (T_{17}). Among the treatments, at 90 DAS seed priming with 0.5 g/l borax solution + 0.5 g/l sodium molybdate solution (T_{17}) recorded highest percent increase over Control which was 26.24%, followed by seed priming with 0.5, 0.75 and 0.25 g/l sodium molybdate solution and the percent increase values were 26.16%, 25.84% and 25.15%. Least percent increase in plant height over Control was reported in soil treatment with 10 kg/ha borax (T_8) which was 7.19% (Fig 1A).

3.2 Number of branches per plant

Number of branches per plant was recorded at 30, 60 and 90 days after planting and the pooled mean values are provided in Table 1. Irrespective of treatments, the number of branches per plant increased with the age of the plant. In general, seed priming treatments either with borax solutions or sodium molybdate solutions recorded higher number of branches per plant than seed coating treatments with borax or sodium molybdate. Among the treatments, seed priming with 0.5 g/l borax solution + 0.5 g/l sodium molybdate solution (T_{17}) recorded maximum numbers of branches per plant, i.e., 5.84, 7.41 and 9.10 followed by seed priming with 0.50 g/l sodium molybdate solution (T_{10}), i.e., 5.61, 7.18 and 8.87.At 30 DAS seed priming with 0.75 g/l sodium molybdate solution (T_{11}) recorded 5.58 numbers of branches per plant which was statistically at par with the best treatment. At 60 DAS, results showed that treatments such as seed priming with 0.75 g/l sodium molybdate solution (T_{11}) and seed priming with 0.25 g/l sodium molybdate solution (T_9) were statistically at par with the best treatment (T_{17}). At 90 DAS, the results showed that the treatments foliar application of 100 ppm borax solution + foliar application of 50 ppm sodium molybdate solution (T_{19}) and foliar application of 50 ppm sodium molybdate solution (T_{15}) were statistically comparable to the best treatment (T_{17}). The lowest plant height was recorded in untreated Control (T_{21}) at 30, 60 and 90 DAS for both cropping seasons.Among the treatments, at 90 DAS seed priming with 0.5 g/l borax solution + 0.5 g/l sodium molybdate solution (T_{17}) recorded highest percent increase over Control which was 20.79%, followed by seed priming with 0.5, 0.75 and 0.25 g/l sodium molybdate solution and the percent increase values were 17.75%, 17.34% and 16.54%. Least percent increase in number of branches per plant over Control was found in soil treatment with 10 kg/ha borax (T_8) which was 5.83% (Fig 1B).

3.3 Number of nodules per plant

Number of nodules per plant was recorded at 45DAP, 60 DAP and at harvest and the data presented in Table 1. Borax or sodium molybdate seed priming treatments generally resulted in a higher number of nodules per plant than borax or sodium molybdate seed coating treatments.The treatments with the highest number of nodules per plant were seed priming with 0.5 g/l borax solution + 0.5 g/l sodium molybdate solution (T_{17}), which recorded 44.66, 57.76, and 29.88 at 45 DAS, 60 DAS, and harvest time. The treatment with the second highest number of nodules per plant was seed priming with 0.50 g/l sodium molybdate solution (T_{10}), which recorded 42.49, 55.58 and 28.30. The treatment T_{17} was considerably superior than all treatments for 45 DAS, 60 DAS and harvest time. Additionally, greater plant height was observed when borax and sodium molybdate were applied together via foliar spray and soil application, respectively, at rates of 10 kg/ha of borax and 1.5 kg/ha of sodium molybdate. The lowest number of nodules per plant was recorded in untreated Control (T_{21}) at 45 DAS, 60 DAS and harvest time for both cropping seasons.At 60 DAS, the treatment with the highest percent increase over Control was seed priming with 0.5 g/l borax solution plus 0.5 g/l sodium molybdate solution (T_{17}). This treatment was followed by seed priming with 0.5, 0.75, and 0.25 g/l sodium molybdate solution, with percent increase values of 52.37%, 52.24%, and 50.24%. Least percent increase in number of nodules per plant over Control was recorded in soil application of 10 kg/ha borax (T_8) which was 5.41% (Fig 2A).

