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Impact of maleic Hydrazide (MH) induced dormancy on plant growth and yield attributes of groundnut seeds

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Abstract
An investigation was undertaken during *kharif 2017* at the Central Research Station and Department of Seed Science and Technology, OUAT, Bhubaneswar to study the impact of maleic hydrazide (MH) induced dormancy on plant growth and yield attributes of groundnut seeds. The experimental material comprised of three groundnut varieties namely, TG 37 A, TG 38 B and Devi and six treatments namely, MH @ 0, 250, 500, 750, 1000 and 1250 ppm applied as foliar spray at 70 and 90 DAS. Appropriate agronomic practices were followed for raising the seed crops. Observations were recorded on 10 plant growth parameters and yield attributes namely, plant height, number of branches, mature and immature pods per plant, 100- pod and seed weight, number of seeds per pod, shelling percentage, pod yield per plant and per hectare. The results indicated presence of significant variations among the varieties for plant height, number of seeds per pod, 100 seed weight and pod yield per plant and among the treatments, for pod weight, number of seeds per pod, 100 seed weight, shelling percentage and pod yield. Among the treatments, application of MH @ 1250 ppm recorded the highest pod weight (2.618 g), 100-seed weight (189.2 g), shelling percentage (72.2%), per plant pod yield (78.22 g) and per hectare pod yield (19.58 q).

Keywords: Maleic hydrazide, groundnut, induced dormancy, plant growth parameters and yield attributes

Introduction
Groundnut (*Arachis hypogaea* L.) is often called as the king of vegetable oil seeds or poor man's nut or wonder nut. It belongs to the family *Papilionaceae*, which is the largest and most important of the three divisions of *Leguminosae*. Groundnut is found to be originated in South America i.e. North-West of Brazil, the secondary centre of its cultivation is in Africa (Vavilov, 1951) [11].

Groundnut seeds contain 40-50% high quality edible oil, 20-50% easily digestible plant protein, and 10-20% carbohydrate depending on the variety and some essential minerals and vitamins (Okello *et al.*, 2010) [4]. Oil cake is a proteinous livestock feed along with it can be used for human consumption. It is rich in about 8% of N, 1.5% of P_2O_5 and 1.2% of K_2O thus can be used as a fertilizer. The haulms (plant stalks) are fed (green, dried or silage) to livestock. Groundnut shell is utilized as a fuel for manufacturing coarse boards, cork substitutes etc. Groundnut is also an excellent rotation crop. Being a legume with root nodules, it can fix atmospheric nitrogen and can increase the soil fertility. It is a rich source of thiamine (vitamin B1), vitamin E and small quantities of vitamin A, C and D (Weiss, 1983) [12]. Groundnut oil is used in medicine as it is highly nutritive and laxative too. Groundnut consumption is highest in the form of groundnut oilseed (5540 thousand tonnes) followed by groundnut meal (1590 thousand tonnes) and groundnut oil (1260 thousand tonnes) during 2020.

Although groundnut production in India suffers from low yields and instability, groundnut is considered as a crop of significant adaptability. Being adaptable to diverse agro climatic conditions, it is grown throughout the tropical and warm temperate regions of the world. Groundnut contributes around 37% of the total oilseeds production in the country during 2020-2021 with an average production of 95.35 lakh tonnes in India (Indiastat, 2020) [10].

Wide variation in germination behavior is seen in groundnut varieties. The kernels of Spanish and Valencia bunch types belonging to subspecies *fastigiata* of the cultivated groundnut *Arachis hypogaea* L. are usually non-dormant, whereas those of Virginia bunch and Virginia runner varieties belonging to subspecies *hypogaea* of *Arachis hypogaea* L are dormant in nature (Rao, 1976) [7].

The non-dormant character in Spanish and Valencia bunch type makes them unsuitable for its cultivation in summer season therefore groundnut is grown as a rainfed crop in the *kharif* or rainy season.

