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Effect of Foliar Spray of Kinetin and Brassinosteroid During Drought Period on Yield and Yield Components of Groundnut (*Arachis hypogaea* L.)

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ABSTRACT

A field experiment was conducted in Agricultural College Farm, Bapatla, during *rabi* 2012-13 to study the effect of foliar spray of kinetin and brassinosteroid during drought period on yield and yield components (test weight, shelling percentage and harvest index) of groundnut. The treatments comprised of foliar sprays of kinetin @ 5 ppm and 10 ppmand homobrassinolide (HBL) @ 0.5 ppm, 1 ppm and 2 ppm at 32 DAS and at 32 and 45 DAS, water stress and irrigation without foliar spray as control in RBD with three replications. The treatment plots were exposed to water stress by withholding irrigation at 30 DAS, continuing for 20 days and relieving at 50 DAS. The present study revealed that homobrassinolide @ 1 ppm at 32 and 45 DAS (T_{10}) increased harvest index over water stress (T_1) by 43.3 per cent, over irrigation without foliar spray (T_{12}) by 30.3 per cent and over other treatments by 2.4 to 26.5 per cent. Irrigation (T_{12}) increased harvest index over water stress (T_1) by 10 per cent.

Key words : Components, Ground nut, Yield

Groundnut is one of the major crops cultivated in Andhra Pradesh. The most important districts of groundnut production in Andhra Pradesh are Prakasam, Kurnool, Guntur and Krishna. Groundnut is mainly grown as a *rabi* crop in coastal sandy loam soils of Andhra Pradesh in irrigated rice fallows, unirrigated rice fallows and unirrigated upland areas. During *rabi,* drought stress poses a major threat to groundnut cultivation limiting its yield.

Brassinosteroids and kinetin are two important plant hormones in the field of Crop Physiology which provide a wide scope in plant hormone research. They are proved to be effective in improving crop health to increase productivity. They influence different developmental processes like growth, germination of seeds, rhizogenesis, flowering and senescence. Brassinosteroids and kinetin increase crop yields by changing plant metabolism and protecting plants from environmental stresses. Various analogues of BRs have proved their importance in seed germination, rhizogenesis, flowering, senescence, abscission and seed maturation (Khripach *et al.*, 2000; Rao *et al.*, 2002 and Hayat and Ahmad, 2003). Fariduddin *et al.* (2004) identified that foliar application of kinetin and 28-homobrassinolide increased the activities of nitrate reductase and carbonic anhydrase, chlorophyll and total protein contents, net photosynthetic rate in leaves and number of pods and seed yield in *Vigna radiata.* The present study has been carried out with a view to study the effect of kinetin and brassinosteroid in increasing yield of groundnut under drought condition.

MATERIAL AND METHODS

The field experiment was conducted using TAG-24 variety of groundnut during *rabi* season (2012-13) in Agricultural College Farm, Bapatla. The experimental plot was laid out in randomized block design with three replications and 12 treatments. The soil type was sandy with a pH of 7.6 which was low in organic carbon (0.4%) and available nitrogen (164.5 Kg ha^{-1}), medium in available phosphorus (25 Kg ha^{-1}) and available potassium (346.5 Kg ha^{-1}). The treatments included, water stress (T_1), water stress + kinetin @ 5 ppm at 32 DAS (T_2), water stress + kinetin @ 10 ppm at 32 DAS (T_3), water stress + kinetin @ 5 ppm at 32 and 45 DAS (T_4), water stress + kinetin @ 10 ppm at 32 and 45 DAS (T_5), water stress + HBL @ 0.5 ppm at 32 DAS (T_6), water stress + HBL @ 1 ppm at 32 DAS (T_7), water stress + HBL @ 2 ppm at 32 DAS (T_8), water stress + HBL @ 0.5 ppm at 32 and 45 DAS (T_9), water stress + HBL @ 1 ppm at 32 and 45 DAS (T_{10}),

Table 1. Effect of foliar spray of kinetin and homobrassinolide (HBL) during drought period on yield and yield components of groundnut.

Treatments	Test weight (g)	Shelling percentage	Harvest index (%)	Yield (Kg ha^{-1})
T_1:Water stress	37.13	53	30	1416.7
T_2:Water stress+kinetin @ 5ppm at 32 DAS	45.78	62	36	2206.7
T_3:Water stress+kinetin @ 10ppm at 32 DAS	44.22	58	34	1871.1
T_4:Water stress+kinetin @ 5ppm at 32 and 45 DAS	46.74	66	38	2553.3
T_5:Water stress+kinetin @ 10ppm at 32 and 45 DAS	46.12	65	37	2363.3
T_6:Water stress+HBL @ 0.5ppm at 32 DAS	45.06	61	35	2057.8
T_7:Water stress+HBL @ 1ppm at 32 DAS	48.65	70	41	3213.3
T_8: Water stress+HBL @ 2ppm at 32 DAS	47.87	68	40	3015.6
T_9:Water stress+HBL @ 0.5ppm at 32 and 45 DAS	47.44	67	39	2773.3
T_{10}:Water stress+HBL @ 1ppm at 32 and 45 DAS	49.77	75	43	3720.0
T_{11}:Water stress+HBL @ 2ppm at 32 and 45 DAS	49.37	73	42	3465.6
T_{12}:Control (without water stress and without foliar spray)	42.78	57	33	1656.7
SEm $\pm$	2.24	4.29	1.87	102.1
CD	6.56	12.59	5.50	299.4
CV(%)	8.44	11.51	8.71	7.0

water stress + HBL @ 2 ppm at 32 and 45 DAS (T_{11}) and control without water stress and without hormone spray (T_{12}). Data on test weight, shelling percentage, harvest index and yield were recorded as detailed below:

