The Andhra Agric. J 64 (3): 623-626, 2017

Effect of Foliar Spray of Ethrel and Boron on Growth, Drymatter and Yield of Groundnut

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ABSTRACT

A field experiment was conducted during the *kharif* season of 2011-2012, at agricultural college farm, Bapatla, Andhra Pradesh to evaluate the effect of foliar application of ethrel and boron on growth, and yield of groundnut. The experiment was laid out in a randomized block design with ten treatments comprising sprays of ethrel (400 ppm), borax (0.25%) at 25 and 45 days after sowing alone and in combinations with three replications. The results revealed that foliar application of ethrel @400 ppm + boron @0.25% at 25 & 45 DAS significantly increased the plant height (59.2 cm), number of branches (43.0) number of leaves (49.9), number of flowers (36.6), leaf area (1768 cm^2) and total drymatter (43 g) over control (33.1 cm, 31.2, 30.3, 22.6, 911.3 cm^2 and 24.8g respectively). The spray of Ethrel (400ppm) + Borax (0.25%) at 25 and 45 DAS resulted in higher yield (36.3 %) over control (1980 kg/ha)

Key words: *Boron, Drymatter, Ethrel, Foliar application, Growth, Yield.*

Groundnut is an important leguminouts crop, an excellent source of plant protein (27 to 33 %), oil (45-50 %), essential minerals and vitamins (E, K, and B). In India it ranks first among the oilseed crops occupying an area of 7.28 mha with 7.85mt production and 1078 kg ha^{-1} productivity. In Andhra Pradesh, groundnut is cultivated in an area of 1.90 m ha with a production of 1.20mt and 652 kg ha^{-1} productivity which is much lower than the world's average.

For enhancing productivity of a crop, the essence of modern agriculture balanced plant nutrition is necessary in order to maintain the physical organization and metabolic processes. Apart from role of macro nutrients, the micronutrients also play an important role in regulating plant functions. Boron plays an important role in flowering, fertilization, hormonal metabolism and translocation of sugars from source to sink that contributes an increase in seed yield (Marschner, 1995; Cakmak and Romheld, 1997).

Growth regulators are known to influence a wide array of physiological processes like assimilate partitioning, flowering, enhancing nitrogen metabolism, uniform pod formation, seed quality, and delayed senescence of leaves. Among several approaches made to improve productivity, regulation of plant metabolism by using exogenous growth substances is one method.

In Andhra Pradesh, groundnut is cultivated in the sandy soils of coastal regions as a *rabi* crop. Generally, sandy soils are poor in organic matter, macro and micronutrients and furthermore, the applied nutrients are lost due to leaching ultimately resulting in lesser yields. Indeterminate growth habit in groundnut results in overlapping of growth and development phases of the reproductive and vegetative organs leading to low fruiting efficiency. The latter is due to inter organ competition for assimilates and other metabolites. Consequently, there is improper partitioning of assimilate to the developing pods and seeds. Most prominent constraint in the low yield is extended duration of flowering and variable pods sizes. Keeping this in mind, the experiment was conducted to evaluate the effectiveness of foliar application of boron and ethrel on groundnut grown on sandy soils.

MATERIAL AND METHODS

A field experiment was carried out at Agricultural College Farm, Bapatla (Andra Pradesh) during kharif season of 2011-2012 in a Randomized Block Design with three replications to study the effect of foliar application of ethrel and boron on growth and yield of groundnut. The experiment consisted of 10 treatments vz., T_1: Ethrel @ 400 ppm at 25 DAS, T_2: Ethrel @ 400 ppm at 45 DAS, T_3: Ethrel @ 400 ppm at 25 and 45 DAS,

T_4: Borax @ 0.25% at 25 DAS, T_5: Borax @ 0.25% at 45 DAS, T_6: Borax @ 0.25% at 25 and 45 DAS, T_7: Ethrel @ 400 ppm + Borax @ 0.25% at 25 DAS, T_8: Ethrel @ 400 ppm + Borax @ 0.25% at 45 DAS, T_9: Ethrel @ 400 ppm + Borax @ 0.25% at 25 and 45 DAS. The soil of the experimental field was is sandy in texture, acidic in reaction (6.1 pH) with organic carbon (0.168 %), available phosphorus (83.61 kg ha^{-1}) and available potash (100.08 kg ha^{-1}). After good tillage field was manured with well decomposed FYM @ 5 t ha^{-1}. The seeds of groundnut variety TAG 24 were sown at a spacing of 30cm x 10cm. The plots having size was 4 m x 3 m and fertilized with recommended dose of N:P:K (30:40:50 kg ha^{-1} respectively) along with gypsum @ 500 kg ha^{-1}.The cultural management and plant protection measures were undertaken as and when needed. Treatment wise spraying was given as per the schedule. Five representative plants were selected randomly in each plot, labeled properly and observations on morpho-physiological parameters, yield attributes and yield were recorded periodically. The data were analysed statistically following the analysis of varience (ANOVA) technique as suggested by Panse and Sukhathme, (1978) for Randomized Block design.