About 20-50 percent losses in the field is mainly due to viviparous germination of seeds in the field due to untimely rain at maturity stage of the crop leading to low productivity (Reddy, 1982; Ramanathan, 1987; Nagarjun and Radder, 1983a) [8, 6, 3] therefore to prevent this losses, it is necessary to study the techniques of dormancy induction by application of certain dormancy inducing chemicals.

Seed dormancy is defined as a state in which seeds are prevented from germinating even under favorable environmental condition for germination. Seed dormancy is considered a desirable trait for groundnut as it prevents pre-harvest sprouting of seeds in the field and can be dangerous when dormancy reduces stand or hampers taking a second crop immediately after harvest.

Non dormancy is regarded as an inherent property in bunch type seeds and does not depend mainly upon soil conditions. For incorporation of short duration of dormancy in the seeds of non-dormant varieties a number of non-conventional methods (John *et al*., 1948) [2] to save the produce and to retain the seed quality against pre harvest sprouting have been developed, out of which foliar application of maleic hydrazide (MH) at variable concentrations and at different stages of crop growth has been successfully employed. (Shelar *et al.* 2014) [9].

Maleic hydrazide as a growth inhibitor is used to inhibit seed germination and to control sprouting of tubers, roots and bulbs during storage. The main objective behind the use of growth regulators is to control some aspects of growth, regulate the balance between source and sink, which is the final analysis result in the higher yield of desired product. There has been a positive correlation between MH, a dormancy inducing chemical in relation to groundnut yield. The spray of maleic hydrazide to groundnut @ 300 ppm at 60 and 80 DAS significantly increased the pod yield, number of branches, plant height, leaf and stem dry matter followed by application of maleic hydrazide at 200 ppm (60 and 80 DAS) as compared to control (Mukund, 2004) [14]. The highest 100 seed weight (189.2 g) was observed with application of 1250 ppm MH followed by application of 1000 ppm MH (173.5 g) in comparison to the control (105.2 g) (Reddy and Shah, 1984; Gupta, 1985 and Jagatap, 2000) [15, 16, 17].

The information on the choice of proper concentrations of MH and its time of application on the locally available groundnut varieties for improving the yield is lacking. Keeping this in view, the present investigation "Impact of maleic hydrazide (MH) induced dormancy on plant growth and yield attributes of groundnut seeds" was undertaken.

Materials and Methods

The present investigation entitled "Impact of maleic hydrazide (MH) induced dormancy on plant growth and yield attributes of groundnut seeds" was conducted during *Kharif*, 2017 in the Department of Seed Science and Technology, OUAT, Bhubaneswar. The details of materials and methods adopted for these investigations are described below.

Field tests

Experimental site and climatic conditions

The Experimental plot was located in the Central Research Station, OUAT, BBSR situated at 20°15' North latitude 85°52' East longitude. Proper climatic conditions were maintained during the experimental period.

Land preparation

Fairly well leveled and uniform fertile land was selected for conducting the experiment. The field was brought to good tilth by ploughing once and harrowing twice and by collecting stubbles and debris of the previous crop before carrying out the experiment.

Experimental material

The experimental material comprised of three bunch type groundnut cultivars-*viz*., Devi, TG 37 A and TG 38 B. Seeds of these varieties were obtained from the AICRP (groundnut), O.U.A.T. Bhubaneswar. The seeds were well protected in sealed gunny bags before collection for the experimental purpose.

Seed sowing

The seed crops of these varieties were sown in *Kharif*, 2017. Pure seeds of these varieties were obtained and the kernels were hand dibbled in the 6 row plots of size 9 × 7 m^2 at a spacing of 30 ×10 cm with one seed per hill for all treatments. Appropriate seed production technology was adopted to raise the crop (Agrawal, 1993). The meteorological conditions were suitable for raising the seed crops.

Fertilizer management

Farmyard manure @10 tonnes per hectare was uniformly spread in the field before harrowing. The fertilizers in the form of urea, single super phosphate and muriate of potash were applied @ 20kg N, 40 Kg P and 40 Kg K and 250 kg of gypsum at the time of sowing. Prophylactic plant protection measures were adopted to protect the crops from weeds, diseases and pests attack.