3.4 Days to 50% flowering

Number of days required to reach initiation of flowering in 50% plants in each plot was recorded for both cropping seasonsand the pooled mean values presented in Table 2. In general, seed priming treatments using borax or sodium molybdate solutions recorded fewer days to reach 50% flowering than seed coating treatments using borax or sodium molybdate (Fig. 2B). Among the treatments, seed priming with 0.5 g/l borax solution+ 0.5 g/l sodium molybdate solution (T_{17}) took least number of days to reach 50% flowering (25.57 days), followed by seed priming with 0.50 g/l sodium molybdate. Other treatments such as T_{11}, T_9, T_{19}, T_{15} and T_3 showed statistically at par result with the best treatment (T_{17}). The number of days to 50% flowering was reduced in case of seed priming treatments in comparison with seed coating treatments. Maximum number of days taken to 50% flowering was in case of untreated Control, i.e., 33.39 days.

3.5 Days to maturity

Number of days required to reach maturity was counted based on maturity indices in each plot for both cropping seasons and the pooled mean values presented in Table 2. In comparison to seed coating treatments with borax or sodium molybdate, seed priming treatments with micronutrients recorded the lowest number of days to maturity.Among the treatments, 0.5 g/l borax solution + 0.5 g/l sodium molybdate solution (T_{17}) took least number of days (111.45 days) to reach maturity, followed by seed priming with 0.50 g/l sodium molybdate solution (T_{10}) (111.70 days) (111.70 days). T_{11}, T_9, T_{19}, T_{15} and T_3 were at par with the best treatment, i.e., T_{17}.

3.6 Seed yield per hectare

Total seed yield from each plot was recorded and converted to seed yield per hectare for both cropping seasons. The pooled mean data are presented in Table 2. In general, seed priming treatments, either with borax solution or sodium molybdate solution gave higher seed yield per hectare compared to seed coating treatments, foliar spray and soil application. Among the treatments, seed priming with 0.5 g/l borax solution + 0.5 g/l sodium molybdate solution (T_{17}) gave maximum seed yield of 1565.70 kg/ha, followed by seed priming with 1 g/l borax solution (T_3), i.e., 1537.59 kg/ha. The treatment T_{17} was significantly superior over all treatments except T_1, T_2, T_3 and T_{10}. Lowest seed yield per hectare (1178.50 kg/ha) was recorded in the untreated Control (T_{21}). Among the treatments, seed priming with 0.5 g/l borax solution + 0.5 g/l sodium molybdate solution (T_{17}) recorded highest percent increase over Control which was 32.86%, followed by seed priming with 1 g/l, 0.5 g/l and 0.1 g/l borax solution. Least percent increase in seed yield per hectare over Control was recorded in foliar application of 50 ppm sodium molybdate (T_{15}) which was 3.38% (Fig 3).

4. DISCUSSION

Plant height is one of the main parameters representing vegetative growth. Results suggested that treatment T_{17} (T_2 + T_{10}), i.e., 11.61 cm, 29.73 cm and 39.91 cm at 30, 60 and 90 DAS showed considerably higher plant height in all the intervals than other treatments. The height of plant was greater in T_{17} treatment due to the application of extra boron and molybdenum by seed priming treatments. Similar results of increase in plant height with combined application of boron and molybdenum were reported by Nayak *et al*. (2009) and Duyingqiong *et al*. (2002). Among the seed priming treatments with varied concentration (0.1, 0.5, 1.0 g/l) of borax, maximum percent increase over control reported in treatment T_3 (seed priming with borax 1 g/l) in all intervals. Similar findings reported by Hirpara *et al*. (2017), Vishwakarma *et al*. (2008) and Geethanjali *et al*. (2015). Among different concentrations of sodium molybdate (0.25, 0.50 and 0.75 g/l) priming treatments and highest concentration treatment T_{10} (seed priming with sodium molybdate 0.50 g/l) found highest percent increase in all three intervals of 30 DAS, 60 DAS and 90 DAS as shown in Fig. 1A. The results have been found similar with reported by Sharma *et al*. (2017) who recorded maximum plant height at 30, 60 and 90 DAS (8.49, 19.09 and 25.89 cm), respectively as effect of molybdenum.

