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Physiological Effect of Salicylic Acid on Pod Setting and Yield of Groundnut (*Arachis Hypogaea* L.)

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ABSTRACT

To study the effect of Salicylic acid on growth and yield of groundnut, to find out its effective concentration along with the proper stage of spraying in improving growth, yield parameters and yield of groundnut plants, present investigation was under taken with salicylic acid at 50,100 and 150ppm concentrations sprayed at three different stages *viz*., peak vegetative stage, flowering stage and peg formation stage. Number of pods per plant (15.53), pod yield per plant (6.59 g), kernel yield per plant (5.02 g), shelling percentage (76.11), harvest index (28.96), yield (2329 kg ha^{-1}) increased with spray of salicylic acid @ 150 ppm at flowering stage (T_6). Test weight (47.63 g) and oil percentage of kernels (48.90) increased with foliar spray of salicylic acid @ 150 ppm at peg formation stage (T_9).

Key words: *Groundnut, Salicylic acid, Pod setting and Yield.*

Groundnut is an important oilseed crop suitable for cultivation in tropical areas of the world. It is cultivated mainly for oilseeds and food. Seeds of groundnut are cheap source of proteins, lipids and fatty acids. It is also a rich source of minerals and vitamins. Groundnut seeds are rich source of edible oil (43.55%) as well as protein (25.28%).The cake or meal is used as animal feed and the shell sometimes used as fuel. Although the crop can be grown in all the seasons, *kharif* season production accounts for about 80 % of the total production. Groundnut is the major annual oilseed crop of India. Groundnut plays an important role in the agricultural and industrial economy of the country. Several studies revealed that significant reduction in productivity potential of groundnut in India as compared to other countries is due to reduction in acreage under peanut, insufficient rainfall, pests and diseases etc. Though, India is the largest cultivator of groundnut crop in terms of acreage, low yields kept it in the second place in terms of output. India shares 14.5 per cent in world's groundnut production with 4.69 million tonnes and the productivity of 995 kg ha^{-1} (Indiastat, 2013-14).

Salicylic acid (SA), a naturally occurring phenolic compound acting as an important signaling molecule adds to tolerance against abiotic stress such as drought (Chini *et al.*, 2004), chilling, heavy metal tolerance (Freeman *et al.*, 2005), heat (Larkindale *et al.*, 2005) and osmotic stress. In this sense, SA appears to be an effective therapeutic agent for plants. Besides this function during biotic and abiotic stress, SA plays a crucial role in the regulation of physiological and biochemical processes during the entire lifespan of the plant.

MATERIAL AND METHODS

The field experiment was conducted at "F" block of Agricultural College Farm, Bapatla, on a sandy soil in *Kharif* season, 2015. The experiment was laid out in a Randomized Block Design with three replications. The crop was fertilized with 30:40:50 kg ha^{-1}. Nitrogen was applied in two equal splits of half as basal dose and the remaining half at 30 DAS. Phosphorus and Potassium were applied as the basal dose at the time of sowing. Salicylic acid (SA) at 50,100 and 150 ppm concentrations were sprayed at peak vegetative stage(T_1, T_2 and T_3), flowering stage(T_4, T_5 and T_6) and at peg formation(T_7, T_8 and T_9) stage, respectively and water spray serve as control. The observations on growth parameters like plant height, number of branches, total dry matter accumulation, leaf area were recorded at 20 days interval starting from 15 Days after sowing (DAS). The observations on yield parameters like number of pods per plant, pod yield per plant, kernel yield per plant, Test weight,

shelling percentage, harvest index, oil percentage of kernels and yield were taken after harvest.

RESULTS AND DISCUSSION

The data related to effect of salicylic acid on yield and yield components of groundnut is presented in Table 3.

Number of pods per plant:

All the treatments significantly increased the number of pods per plant over control. Among all the treatments more number of pods per plant (15.53) was observed with the foliar spray of Salicylic acid @ 150 ppm at flowering stage (T_6). All other treatments are on par with each other but significantly high over control (T_{10}-11.89).

It is plausible that SA concentration resulted in higher number of branches plant^{-1}, consequently increased the number of pods plant^{-1}. These findings are in a good line with those obtained by Karimian *et al.* (2015) in groundnut, Kaur *et al.* (2015) in soybean, Narayanan *et al.* (2015) in black gram.

Pod weight per plant:

All the treatments significantly increased the weight of pods per plant over control. Among all the treatments higher weight of pods per plant (6.59 g) was observed with the foliar spray of Salicylic acid @ 150 ppm at flowering stage (T_6). All other treatments are on par with each other but significantly high over control (T_{10}-5.05 g).

The increase in pod dry weight per plant by exogenous application of Salicylic acid might be due to the increased total biomass and then might have resulted in an increase in assimilate transport from source to sink and their ultimate conversion into final reserved food. Similar results were also reported by Karimian *et al.* (2015) in groundnut, Narayanan *et al.* (2015) in black gram.

Kernel weight per plant:

Among all the treatments spray of Salicylic acid @ 150 ppm at flowering stage (T_6) recorded higher kernel weight per plant (5.02 g) which is on par with all the treatments except spray of Salicylic acid @ 50 ppm at peak vegetative (T_1-4.03 g) and peg formation stages (T_7-3.99 g). Remaining treatments are on par with each other but significantly high over control (T_{10}-2.94 g). These results are in accordance with those of Karimian *et al.* (2015) in groundnut, Kaur *et al.* (2015) in soybean, Narayanan *et al.* (2015) in black gram.