Irrigations

First pre-sowing irrigation followed by second irrigation was given immediately after sowing. There after irrigation was given as and when required till harvest of the crop.

Design of field experiment

Location of experimental plot	: Central Research Station, OUAT, BBSR.
Growing season	: *Kharif*, 2017
Plot size	: 9m × 7m
Crop	: Groundnut
Spacing	: 30cm × 10cm
No. of replications	: 3 (Three)
Experimental design	: Factorial RBD

Factor A: – Treatments

T_0: Control (distilled water)
T_1: Maleic hydrazide @ 250 ppm
T_2: Maleic hydrazide @ 500 ppm
T_3: Maleic hydrazide @ 750 ppm
T_4: Maleic hydrazide @ 1000 ppm
T_5: Maleic hydrazide @ 1250 ppm

Factor B: - Variety

V_1: TG 37 A
V_2: TG 38 B
V_3: Devi

Foliar application of MH

Six treatments of maleic hydrazide, a dormancy inducing chemical was given as foliar spray solution of different concentrations along with a control. This dormancy inducing chemical isa growth and respiratory inhibitor. In order to prepare a solution of 250 ppm, 500 ppm, 750 ppm, 1000 ppm, 1250 ppm concentrations, 0.25 g, 0.5 g, 0.75 g, 1 g, 1.25 g of the chemical was dissolved in 1 litre of distilled water respectively. In the beginning, 250 ppm of MH spray solution was prepared by dissolving 250 mg of MH powder in one litre of distilled water. Then mixture was solubilized by adding KOH pellets with the use of magnetic stirrer. Likewise, the spray solution of 500 ppm, 750 ppm, 1000 ppm and 1250 ppm were prepared. Care was taken while spraying to check the carryover of the drift of solution to the adjoining plots. Maleic hydrazide was sprayed at two different stages of crop growth i.e. 70 and 90 DAS. In case of control (T_0), only distilled water was given as foliar spray.

Collection of sample plants

Five plants were selected randomly from each plot and were tagged for recording various biometrical observations after harvest.

Plant height

The plant height was recorded at harvest in the tagged plants by measuring the height of the plant from ground level to the tip of the canopy. The average height of the plant was calculated and expressed in centimeter (cm).

Number of branches per plant

The total number of primary (n+1) branches per plant were counted from the tagged plants and the average was computed.

Yield attributing characters and yield

1. Number of mature pods per plant: Number of mature pods per plant was counted by observing pod morphology and hardness. Average number of mature pods per plant was computed from the observation data.
2. Pod weight: Weight of 100 randomly selected mature and dried pods was recorded for each variety and the mean pod weight was computed and expressed in gram.
3. Number of seeds (kernels) per pod: After shelling of the 100 pods, total number of seeds was counted and average number of seeds per pod was computed.
4. 100-seed weight: Weight of 100 filled kernels was taken from those of the 100 randomly selected pods used for recording the 100-seed weight for each variety and treatment and expressed in gram.
5. Shelling percentage: From the observation data, 100 pods and 100 kernel weights, the shelling percentage was computed as weight of kernels expressed as percentage of pod weight.
6. Pod yield per plant: All the dried mature pods from the sampled plants from each plot were weighed and mean pod yield per plant was computed and expressed in gram.
7. Pod yield per hectare: Pod yield per hectare of each variety was computed from the recorded pod yield per plot data and was expressed in q/ha.

Statistical analysis

The data obtained from various experiments were statistically Analysed by using Factorial RBD method following the principles and procedures outlined by Panse and Sukhatme (1978) [5]. The significance of difference between any two means was tested through computation of critical difference (CD) and differences between the treatments were worked out at five per cent level of significance (Snedecor and Cochran, 1967) [13].