It was observed that treatment T_{17} (T_2 + T_{10}) has shown the maximum number of branches per plant, i.e., 5.84, 7.41 and 9.10. Significant growth in the number of branches at all intervals was found. This might be due to the involvement of micronutrients in root and shoot elongation through cell enlargement and cell division that might have enhanced the plant growth through development of vigorous and stronger root system thereby enabling the plant to derive available soil moisture and nutrients and hence resulted in increased plant height and branches per plant. Similar results were reported by Vijaya and Ponnuswamy (1998) in black gram with $ZnSO_4$ (0.2%) + $MnSO_4$ (0.2%) + Na_2MO_4 (0.1%) per kg of seed, Srimathi *et al*. (2007) in green gram due to combined hardening with $MnSO_4$ (100 ppm) and Prosopis leaf extract (1.0%) + pelleting with DAP (40 g) + $MnSO_4$ (100 mg) + $FeSO_4$ (100 mg) + ammonium molybdate (250 mg/kg) of seed and Gupta and Sahu (2012) in chickpea who recorded 25.3 percent increase in grain yield due to combined application of RDF + $FeSO_4$ (10 kg/ha) + Borax (10 kg/ha) + $ZnSO_4$ (25 kg/ha) + ammonium molybdate (1 kg/ha). Sahu *et al*. (1998) also noticed comparable outcomes when treated with combined application of Zn, B and Mo. When boron applied at the rate 5 kg/ha it gave maximum plant height and number of branches per plant in peanut plant Vishwakarma *et al*. (2008).

The treatment T_{17} (T_2 + T_{10}) showed maximum number of nodules per plant at 45 DAS, 60 DAS and at time of harvest i.e., 44.66, 57.76 and 29.88. It is well known that molybdenum is involved in nitrogen fixation through nodulation (Mengel *et al*., 2002). This might be explained by the possibility that the added molybdenum boosted IAA secretion, which encouraged an increase in the number of nodules, rate of activity, and number of rhizobia in the soil (De and Chatterjee, 1976; Soundara *et al*., 1985). Additionally, increasing the number of nodules in the soil through the application of boron as borax did so because this micronutrient is crucial for cell division during the formation of nodules. In line with the present work, Soundara *et al*. (1985), Kulkami *et al*. (1989), Bhuiyan *et al*. (1997), Tripathy *et al*. (1999) and Duraisamy and Mani (2001) have reported similar results of improved nodulation of the crop due to the application of micronutrients and bio-inoculants.

The highest reduction in days to fifty percent flowering was seen by treatment T_{17} (T_2 + T_{10}) i.e., 25.57 days in comparison to all other treatments.This early flowering may have been achieved by micronutrient priming treatments applied to the seed. Kumar *et al*. (2008) also discovered comparable outcomes when priming was done using boron. Gopalkrishnan *et al*. (1967) noted similar results, which may be related to the crop's reproductive growth period's maximum light interception.

Based on maturity indices in each plot for both crop seasons, the number of days needed to mature was calculated. Among the treatments, 0.5 g/l borax solution + 0.5 g/l sodium molybdate solution (T_{17}) took least number of days (111.45 days) to reach maturity, followed by seed priming with 0.50 g/l sodium molybdate solution (T_{10}) (111.70 days). Compared to seed priming treatments with varying concentrations of borax solutions, seed coating treatments, soil applications, and foliar sprays, sodium molybdate seed priming treatments matured seeds earlier. There is positive link between days to flowering, days to pod commencement, days to maturity and days to harvesting. Similar result was recorded by Gritton and Ebert (1975) in the field trials conducted on peanut cultivars of early and late maturing varieties sown at seven days intervals and concluded that the July sowings emerged faster and required less time to reach flowering and early harvesting.

The investigation on the impact of seed priming, seed coating, basal and foliar application of micronutrients on seed yield per hectare was studied. Among the treatments, seed priming with 0.5 g/l borax solution+ 0.5 g/l sodium molybdate solution (T_{17}) gave maximum seed yield of 1565.70 kg/ha, followed by seed priming with 1.0 g/l borax solution (T_3), i.e., 1537.59 kg/ha. Lowest seed yield per hectare (1178.50 kg/ha) was recorded in the untreated Control (T_{21}). The seed yield is an end product, which obviously depends upon the total dry matter production at different stages of crop growth and its partitioning into reproductive parts for higher production. Increase in the seed yield was may be due to boron application, it has the ability to increase photosynthetic and enzymatic activity in peanut plant and molybdenum involves in nitrogenase enzyme which is responsible for the nitrogen fixation process by bacteria, symbiotically with legumes crops. Treatment T_{17} (T_2 +T_{10}) results are supported by results of Duyingqiong *et al*. (2002). The increase in seed yield of groundnut as a result of boron and molybdenum application might be attributed to better crop stand and increase in plant height, number of pods per plant and test weight as a consequence of improvement in root growth and nodulation. These findings are in agreement with those reported by Singh *et al*. (1990), Sahu *et al*. (1995), Bhuiyan *et al*. (1997), Noor *et al*. (1997) and Shankhe *et al*. (2004). The increase in growth and yield of groundnut due to application of boron and molybdenum in combination might be attributed to complementary effect of these nutrients on growth and yield.

