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Effect of maleic hydrazide and abscisic acid on growth, yield and seed quality on different varieties of groundnut

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Abstract
A field experiment was conducted at Regional Research Station, Anand Agricultural University, Anand during *kharif* season of 2021. Fifteen treatment combination comprising three varieties and five levels of growth regulators treatment were included in the experiment. Significantly higher plant height (64.05 cm) at 90 DAS and (75.05 cm) at harvest in TG 37 A and effect of growth regulators found non-significant on plant height at all stage Effect of varieties on number of branches per plant was found significant. Significantly the highest branches per plant (6.54) in TG 37 A. While, effect of growth regulators was found non-significant on number of branches per plant. Effect of varieties as well as growth regulators treatments found significant on number of pods per plant and pod yield. Significantly the highest number of pods per plant (25.76) was found in variety TG 37 A and significantly higher number of pods per plant (25.04) was found in ABA 500 ppm and it was at par with ABA 250 ppm (24.36 pods/plant). Significantly the highest pod yield (2478 kg/ha) was recorded in TG 37 A variety and treatment ABA 500 ppm achieved significantly higher pod yield (2442 kg/ha) and it was at par with ABA 250 ppm (2303 kg/ha). Significantly the highest haulm yield (4394 kg/ha) in variety TG 37 A. Effect of growth regulators was found significantly lower on seed germination % and seed germination in pod per plant. Significantly lower seed germination and seed germination in pod per plant found in ABA 500 ppm and it was at par with ABA 250 ppm.

Keywords: Maleic hydrazide, abscisic acid and varieties

1. Introduction

Groundnut, 'the unpredictable legume' is also known as earthnut, peanut, monkey nut and manilla nut. It is the 13th most important food crop and 4th most important oilseed crop of the world. It is the part of Leguminosae (Fabaceae) family and the botanical name *Arachis hypogaea* L. has been derived from the Greek words, *Arachis* meaning a 'legume' and *hypogaea* meaning 'below ground referring to geocarpic nature of pod formation'. The most important groundnut producing countries in the world are China, India, Nigeria, USA, Sudan and West Africa. India ranks first in the world in area (8.5 M ha), and second in production (8.4 MT) contributes about 40% of world's area and 33 % of the production, respectively. The total annual world production amounts to about 25 million tons of unshelled nuts, 70 % of which is contributed by China, India and USA (Hussein, 2004) [2]. Its cultivation in India is mainly confined to the states of Gujarat, Andhra Pradesh, Tamil Nadu, Karnataka, Maharashtra, Madhya Pradesh, Uttar Pradesh, Rajasthan, Punjab and Odisha. About 80 % of the total area and 84 % of the total production in the country are confined to first five states. Gujarat is the largest producer contributing 25 % of the total production of groundnut followed by Andhra Pradesh, Tamil Nadu and Karnataka (Lokapur *et al*., 2014) [5]. Maleic hydrazide (MH; 1,2-dihydro-3,6-pyridazinedione) has been extensively used as a commercial systemic plant growth regulator and as herbicide since its introduction in 1949. After application to foliage, MH is freely translocated in plants to meristematic tissues, with mobility in both phloem and xylem. Its mode of action in plants is not clear, although several hypotheses have been proposed and investigated, such as inhibition of cell division by mitotic disruption. Some suggestions say that MH acts as an anti-auxin, anti- gibberellin or regulator of auxin metabolism and other plant growth regulators.

2. Material and Methods

The present investigation was conducted field experiment on plot no. A-17 and laboratory during the year of 2021 in the *kharif* season at Regional Research Station, Anand Agricultural

University, Anand, Gujarat. Geographically, Anand is located at 22˚-35' N latitude and 72˚-55' E longitude with an altitude of 45.1 m above mean sea level and 70 km away from Arabian Sea coast and has a semi-arid and subtropical climate with fairly hot and dry summer, fairly cold and dry winter and moderately humid monsoon. Fifteen treatment combination comprising three varieties and five levels of growth regulators treatment were included in the experiment. Three varieties were allotted to factor A while five levels of spray of growth regulators treatment with were allotted as factor B.

The experiment was laid out in randomized block design with factorial concept for field condition and CRD (factorial) for laboratory condition. It was replicated three times for both conditions. There were fifteen treatment combinations comprising three different groundnut varieties *viz*., V_1, V_2 and V_3 which was TG 37 A, TAG 24 and GG 6 respectively, with five levels of foliar application of growth regulators with *viz*., S_1 (water spray), S_2 (MH 1000 ppm), S_3 (MH 1500 ppm) S_4 (ABA 250 ppm) and S_5 (ABA 500 ppm).

2.1 Application of maleic hydrazide and abscisic acid

One hundred per cent maleic hydrazide (MH) in the form of powder was used for the foliar spray. Initially 1000 ppm and 1500 ppm of MH spray solution was prepared by adding 1000 mg and 1500 mg of MH powder in one litre of distilled water respectively. Abscisic acid (ABA) 250 ppm and 500 ppm spray solution was prepared by adding 250 mg and 500 mg of ABA powder in one litre of water, respectively. ABA powder was dissolved in small quantity of ethanol and solution make up to one litre. MH and ABA solution was sprayed at 60 and 75 days after sowing.

The observations like plant population, plant height (cm), seed germination in pod, number of branches per plant, number of pods per plant, pod yield (kg/ha), haulm yield (kg/ha), and germination % were observed for each treatment.

3. Results and Discussion

An examination of results presented in Table 1 pointed out that growth regulators exerted non-significant influence on plant height at 90 DAS and at harvest stage.