Results and Discussion

Effect of MH on plant growth parameters

Plant height: The analysis of variance showed presence of significant variation only among the varieties studied in respect of this character (Table-1) and significant variations for this trait was found to be absent among the treatments as well as the interaction effects. Among the varieties, the highest (42.68 cm) and the lowest (40.20 cm) plant height were observed in TG 37 A and Devi, respectively with an overall mean value of 41.44 cm. Although, treatment effects showed non-significant variations, the mean values ranged from 40.53 cm (T_4) to 42.42 cm (T_3). Among the interaction effects, the highest (43.50 cm) and lowest (39.00 cm) values were recorded in V_1T_3 and V_3T_5, respectively. Since plant height is considered as an important morphological trait which determines the yield potential of the crop through development of greater canopy growth and photosynthetic area. An increase in plant height due to application of MH has been reported earlier in groundnut (Mukund, 2004) [14].

Table 1: Effect of foliar application of MH on plant height (cm) in three varieties of groundnut

Variety/Treatment	V_1 (TG 37 A)	V_2 (TG 38 B)	V_3 (Devi)	Mean
T_0 (Control)	43.05	42.50	40.90	42.15
T_1 (250 ppm)	43.00	41.00	41.40	41.80
T_2 (500 ppm)	43.00	41.05	39.35	41.13
T_3 (750 ppm)	43.50	42.50	41.25	42.42
T_4 (1000 ppm)	41.50	40.80	39.30	40.53
T_5 (1250 ppm)	42.00	40.90	39.00	40.63
Mean	42.68	41.46	40.20	41.44
	S.Em (±)	CD (0.05)	CV (%)	
Variety	0.564	1.682	4.713	
Treatment	0.797	NS		
V × T	1.381	NS		

Number of branches per plant

The analysis of variance in respect of this character showed absence of significant variation among the varieties, treatments and also interaction effects (Table-2). Among the varieties, the mean number of branches per plant ranged from 5.30 (Devi) to 5.47 (TG 37 A) with an overall mean value of 5.38. Among the treatments, the mean values ranged from 5.20 (T_2) to 5.57 (T_4) and among the interaction effects, the mean value ranged from 5.10 (V_2T_2) to 5.60 observed in V_1T_0, V_1T_4 and V_2T_4. Numbers of primary and secondary branches per plant are also other morphological traits determining yielding ability of the crop through development of photosynthetic area and reproductive growth of plant. The increase in the number of branches per plant due to application of MH has been reported earlier in groundnut. (Mukund, 2004) [14].

Table 2: Effect of foliar application of MH on number of branches per plant in three varieties of groundnut

Variety/Treatment	V_1 (TG 37 A)	V_2 (TG 38 B)	V_3 (Devi)	Mean
T_0 (Control)	5.60	5.50	5.40	5.50
T_1 (250 ppm)	5.40	5.40	5.30	5.37
T_2 (500 ppm)	5.30	5.10	5.20	5.20
T_3 (750 ppm)	5.40	5.30	5.10	5.27
T_4 (1000 ppm)	5.60	5.60	5.50	5.57
T_5 (1250 ppm)	5.50	5.40	5.30	5.40
Mean	5.47	5.38	5.30	5.38
	S.Em (±)	CD (0.05)	CV (%)	
Variety	0.097	NS	6.259	
Treatment	0.138	NS		
V × T	0.238	NS		

Effect of MH applications on seed yield and yield attributes

Number of mature pods per plant

The analysis of variance showed absence of significant variation among the varieties, treatments and also the interaction effects studied in respect of this character in (Table-3). Among the varieties, the mean number of mature pods per plant ranged from 27.32 (Devi) to 29.77 (TG 37 A) with an overall mean value of 28.44. Among the treatments, the mean values ranged from 27.20 (T_0) to 29.80 (T_5) and among the interaction effects, the values in respect of this character ranged from 26.00 (V_3T_0) to 31.50 (V_1T_5) with the maximum effect (31.50) observed in V_1T_5. All the treatments resulted in improvement of this character over the control. Number of pods per plant is an important contributor of yield. In the present study, significant variations with respect to these traits were absent among the varieties, treatments as well as the interaction effects. However, significant variation among the groundnut cultivars for this trait due to application of GA, NAA, and MH has been reported by Reddy and Shah (1984) [15].