5. CONCLUSION

From the results of the present investigation, it can be concluded that seed priming with micronutrients, such as 0.5 g/l borax + 0.5 g/l sodium molybdate (T_{17}) for 6 hours and drying to original moisture content, followed by sowing was effective in improving plant growth parameters and seed yield. In groundnut seeds, in general, seed priming treatments either with borax or sodium molybdate proved to be more effective than the seed coating treatments. Micronutrient delivery to crops through seed priming was found to be an effective method, in comparison to the conventional soil application and foliar spray.

DATA AVAILABILITY

All data generated or analysed during this study are included in this article.

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Comment [D4]: Check and provide the DOI of all the references used except there is no DOI assigned to the manuscript.

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Table 1. Effect of seed priming and coating with borax and sodium molybdate on plant height and number of branches at 30, 60 and 90 DAS, and on number of nodules per plant at 45 DAS, 60 DAS and harvest in groundnut cv. ICGV 91114

Treatments	**Plant height (cm)**			**No. of branches plant^{-1}**			**No. of nodules plant^{-1}**		
	30 DAS	**60 DAS**	**90 DAS**	**30 DAS**	**60 DAS**	**90 DAS**	**45 DAS**	**60 DAS**	**Harvest**
T_1 : Priming with borax 0.1 g/l	10.00	26.11	37.92	5.30	6.88	8.56	34.15	47.25	24.17
T_2 : Priming with borax 0.5 g/l	10.11	26.23	38.03	5.33	6.89	8.58	34.72	47.82	24.64
T_3 : Priming with borax 1.0 g/l	10.22	26.30	38.29	5.40	6.97	8.66	36.36	49.46	25.45
T_4 : Coating with borax 100 mg/kg seed	8.89	24.99	35.20	4.92	6.49	8.17	30.04	43.14	20.02
T_5 : Coating with borax 200 mg/kg seed	8.76	25.32	34.92	4.89	6.45	8.14	29.77	42.87	19.26
T_6 : Coating with borax 300 mg/kg seed	8.72	24.82	34.83	4.83	6.40	8.08	29.64	42.74	18.64
T_7 : Two foliar sprays of borax 100 ppm	9.85	26.07	36.25	5.18	6.75	8.43	34.04	47.14	23.79
T_8 : Soil application of borax 10 kg/ha	8.15	23.90	33.89	4.72	6.28	7.97	25.36	38.45	16.32
T_9 : Priming with SM 0.25 g/l	10.61	27.26	39.57	5.52	7.09	8.78	41.71	54.81	27.76
T_{10} : Priming with SM 0.50 g/l	10.70	27.63	39.88	5.61	7.18	8.87	42.49	55.58	28.30
T_{11} : Priming with SM 0.75 g/l	10.64	27.55	39.78	5.58	7.15	8.84	42.44	55.54	27.85
T_{12} : Coating with SM 2 g/kg seed	9.08	25.41	35.58	5.10	6.67	8.35	30.33	43.43	21.70
T_{13} : Coating with SM 4 g/kg seed	9.01	25.22	35.40	5.06	6.63	8.31	30.20	43.30	21.38
T_{14} : Coating with SM 6 g/kg seed	8.97	25.14	35.32	5.00	6.56	8.25	30.11	43.21	21.34
T_{15} : Two foliar sprays of SM 50 ppm	10.27	26.57	38.47	5.46	7.02	8.71	37.29	50.39	25.91
T_{16} : Soil application of SM 1.5 kg/ha	8.26	24.20	34.38	4.72	6.29	7.97	25.70	38.79	16.51
T_{17} : $T_2 + T_{10}$	11.61	29.73	39.91	5.84	7.41	9.10	44.66	57.76	29.88
T_{18} : $T_5 + T_{13}$	9.67	25.75	35.93	5.17	6.73	8.42	32.51	45.61	22.92
T_{19} : $T_7 + T_{15}$	10.38	26.72	38.81	5.51	7.07	8.76	37.38	50.48	26.12
T_{20} : $T_8 + T_{16}$	8.48	24.74	34.52	4.78	6.34	8.03	26.26	39.35	16.61
T_{21} : CONTROL	7.90	21.44	31.61	4.28	5.84	7.53	23.38	36.48	13.54
Mean	9.54	25.77	36.59	5.15	6.72	8.41	33.26	46.36	22.48
S.E.m(±)	0.168	0.393	0.560	0.097	0.116	0.140	0.735	0.738	0.442
$CD_{0.05}$	0.470	1.102	1.571	0.271	0.326	0.393	2.063	2.071	1.241