Yield and yield attributes depends on branches per plant. However, it is increased with a greater number of branches per plant. Data relating to effect of varieties as well as effect of growth regulators on number of branches per plant of *kharif* groundnut are presented in Table 1. The findings summarized in Table 1 revealed that number of branches per plant at harvest significantly influenced by different varieties. Number of branches per plant (6.54) was found significantly the highest in variety TG 37 A. whereas, lowest number branches per plant (6.06) observed in variety GG 6 at harvest.

It might be due to the varietal character and genetic makeup of groundnut variety TG 37A. While, effect of growth regulators treatment recorded non-significant differences in number of branches per plant at harvest. Higher number of branches per plant (6.38) was found under treatment ABA 500 ppm and lower number of branches per plant (6.11) was found in MH 1000 ppm at harvest.

Number of pods per plant is main yield attributing character in groundnut crop production. It is increasing the pod yield of groundnut. Data concerning to the effect of different variety as well as growth regulators on number of pods per plant recorded at harvest are presented in Table 1. An appraisal of data presented in Table 1 noticed that number of pods per plant were significantly influenced by growth regulators treatment. ABA 500 ppm treatment perceived significantly higher number of pods per plant (25.04) over the treatment water spray (Control). It was statistically at par with ABA 250 ppm treatment. It might be due to ABA successfully control the in-situ sprouting at harvest stage. Ultimately resulted into increase in the pod yield. Similar result was found by Kermode (2005) [3].

The data confirmed that number of pods per plant at harvest was significantly differ due to interaction effect of varieties with growth regulators treatment. Interaction of treatment TG 37 A with ABA 500 ppm gained significantly maximum number of pods per plant (29.54) V_1S_5 (TG 37 A + ABA 500 ppm) and treatment V_1S_4 (TG 37 A + ABA 250 ppm) was found statistically at par in number of pods per plant. Whereas, minimum number of pods per plant (20.43) was found in V_2S_1 (TAG 24 + water spray) treatment.

A perusal of data allotted in Table 1 noticed that seed germination was significantly influenced by different growth regulators treatments. ABA 500 ppm treatment obtained significantly lower seed germination (68.22 %). It was found at par with ABA 250 ppm treatment (70.44 %). Significantly the higher seed germination (91.89 %) observed in the water spray (Control)

It might be due to abscisic acid compound present in embryo which was responsible for the dormancy. ABA treatment decreased the activity of gibberellic acid and increased ABA activity in embryo. This way germination percent was decreased due to ABA and they make seed dormant. Similar finding was observed by Ketring and Morgan (1972) [4].

Table 1 data showed that significantly effect of growth regulators on seed germination in pod per plant. Significantly the lowest seed germination in pod per plant (5.58 %) was found in treatment S_5 (ABA 500 ppm) and it was at par with S_4 (ABA 250 ppm). Whereas, maximum seed germination in pod (10.77 %) was found in water spray (Control). It might be due to ABA level that significantly lowered ethylene production and germination of after-ripened seeds and reduced ethylene production and germination of dormant seeds below the water controls. Similar result was found by Gowda *et al*. (2015) [1].

The data tabulated in Table 1 pointed out that pod yield per ha was significantly differed due to growth regulators treatments. Application of ABA 500 ppm achieved significantly higher pod yield (2442 kg/ha). While, it was found at par with treatment ABA 250 ppm treatment. Significantly lower pod yield (1949 kg/ha) was observed in treatment water spray (Control).

It might be due to application of ABA which might reduce *in-situ* sprouting or viviparous germination. ABA diverted flow of energy toward the right path. So, that energy was used in vegetative and reproductive growth of plant. Ultimately, it increased photosynthesis efficiency and resulted into higher pod yield. Similar result was found by Yoga *et al*. (2014) [6].

Table 1: Effect of various treatments on growth, yield and seed quality parameters

Treatment	Plant height		Number of branches per plant	Number of pods per plant	Germination (%)	Seed germination in pod/plant (%)	Pod yield (kg/ha)
	90 DAS	At harvest					
Effect of varieties							
V_1: TG 37 A	64.05	75.05	6.54	25.76	77.47	7.12	2478
V_2: TAG 24	61.09	70.59	6.09	21.25	79.07	9.01	2011
V_3: GG 6	60.06	69.56	6.06	22.05	78.73	8.54	2062
S.Em. ±	1.12	1.33	0.12	0.44	0.86	0.23	49.25
CD at 5 %	3.25	3.86	0.36	1.28	NS	0.65	142.63
Effect of plant growth regulators							
S_1: Water spray (control)	61.49	71.49	6.16	20.83	91.89	10.77	1949
S_2: MH 1000 ppm	61.57	71.57	6.11	21.94	83.89	9.55	2080
S_3: MH 1500 ppm	61.98	71.98	6.20	22.93	77.67	8.88	2144
S_4: ABA 250 ppm	61.90	71.90	6.30	24.36	70.44	6.32	2303
S_5: ABA 500 ppm	61.72	71.72	6.38	25.04	68.22	5.58	2442
S.Em. ±	1.45	1.72	0.15	0.57	1.11	0.29	63
CD at 5 %	NS	NS	NS	1.65	3.22	0.85	184.13
V × S interaction							
S.Em. ±	2.51	2.98	0.27	0.98	1.93	0.51	110
CD at 5 %	NS	NS	NS	2.85	NS	NS	318
CV %	7.05	7.20	7.66	7.41	4.26	10.66	8.73

4. Conclusion
Overall results indicated that, groundnut varieties (TG 37A, TAG 24 and GG 6) with foliar application of ABA 250 ppm at 60 DAS and 75 DAS recorded significantly higher pod yield. ABA 250 ppm successfully induction of seed dormancy and decline the seed germination.

5. References

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