Table 3: Effect of foliar application of MH on the number of mature pods per plant in three varieties of groundnut

Variety/Treatment	V_1 (TG 37 A)	V_2 (TG 38 B)	V_3 (Devi)	Mean
T_0 (Control)	28.50	27.10	26.00	27.20
T_1 (250 ppm)	29.20	27.50	26.90	27.87
T_2 (500 ppm)	29.40	28.10	27.00	28.17
T_3 (750 ppm)	29.50	28.50	27.40	28.47
T_4 (1000 ppm)	30.50	29.10	27.90	29.17
T_5 (1250 ppm)	31.50	29.20	28.70	29.80
Mean	29.77	28.25	27.32	28.44
	S.Em (±)	CD (0.05)	CV (%)	
Variety	0.963	NS	11.725	
Treatment	1.362	NS		
V × T	2.358	NS		

Number of immature pods per plant

The analysis of variance showed absence of significant variation among the varieties, treatments and also the interaction effects studied in respect of this character (Table-4). Among the varieties, the mean number of immature pods per plant ranged from 8.65 (TG 38 B) to 10.04 (Devi) with an overall mean value of 9.16. Among the treatments, the mean values ranged from 7.65 (T_5) to 10.40 (T_2) and among the interaction effects, the mean values in respect of this character ranged from 6.30 (V_1T_5) to 11.20 (V_3T_4) with the maximum effect (11.20) observed in V_3T_4.

Table 4: Effect of foliar application of MH on number of immature pods per plant in three varieties of groundnut

Variety/Treatment	V_1 (TG 37 A)	V_2 (TG 38 B)	V_3 (Devi)	Mean
T_0 (Control)	8.80	7.90	9.70	8.80
T_1 (250 ppm)	10.30	8.90	10.20	9.80
T_2 (500 ppm)	10.10	10.20	10.90	10.40
T_3 (750 ppm)	7.60	6.85	9.50	7.98
T_4 (1000 ppm)	9.60	10.15	11.20	10.32
T_5 (1250 ppm)	6.30	7.89	8.75	7.65
Mean	8.78	8.65	10.04	9.16
	S.Em (±)	CD (0.05)	CV (%)	
Variety	0.595	NS	22.493	
Treatment	0.841	NS		
V × T	1.457	NS		

Number of seeds per pod

The analysis of variance showed presence of significant variation among the varieties and treatments studied in respect of this character (Table-5). Number of seeds per pods is another important yield attribute of crop plants. Better growing conditions of the seed crop results in higher seed set thereby increase in the number of seeds per pod. In the present investigation, significant variations were observed for this trait among the groundnut varieties as well as MH treatments. The highest (1.78) number of pods per plant was observed in TG 37 A followed by (1.74) in TG 38 B while in Devi it was the lowest (1.60). Among the treatments, the highest (1.85) number of seeds per pod was observed with application of MH @ 1000 ppm (T_4) followed by 1.76 in T_3 (750 ppm) and T_5 (1250 ppm) in comparison to the control (1.52). The interaction effect was found to be non-significant.

Table 5: Effect of foliar applications of MH on number of seeds per pod in three varieties of groundnut

Variety/Treatment	V_1 (TG 37 A)	V_2 (TG 38 B)	V_3 (Devi)	Mean
T_0 (Control)	1.55	1.54	1.48	1.52
T_1 (250 ppm)	1.66	1.69	1.57	1.64
T_2 (500 ppm)	1.78	1.72	1.65	1.71
T_3 (750 ppm)	1.82	1.75	1.71	1.76
T_4 (1000 ppm)	1.90	1.85	1.81	1.85
T_5 (1250 ppm)	2.00	1.91	1.38	1.76
Mean	1.78	1.74	1.60	1.71
	S.Em (±)	CD (0.05)	CV (%)	
Variety	0.046	0.136	9.250	
Treatment	0.064	0.192		
V × T	0.112	NS		

Pod length

The analysis of variance showed absence of significant variation among the varieties, treatments and interaction studied in respect of this character (Table-6). Among the varieties, the mean pod length ranged from 1.64 cm (Devi) to 1.73 cm (TG 37 A) with an overall mean value of 1.70 cm. Among the treatments, the mean values ranged from 1.54 cm (T_2) to 1.80 cm (T_5) and among the interaction effects, the mean values in respect of this character ranged from 1.51 cm (V_1T_2) to 1.83 cm observed in V_1T_0 and V_1T_5.