Table 2. Effect of seed priming and coating with borax and sodium molybdate on days to flowering and days to maturity in groundnut cv. ICGV 91114

Treatments	Days to 50% flowering	Days to maturity	Seed yield (kg ha^{-1})
T_1 : Priming with borax 0.1 g/l	26.81	112.70	1489.95
T_2 : Priming with borax 0.5 g/l	26.64	112.55	1522.15
T_3 : Priming with borax 1.0 g/l	26.51	112.43	1537.59
T_4 : Coating with borax 100 mg/kg seed	28.21	114.09	1346.12
T_5 : Coating with borax 200 mg/kg seed	28.46	114.43	1334.10
T_6 : Coating with borax 300 mg/kg seed	28.84	114.76	1327.97
T_7 : Two foliar sprays of borax 100 ppm	27.26	112.77	1280.89
T_8 : Soil application of borax 10 kg/ha	30.87	115.22	1392.46
T_9 : Priming with SM 0.25 g/l	25.94	111.82	1435.82
T_{10} : Priming with SM 0.50 g/l	25.82	111.70	1465.44
T_{11} : Priming with SM 0.75 g/l	25.91	111.80	1445.65
T_{12} : Coating with SM 2 g/kg seed	27.84	113.35	1260.64
T_{13} : Coating with SM 4 g/kg seed	27.94	113.45	1244.43
T_{14} : Coating with SM 6 g/kg seed	27.97	113.85	1233.48
T_{15} : Two foliar sprays of SM 50 ppm	26.45	112.33	1218.32
T_{16} : Soil application of SM 1.5 kg/ha	30.66	115.39	1374.69
T_{17} : T_2 + T_{10}	25.57	111.45	1565.70
T_{18} : T_5 + T_{13}	27.59	113.10	1362.06
T_{19} : T_7 + T_{15}	26.15	112.03	1292.68
T_{20} : T_8 + T_{16}	29.05	114.94	1410.46
T_{21} : CONTROL	33.39	116.13	1178.50
Mean	27.80	113.35	1367.58
S.E.m(±)	0.340	1.735	37.926
$CD_{0.05}$	0.955	NS	106.411

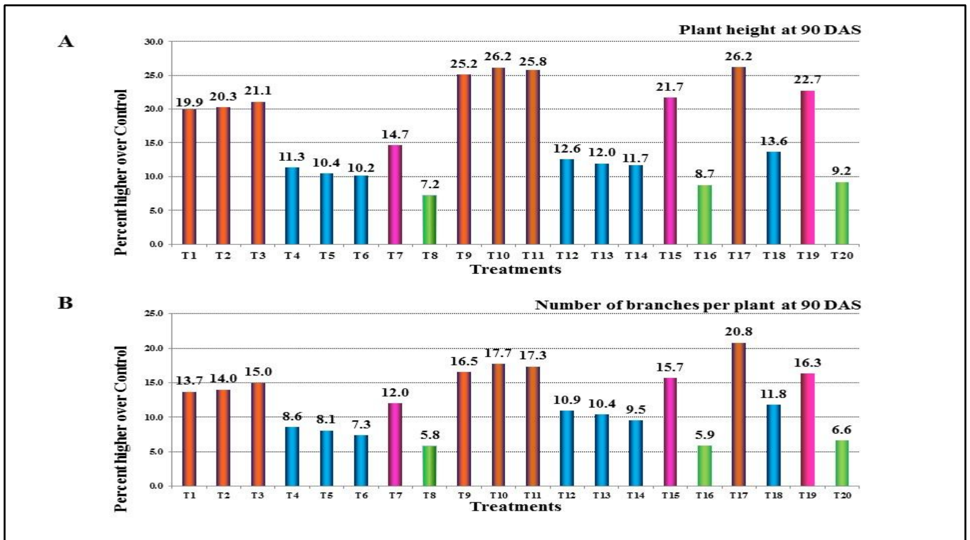

Fig 1. Percent increase in plant height (A) and number of branches per plant (B) over Control at 90 DAS as influenced by priming and coating of groundnut seeds with borax and sodium molybdate**.**