RESULTS AND DISCUSSION

The foliar spray of Ethrel and boron significantly influenced the growth and drymatter production in groundnut (Table 1).

Foliar application of Ethrel(400 ppm) + Borax(0.25%)at 25 and 45 DAS (T_9) recorded the highest plant height (59.2 cm) compared to all other treatments except Ethrel (400 ppm) + Borax (0.25%) at 45 DAS (T_8-53.3 cm). The lowest plant height was observed in control plants (33.1 cm). Maximum number of branches (43) were recorded with Ethrel(400 ppm) + Borax (0.25%)at 25 and 45 DAS (T_9) was on par with the effect of Ethrel + Borax at 45 DAS, Ethrel + Borax at 25 DAS, Ethrel at 25 and 45 DAS and Borax at 25 and 45 DAS and significantly superior to remaining treatments. More number of leaves (49.9) were recorded with Ethrel(400 ppm) + Borax (0.25%) at 25 and 45 DAS (T_9) and it was on par with the spray of Ethrel at 25 and 45 DAS (46.0), Ethrel + Borax at 25 DAS (45.8) and Ethrel at 25 and 45 DAS (45.7). Application of ethrel and boron alone and in combination sprays contributed to significant differences in number of flowers over control. Among all the treatments, spray of Ethrel + Borax at 25 and 45 DAS (T_9) recoded significantly higher value (36.6) which was on par with the sprays of Ethrel + Borax at 45 DAS (T_8 –32.4), Ethrel at 25 and 45 DAS (T_3-32.2), Borax at 25 and 45 DAS (T_6- 31.9), and Ethrel at 45 DAS (T_2- 30.1). Lower value was recorded with control. among sprays of Ethrel and Boron, Ethrel + Borax at 25 and 45 DAS (T_9) recorded significantly high leaf area (1768.0 cm^2) which was on par with the sprays Ethrel + Borax at 45 DAS (T_8 -1664.3 cm^2), and Ethrel + Borax at 25 DAS (T_7 -1479.3 cm^2). The effect of remaining sprays was on par with control except Borax at 25 and 45 DAS and also no among them differences were observed. At harvest, among all the treatments, spray of Ethrel + Borax at 25 and 45 DAS (T_9) recorded higher dry matter (43.0 g) which was on par with the sprays of Ethrel + Borax at 45 DAS (T_8 -40.3 g), Ethrel + Borax at 25 DAS (T_7- 38.3g) and Borax at 25 and 45 DAS (T_6-38.3 g). In all the above parameters increase in growth might be due to involvement of ethrel and boron in cell division and cell elongation, development of new cells in meristematic tissue and tissue differentiation, ion absorption, IAA and carbohydrate metabolism, source sink relation ship and translocation of sugars (Marschner, 1995; Cakmak & Romheld, 1997). Exogenous application of ethrel enhanced photosynthesis and higher photosynthetic rate as reflected through the total drymatter. Similar increase in growth was reported by Narasimha Rao et al., (2005) in chickpea, Bangar et al., (2010) in soybean and Rizwan Zahoor et al., (2011) in sunflower.The results are in conformity with the findings of Thakur *et al* .,(2008). Shankhe et al., (2003) in groundnut, and Mir et al., (2009b,c) in mustard.

Foliar application of ethrel and borax significantly influenced the yield and yield components in groundnut (Table 2). Among the treatments, foliar application of Ethrel@400 ppm + Borax @0.25% at 25 and 45 DAS (T_9), Ethrel @400 ppm + Borax @0.25% at 45 DAS (T_8) and Borax @0.25% at 25 and 45 DAS (T_6) recorded more number of pods (27.0, 26.0, and 26.1respectively) compared to control(22.7) .The increased number of pods by boron might be due to boron is known to play a role in IAA and carbohydrates metabolism, translocation of sugars, seed development (Singh and Vidyachowdari

Table 1. Effect of foliar application of ethrel and boron on growth attributes of groundnut.