Table 6: Effect of foliar applications of MH on pod length (cm) in three varieties of groundnut

Variety/Treatment	V_1 (TG 37 A)	V_2 (TG 38 B)	V_3 (Devi)	Mean
T_0 (Control)	1.83	1.79	1.75	1.79
T_1 (250 ppm)	1.79	1.75	1.73	1.75
T_2 (500 ppm)	1.51	1.69	1.43	1.54
T_3 (750 ppm)	1.78	1.65	1.59	1.67
T_4 (1000 ppm)	1.69	1.64	1.58	1.63
T_5 (1250 ppm)	1.83	1.80	1.79	1.80
Mean	1.73	1.72	1.64	1.70
	S.Em (±)	CD (0.05)	CV (%)	
Variety	0.061	NS	12.543	
Treatment	0.087	NS		
V × T	0.151	NS		

Pod weight

The analysis of variance showed presence of significant variation only among the treatments studied in respect of this character (Table-7). The weight of pod is an indicator of number of seeds per pod which represents the total amount of dry matter accumulated during seed development. Higher pod weight is often related to higher seed yield. In the present study, significant variations were observed only among the treatments. The results indicated gradual increase in pod weights with corresponding increase in the dose of MH applications. The highest pod weight (2.618 g) was observed with the application of MH @ 1250 ppm (T_5) closely followed by 2.591 g with the application of 1000 ppm MH (T_4) while it was the lowest (1.717 g) in the control (T_0). All the treatments showed positive influence in respect of this character and there is gradual increase in pod weight values with increase in the dose of MH applications. Among the interaction effects, the mean values ranged from 1.682 g (V_3T_1) to 2.735 g (V_1T_5) with the maximum effect (2.735 g) observed in V_1T_5.

Table 7: Effect of foliar applications of MH on pod weight (g) in three varieties of groundnut

Variety/Treatment	V_1 (TG 37 A)	V_2 (TG 38 B)	V_3 (Devi)	Mean
T_0 (Control)	1.742	1.725	1.685	1.717
T_1 (250 ppm)	1.891	1.751	1.682	1.775
T_2 (500 ppm)	1.946	1.895	1.78	1.874
T_3 (750 ppm)	2.45	1.8425	1.72	2.004
T_4 (1000 ppm)	2.734	2.5485	2.49	2.591
T_5 (1250 ppm)	2.735	2.68	2.44	2.618
Mean	2.250	2.074	1.966	2.097
	S.Em (±)	CD (0.05)	CV (%)	
Variety	0.0799	NS	13.2000	
Treatment	0.1130	0.3371		
V × T	0.1957	NS		

100 seed weight

The analysis of variance showed presence of significant variation among the varieties and treatments studied in respect of this character (Table-8). The mean 100 seed weight of the varieties ranged from 125.2 g (Devi) to 151.1 g (TG 37 A) with an overall mean value of 137.7 g. Among the treatments, the mean values ranged from 105.2 g (T_0) to 189.2 g (T_5) and among the interaction effects, the values ranged from 101.4 g (V_3T_0) to 204.2 g (V_1T_5) with the maximum effect (204.2 g) observed in V_1T_5. The results indicated positive influence of MH treatments on expression of this character in groundnut. Among various factors responsible for quality seed production, the seed size and weight have significant influence on both seed yield and quality. All the treatments were found to have enhancing effect on this trait except the control and the mean values increased with increase in the dose of MH application. The highest 100 seed weight(189.2 g) was observed with application of 1250 ppm MH followed by application of 1000 ppm MH (173.5 g) in comparison to the control (105.2 g). The present findings agreed with the findings of several earlier works (Reddy and Shah, 1984; Gupta, 1985 and Jagatap, 2000) [15, 16, 17] in groundnut.