Oil per cent of kernels:

The effect of different treatments except spray of Salicylic acid @ 50 ppm at peak vegetative (T_1) and flowering stage (T_4) on oil content of groundnut was found to be significant. All the spray treatments resulted in an increase in seed oil content.

High oil content (48.90%) was observed with the spray of Salicylic acid @ 150 ppm at peg formation stage (T_9) which was on par with the spray of Salicylic acid @ 150 ppm at flowering stage (T_6-47.67%). All other treatments are on par with each other but significantly high over control (T_{10}-43.13).

The present findings on the promoting effect of Salicylic acid in increasing seed oil content are supported by findings of other authors like Kobeasy *et al.* (2011) in groundnut, Ahmed *et al.* (2013) in sunflower, Jadhav and Bhamburdekar (2014) in groundnut.

Test weight (g):

All the treatments recorded significantly high test weights compared to control. High test weight (47.63 g) was noted with spray of Salicylic acid @ 150 ppm at peg formation stage (T_9) which is on par with the spray of Salicylic acid @ 150 ppm at flowering stage (T_6-47.55 g), spray of Salicylic acid @ 150 ppm at peak vegetative stage (T_3-45.56 g), spray of Salicylic acid @ 100 ppm at peg formation stage (T_8-44.09 g) and spray of Salicylic acid @ 100 ppm at flowering stage (T_5-42.91 g). All other treatments are on par with each other but significantly high over control (T_{10}-34.65 g).

Spray of Salicylic acid increased test weight significantly. This might be due to the efficient translocation of assimilates from source to sink. These results are similar to the findings of Karimian *et al.* (2015) in groundnut, Narayanan *et al.* (2015) in black gram.

Shelling per cent:

The shelling percentage is higher in plants treated with spray of Salicylic acid @ 150 ppm at flowering stage (T_6-76.11 %) which is on par with

Table 1. Effect of foliar spray of salicylic acid on yield and yield components of groundnut.

Treatments	no.of pods per plant	pod yield (g) per plant	kernel yield (g) per plant	Oil % of kernels	Test weight (g)	Shelling %	Harvest Index (%)	Yield (kg ha^{-1})
T_1 : Salicylic acid @ 50 ppm at peak vegetative phase	13.94	5.92	4.03	43.85	39.63	68.20	28.79	2016.57
T_2 : Salicylic acid @ 100 ppm at peak vegetative phase	14.88	6.32	4.60	45.27	42.11	72.90	28.88	2125.76
T_3 : Salicylic acid @ 150 ppm at peak vegetative phase	15.26	6.48	4.83	46.04	45.56	74.56	28.90	2325.63
T_4 : Salicylic acid @ 50 ppm at flowering phase	14.24	6.05	4.41	44.68	39.73	72.85	28.80	2053.14
T_5 : Salicylic acid @ 100 ppm at flowering phase	15.07	6.40	4.78	45.34	42.91	74.66	28.86	2179.92
T_6: Salicylic acid @ 150 ppm at flowering phase	15.53	6.59	5.02	47.67	47.55	76.11	28.96	2328.96
T_7 : Salicylic acid @ 50 ppm at peg formation phase	13.85	5.88	3.99	44.93	40.30	67.84	28.77	1998.41
T_8 : Salicylic acid @ 100 ppm at peg formation phase	14.88	6.32	4.41	45.56	44.09	69.75	28.85	2107.63
T_9: Salicylic acid @ 150 ppm at peg formation phase	15.23	6.47	4.77	48.90	47.63	73.80	28.88	2252.70
T_{10}: control (water spray)	11.89	5.05	2.94	43.13	34.65	58.22	28.00	1816.63
Sem ±	0.62	0.26	0.206	0.53	1.68	2.87	0.77	90.10
CD (5%)	1.85	0.78	0.6127	1.56	4.98	8.54	NS	267.72
CV (%)	7.46	7.44	8.16	2.00	6.84	7.03	4.63	7.36

all the treatments. The lower value is recorded for control (T_{10}-58.22 %).

The higher shelling percentage by Salicylic acid might be due to the better partitioning of biomass ultimately resulted in higher kernel yield. These findings are in accordance with Karimian *et al.* (2015) in groundnut.

Harvest index (HI):

Among all the treatments, higher harvest index (HI) of 28.96 % is observed with spray of Salicylic acid @ 150 ppm at flowering stage (T_6) which is on par with all the treatments and with control (T_{10}-28 %).

Differences due to spraying treatments with respect to harvest index were not significant. Similar findings were reported by Mulgir *et al.*(2014) in groundnut.

Yield:

Among all the treatments spray of Salicylic acid @ 150 ppm at flowering stage (T_6) recorded higher pod yield ha^{-1} (2329 kg ha^{-1}) which is on par with spray of Salicylic acid @ 150 ppm at peak vegetative stage (T_3-2326 kg ha^{-1}), spray of Salicylic acid @ 150 ppm at peg formation stage (T_9-2253 kg ha^{-1}), spray of Salicylic acid @ 100 ppm at flowering stage (T_5-2180 kg ha^{-1}), spray of Salicylic acid @ 100 ppm at peak vegetative stage (T_2-2126 kg ha^{-1}) and spray of Salicylic acid @ 100 ppm at peg formation stage (T_8-2108 kg ha^{-1}). Remaining treatments are on par with each other and with control (T_{10}-1817 kg ha^{-1}).

This is a rational expectation since the same SA concentration gave the highest values of yield components and consequently seed yield. These results are in harmony with those obtained by Karimian *et al.* (2015) in groundnut, Kaur *et al.* (2015) in soybean, Narayanan *et al.* (2015) in blackgram.

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