Treatments	Plant height (cm)	Number of branches Per plant	Number of leaves per plant	Number of flowers per plant	Leaf area per plant (cm^2)	Total biomass per plant (g)
T1: Ethrel 400ppm at 25 DAS	44.2	32.0	41.8	25.1	965.0	32.0
T2: Ethrel 400ppm at 45 DAS	40.3	35.3	44.3	30.1	999.7	31.1
T3: Ethrel 400ppm at 25 and 45 DAS	50.1	41.9	46.0	32.2	1166.7	35.5
T4: Borax 0.25% at 25 DAS	47.9	32.3	40.7	27.7	1127.3	28.4
T5: Borax 0.25% at 45 DAS	44.9	33.5	41.7	29.4	1146.7	27.5
T6: Borax 0.25% at 25 and 45 DAS	49.6	41.0	43.3	31.9	1293.0	38.3
T7: Ethrel 400ppm + Borax 0.25% at 25 DAS	50.7	40.7	45.8	28.7	1479.3	38.3
T8: Ethrel 400ppm + Borax 0.25% at 45 DAS	53.3	40.3	45.7	32.4	1664.3	40.3
T9: Ethrel 400ppm + Borax 0.25% at 25 and 45 DAS	59.2	43.0	49.9	36.6	1768	43.0
T10: Water spray (control)	33.1	31.2	30.3	22.6	911.3	24.8
SEm+	2.0	1.7	1.6	2.2	103.8	1.6
CD (P=0.05)	6.0	5.2	4.9	6.6	308.3	4.8
CV (%)	7.4	8.1	6.6	12.9	14.4	8.2

,1996). The 100-kernel weight was high (47.6 g) in Ethrel @ 400 ppm + Borax @0.25% at 25 and 45 DAS (T_9) followed by T8(44.4 g), T7 (44.1g), T_6(42.9g) and T_3(42.1 g) and lowest in control (34.6 g) Table 2. Aman Verma et al. 2009, reported that 100 kernel weight was significantly enhanced with foliar application of Ethrel. The higher shelling percentage (87.1%) was observed with Ethrel@400 ppm + Borax @0.25% at 45 DAS (T_8) spray which was on par with the sprays T_9(86.3 %), T_7 (84.4 %) ,T_2(80.2 %), T_6 (79.5 %) and T_3(79.0 %) where as control it was only (65.2 %). Application of Ethrel @400 ppm + Borax@0.25% at 25 and 45 DAS (T_9) .The higher yield was obtained in foliar application of Ethrel @400 ppm + Borax @0.25% at 25 and 45 DAS (4521.5 kg ha^{-1}) followed by of Borax @0.25% at 25 and 45 DAS (4326.7 kg ha^{-1}) and Borax @0.25% at 25 DAS (2260.6 kg ha^{-1}) where as in control it was only (3700.5 kg ha^{-1}). This increased pod yield might be due to involvement of nutrient element boron, the growth regulator ethrel. Boron might have played important role in flowering, fertilization, hormonal metabolism and translocation of sugars from source to sink. The results obtained are in accordance with the findings of Narasimha Rao *et al.,* 2005. Saxena *et al*., (2007)findings support the above results that foliar spray of ethrel (250 ppm) at pre flowering and mid flowering stages of chickpea increased the yield by 11 % and 14 % respectively.

Conclusions

All the foliar sprays of ethrel and borax improved yield and yield components of groundnut. Among the treatments, Foliar application Ethrel@400 ppm + Borax@0.25% at 25 and 45 DAS (T_9) recorded higher pod yield ha^{-1}in groundnut.

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Table 2. Effect of Ethrel and Boron on yield and yield components of groundnut.

Treatments	Number of Pods / plant	100-kernels weight (g)	Shelling percentage (%)	Pod yield / plant (g)	Yield (kg/ha)	B:C Ratio
T1: Ethrel 400ppm at 25 DAS	24.2	38.1	71.2	24.2	2176.8	1.42
T2: Ethrel 400ppm at 45 DAS	24.5	40.3	80.2	24.4	2194.0	1.44
T3: Ethrel 400ppm at 25 and 45 DAS	25.2	42.1	79.0	26.4	2189.5	1.27
T4: Borax 0.25% at 25 DAS	25.2	39.7	70.1	28.3	2260.7	1.68
T5: Borax 0.25% at 45 DAS	25.2	39.3	74.8	26.5	2169.4	1.57
T6: Borax 0.25% at 25 and 45 DAS	26.1	42.9	79.5	28.4	2179.8	1.55
T7: Ethrel 400ppm + Borax 0.25% at 25 DAS	25.6	44.1	84.4	26.3	2223.7	1.46
T8: Ethrel 400ppm + Borax 0.25% at 45 DAS	26.0	44.4	87.1	26.7	2238.4	1.48
T9: Ethrel 400ppm + Borax 0.25% at 25 and 45 DAS	27.0	47.6	86.3	29.3	2700.0	1.77
T10: Water spray (control)	22.7	34.6	65.2	24.1	1980.8	1.38
SEm+	0.8	1.9	3.1	1.0	99.5	
CD (P=0.05)	2.3	5.6	9.3	3.1	295.7	
CV (%)	5.2	7.9	6.9	6.8	7.7	

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(Received on 6.09.2014 and revised on 2.06.2016)