Table 8: Effect of foliar applications of MH on 100 seed weight (g) in three varieties of groundnut

Variety/Treatment	V_1 (TG 37 A)	V_2 (TG 38 B)	V_3 (Devi)	Mean
T_0 (Control)	108.8	105.3	101.4	105.2
T_1 (250 ppm)	119.0	107.4	101.7	109.4
T_2 (500 ppm)	126.6	121.4	109.2	119.0
T_3 (750 ppm)	162.7	120.7	106.8	130.1
T_4 (1000 ppm)	185.5	171.0	163.9	173.5
T_5 (1250 ppm)	204.2	195.5	168.0	189.2
Mean	151.1	136.8	125.2	137.7
	S.Em (±)	CD (0.05)	CV (%)	
Variety	5.90	17.62	14.85	
Treatment	8.35	24.91		
V × T	14.46	NS		

Shelling percentage

The analysis of variance showed presence of significant variation only among the treatments studied in respect of this character (Table-9). Among the varieties, the mean shelling (%) values ranged from 63.0% (Devi) to 66.7% (TG 37 A) with an overall mean value of 65.0%. Among the treatments, the mean values ranged from 61.3% (T_0) to 72.2% (T_5) and among the interaction effects, the values ranged from 60.00% (V_3T_0) to 74.90% (V_1T_5) with the maximum effect (74.90%) observed in V_1T_5. All the treatments were found to have enhancing effects on the expression of this trait in groundnut.

Table 9: Effect of foliar applications of MH on shelling (%) in three varieties of groundnut

Variety/Treatment	V_1 (TG 37 A)	V_2 (TG 38 B)	V_3 (Devi)	Mean
T_0 (Control)	62.7	61.2	60.0	61.3
T_1 (250 ppm)	63.0	61.2	60.4	61.6
T_2 (500 ppm)	65.0	63.6	61.2	63.3
T_3 (750 ppm)	66.5	65.5	62.1	64.7
T_4 (1000 ppm)	67.9	67.0	65.5	66.8
T_5 (1250 ppm)	74.9	72.8	69.0	72.2
Mean	66.7	65.2	63.0	65.0
	S.Em (±)	CD (0.05)	CV (%)	
Variety	1.13	NS	6.00	
Treatment	1.59	4.75		
V × T	2.76	NS		

Pod yield per plant

The analysis of variance showed presence of significant variation among the treatments and varieties studied in respect of this character (Table-10). Among the varieties, the mean pod yield per plant (g) ranged from 54.11 g (Devi) to 67.21 g (TG 37 A) with an overall mean value of 60.06 g. Among the treatments, the mean values ranged from 46.23 g (T_0) to 78.22 g (T_5) and among the interaction effects, the values ranged from 43.75 g (V_3T_0) to 85.58 g (V_1T_5) with the maximum effect 85.58 g observed in V_1T_5. The results indicated positive influence of MH applications on yield enhancement in this crop.

Pod or seed yield is an important consideration in any study relating to commercial cultivation as well as seed production

of a crop. In the present study, the pod or seed yield in groundnut was assessed both on per plant and per hectare basis. Among the groundnut varieties studied, TG 37 A and Devi exhibited the highest (67.21 g) and the lowest (54.11 g) per plant yield, respectively. Although applications of MH enhanced per plant pod yield, the maximum enhancement (78.22 g) was observed with application of 1250 ppm MH followed by (76.14 g) with application of 1000 ppm MH in comparison with the control (46.23g).