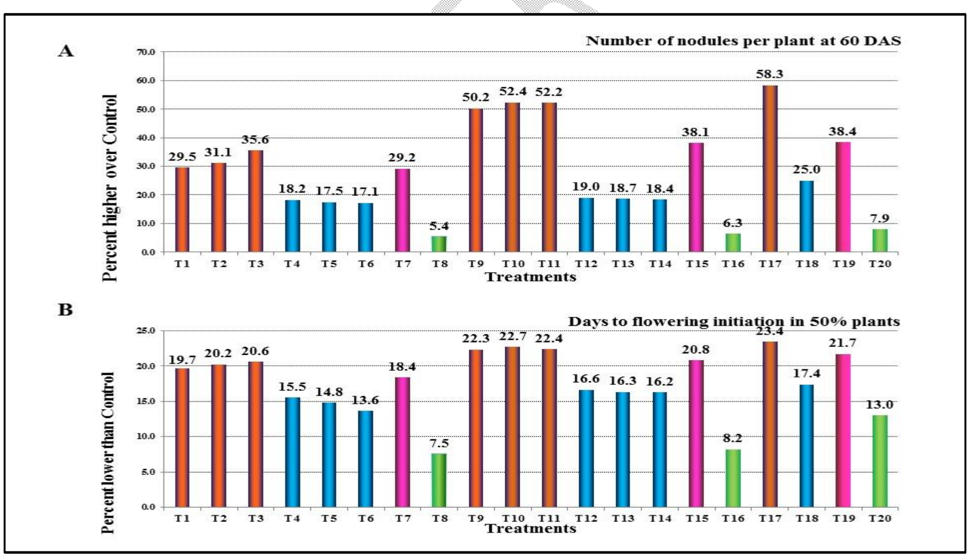

Fig 2. Percent increase in number of nodules per plant (A) over Control at 60 DAS as influenced by priming and coating of groundnut seeds with borax and sodium molybdate; Percent decrease in days to flowering initiation in 50% plants (B) over Control as influenced by priming and coating of groundnut seeds with borax and sodium molybdate.

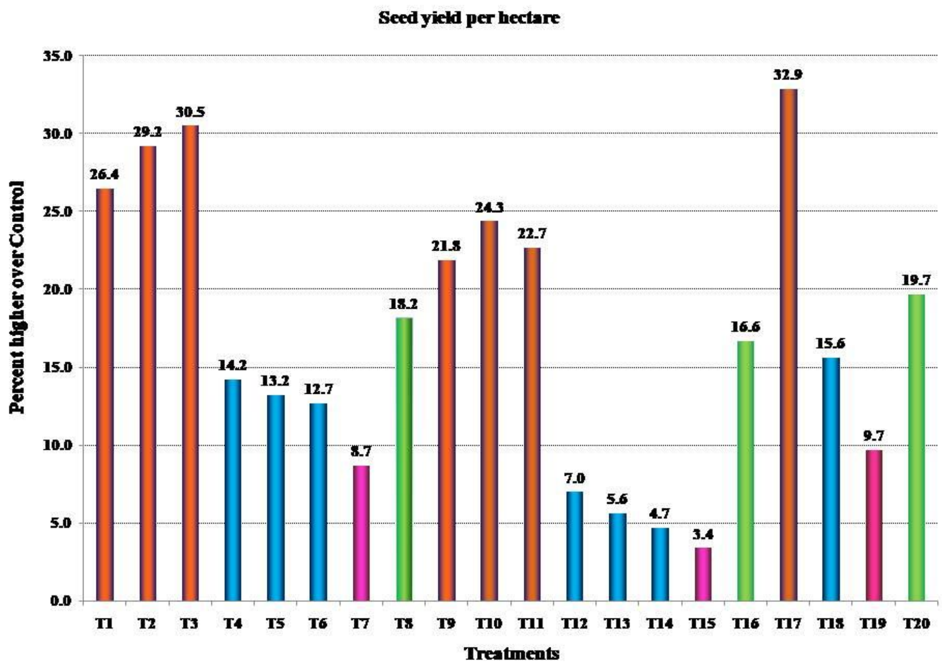

Fig 3. Percent increase in seed yield per hectare over Control as influenced by priming and coating of groundnut seeds with borax and sodium molybdate.