1 Test weight (g) The weight of 100 seeds drawn randomly from each treatment was recorded in three replications.

2 Shelling percentage A random sample of 200 g of pods was taken from the produce of net plot, shelled and the kernel weight was recorded to determine the shelling percentage by using the formula:

$$\text{Shelling percentage} = \frac{\text{Weight of kernels}}{\text{Weight of pods}} \times 100$$

3.Harvest index (%)

Harvest Index was computed by the following formula:

$$\text{Harvest Index} = \frac{\text{Economic yield per plant (g)}}{\text{Biological yield per plant (g)}} \times 100$$

4. Yield (kg ha^{-1})

All the plants from the net plot area were harvested and cleaned separately and were dried under shade up to the moisture content in kernel was reduced to 9%. The pod yield per ha was computed and expressed in kg ha^{-1}.

The data were analyzed statistically following analysis of variance (ANOVA) technique suggested by Panse and Sukhathme (1978) for randomized block design. The statistical hypothesis of equalities of treatment means was tested by F-test in ANOVA at 5 per cent level of significance. Critical difference was correlated at 5 per cent level of significance to compare different treatment means.

RESULTS AND DISCUSSION

Water stressed plants treated with 1 ppm HBL at 32 and 45 DAS (T_{10}) recorded higher yield (697.5 Kg ha^{-1}) and yield components (Table 1).

All the treatments recorded significantly higher test weights compared to water stress (T_1-37.13 g) and irrigation without foliar spray (T_{12}-42.78 g). Higher test weight (49.77 g) was recorded with double spray of HBL @ 1 ppm (T_{10}) which was on par with all the other treatments. Water stress + HBL @ 1 ppm at 32 and 45 DAS (T_{10}) increased test weight over water stress (T_1) by about 34.0 per cent, over control (T_{12}) by about 16.3 per cent and by about 0.8 to 12.6 per cent over other treatments. Irrigation (T_{12}) could increase test weight by 15.2 per cent over water stress (T_1). Both kinetin and brassinosteroid spray increased test weights significantly. This might be due to the efficient translocation of assimilates from source to sink. Mathur and Vyas (2007) reported an increase in test weight in Pearl millet by brassinosteroid foliar application. Amin *et al*. (2007) reported an increase in yield and yield components of eight maize hybrids by benzyl adenine application.

Foliar spray of HBL @ 1 ppm at 32 and 45 DAS (T_{10}) exhibited superior performance by increasing shelling percentage by 41.5 per cent over water stress (T_1), by 31.6 per cent over irrigation without foliar spray (T_{12}) and by 2.7 to 29.3 per cent compared to the remaining treatments. Irrigated plants (T_{12}) showed 7.5 per cent increase in shelling percentage over water stressed plants (T_1). High shelling percentage by brassinosteroid might be due to the better partitioning of biomass ultimately resulted in higher kernel yield. These findings are in accordance with those of Fariduddin *et al*. (2005) in greengram and Prakash *et al*. (2006) in groundnut.

It is evident from the present study that HBL @ 1 ppm at 32 and 45 DAS (T_{10}) increased harvest index over water stress (T_1) by 43.3 per cent, over irrigation without foliar spray (T_{12}) by 30.3 per cent and over other treatments by 2.4 to 26.5 per cent. Irrigation (T_{12}) increased harvest index over water stress (T_1) by 10 per cent. Higher harvest index resulted due to higher pod weight, stem weight and better translocation in BR treated plants.

Among all the treatments, foliar spray of HBL @ 1 ppm at 32 and 45 DAS (T_{10}) recorded higher pod yield ha^{-1}(3720 kg ha^{-1}) compared to other treatments and it is on par with water stress + HBL @ 2 ppm at 32 and 45 DAS (T_{11}-3465.6 kg ha^{-1}). Low pod yield is reported in water stressed plants (T_1-1416.7 Kg ha^{-1}). Spray of HBL @ 1 ppm at 32 and 45 DAS (T_{10}) recorded an increase in pod yield by 2.6 folds over water stress (T_1), 2.2 folds over irrigated plants without foliar spray (T_{12}) and by 15.8 to 68.6 per cent compared to the remaining treatments. The increase in yield due to the application of homobrassinolide is in consonance with the findings of Talaat and Abdallah (2010) in Fababean and Ali *et al*. (2008) in Mungbean.

CONCLUSIONS

From the study, it is concluded that the double spray of homobrassinolide @ 1ppm at 32 and 45 DAS in groundnut mitigated water stress and ultimately increased yield and its components significantly over water stress.

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