Table 10: Effect of foliar applications of MH on pod yield per plant (g) in three varieties of groundnut

Variety/Treatment	V_1 (TG 37 A)	V_2 (TG 38 B)	V_3 (Devi)	Mean
T_0 (Control)	49.29	45.65	43.75	46.23
T_1 (250 ppm)	55.20	48.64	45.25	49.70
T_2 (500 ppm)	57.29	53.01	48.05	52.78
T_3 (750 ppm)	72.11	52.58	47.15	57.28
T_4 (1000 ppm)	83.78	74.15	70.50	76.14
T_5 (1250 ppm)	85.58	79.13	69.95	78.22
Mean	67.21	58.86	54.11	60.06
	S.Em (±)	CD (0.05)	CV (%)	
Variety	3.251	9.700	18.751	
Treatment	4.597	13.718		
V × T	7.963	NS		

Pod yield per hectare

The analysis of variance showed presence of significant variation only among the treatments studied in respect of this character (Table- 11). Among the varieties, the mean pod yield values ranged from 17.50q (V_3) to 18.72 q (V_1) with an overall mean value of 18.12 q. Among the treatments, the mean values ranged from 16.93 q (T_0) to 19.58 q (T_5) and among the interaction effects, the mean values ranged from 16.33 q (V_2T_0), (V_3T_1) to 20.82 q (V_1T_5). The highest yield (19.58 q/ha) followed by (19.30 q/ha) were observed with application of MH @ 1250 ppm and 1000 ppm, respectively in comparision to the control (16.93 q/ha). Positive effect of MH applications in enhancing pod yield and shelling percentage in groundnut have been reported earlier (Reddy and Shah, 1984; Gupta *et al.*, 1985 and Phulekar *et al*., 1998) [15, 16].

Table 11: Effect of foliar applications of MH on pod yield (q/ha) in three varieties of groundnut

Variety/Treatment	V_1 (TG 37 A)	V_2 (TG 38 B)	V_3 (Devi)	Mean
T_0 (Control)	17.77	16.33	16.70	16.93
T_1 (250 ppm)	17.60	17.22	16.33	17.05
T_2 (500 ppm)	17.55	17.55	17.56	17.55
T_3 (750 ppm)	18.37	18.37	18.12	18.29
T_4 (1000 ppm)	20.21	19.35	18.34	19.30
T_5 (1250 ppm)	20.82	20.00	17.93	19.58
Mean	18.72	18.14	17.50	18.12
	S.Em (±)	CD (0.05)	CV (%)	
Variety	0.336	NS	6.42	
Treatment	0.475	1.417		
V × T	0.823	NS		

Summary and conclusion

The present investigation was conducted during *kharif*, 2017 at the Central Research Station and Department of Seed Science and Technology, OUAT, Bhubaneswar to study the impact of maleic hydrazide (MH) induced dormancy on plant growth and yield attributes of groundnut seeds. The experiment was laid in factorial RBD with three varieties, six treatments and three replications.

The experimental materials comprised of three groundnut varieties *viz*., TG 37 A, TG 38 B and Devi and six treatments *viz*., MH @ 0 ppm, 250 ppm, 500 ppm, 750 ppm, 1000 ppm and1250 ppm. Recommended package of practices was adopted for raising the seed crop.

Observations were recorded on ten plant growth and yield attributes *viz*., plant height, numbers of primary branches, mature and immature pods per plant, 100 pod and seed weight, number of seeds per pod, shelling percentage, pod yield per plant and per hectare.

Significant variations among the varieties were observed for plant height, number of seeds per pod, 100 seed weight and pod yield per plant. On the other hand, significant variations among the treatments were observed in pod weight, number of seeds per pod, 100-seed weight, shelling percentage, pod yield per plant and pod yield per hectare.

Among the groundnut varieties studied, TG 37 A recorded the maximum plant height (42.68 cm), number of seeds per pod (1.78), 100-seed weight (151.1 g) and per plant pod yield (67.21 g) while, this characteristic were the lowest in Devi with corresponding mean values of plant height (40.20 cm), number of seeds per pod (1.60), 100-seed weight (125.2 g) and per plant pod yield (54.11 g).

Among the treatments, foliar applications of MH @ 1250 ppm recorded the maximum pod weight (2.618 g), 100-seed weight (189.2 g), shelling percentage (72.2), pod yield per plant (78.22 g) and pod yield per hectare (19.58 q).

In the present investigation, it is apparent that foliar application of dormancy inducing chemical i.e, MH @ 1000 ppm to 1250 ppm at 70 and 90DAS enhanced a number of plant growth parameters and yield attributes including pod yield.

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