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Effect of foliar spray of maleic hydrazide on biochemical traits of groundnut seeds

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Abstract
An investigation was undertaken during *kharif* 2021 at the Central Research Station and Department of Seed Science and Technology, OUAT, Bhubaneswar to study the impact of foliar application of a dormancy inducing chemical like maleic hydrazide (MH) on the biochemical traits of groundnut seeds. The experimental material consisted 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. The biochemical seed vigour parameters like dehydrogenase activity, FFA content and electrical conductivity were studied. The dehydrogenase activity (OD values) of seed at monthly intervals during storage exhibited non-significant variations among the varieties, treatments (except after 3 months) and also the interaction effects during all period of storage. There was gradual decrease in OD values with advancement of storage upto three months. The initial mean OD values of the varieties (0.816) after one month was decreased to 0.763 and then decreased to 0.587 and 0.369 after two and three months of storage, respectively. Among the treatments, the highest OD values was observed in T_5 and lowest in T_0 (control) throughout the entire storage period. The free fatty acid (FFA values) of seed at monthly intervals during storage exhibited significant variations among the varieties and treatments during one and two months of storage while there was presence of significant variations among the interaction effects only after three months of storage. There was gradual increase in FFA values with advancement of storage up-to three months. Similarly, the initial mean electrical conductivity (EC) values of varieties were 0.084 which gradually increased to 0.144 after three months of storage. Among the treatments, the lowest EC and FFA values was observed in T_5 and highest in T_0 (control) throughout the entire storage period. The EC of seed leachate exhibited significant variations among the varieties during all period of storage and among the treatments at two and three months of storage. Among the varieties, Devi exhibited relatively lower FFA & EC values and higher OD values during the entire period of storage followed by TG 38 B and TG 37 A. There exists a close relationship between induced dormancy on various seed quality parameters (biochemical traits) which thereby plays a vital role in enhancing storability of groundnut seeds.

Keywords: Dormancy, maleic hydrazide, dehydrogenase activity. Free fatty acid, electrical conductivity

Introduction
The cultivated groundnut (*Arachis hypogaea* L.) is an important oilseed and protein crop world-wide. Peanuts are used primarily as food in the U.S. and as an oilseed crop in the rest of the world. It is highly valued for their high-quality oil content, which makes them one of the world's leading oil seed crops (Savage and Keenan, 1994) [21].

In oilseeds, the majority of the lipids are stored in the cotyledons and endosperm. The enzyme lipase is used to break down lipids to produce glycerol and free fatty acids. The free fatty acids are then broken down by α-oxidation (Copeland and McDonald, 1995) [4] or β-oxidation (Mayer and Paljakoff-Mayber, 1975) [12]. β-oxidation is the main source of fatty acid breakdown during the germination process, α-oxidafion does play a minor role. In oil-bearing seeds metabolism of storage lipid provides the main source of energy for the early cellular development and in general the onset of germination is concomitant with a large increase in lipase activity in the storage tissue resulting in the release of free fatty acids which then become available for the catabolic processes by which energy is released (Hitchcock and Nichols, 1971) [7].

The fatty acid profile of the peanut has a large bearing on the quality of the peanut, which can be used as cooking oil, in snack foods, peanut butter, and in confectionaries. The fatty acid profile affects the shelf-life and flavor of snacks and peanut butter, and the stability of the cooking oil.

The typical fatty acid profile for peanut (estimated) is: 10% palmitic, 3% stearic, 45% oleic, 35% linoleic, and 2% behenic, with the other 5% comprising small amounts of possibly seven different fatty acids, which include linolenic, arachidic, and eicoseonic (Ahmed and Young, 1982) [2]. The ratio of oleic to linoleic acid (O/L) is a measure of oil stability (Holley and Hammons, 1968; Worthington and Hammons, 1977) [8, 25] and it is a critical factor in determining peanut oil quality (Fore *et al*., 1953; Sanders et ah, 1992) [5, 20]. The majority of commercial peanuts have an O/L ranging from 1:1 to 2.5:1, with Spanish types usually having a lower O/L. Shelf-life and flavor are determined, in part, by how quickly oxidative rancidity occurs. The variation among the fatty acids (palmitic, oleic, and linoleic acids) is most important for conferring shelf-life qualities (Knauft and Ozias-Akins, 1995) [10]. Fatty acids play a major role in the seed because they provide a source of energy to the germinating seedling, especially in early development.

Peanut belongs to the family *Papilionaceae*, which is the largest and most important of the three divisions of *Leguminosae*. It has two sub species: subspecies hypogaea (Virginia Bunch and Virginia Runner varieties) and subspecies fastigiata (Spanish and Valencia varieties). The kernels of Spanish and Valencia bunch types are usually non-dormant, whereas those of Virginia bunch and runner varieties are dormant (Rao, 1976) [17]. The non-dormant character in Spanish and Valencia bunch type is undesirable for its cultivation in summer season. In the country, groundnut is grown as a rainfed crop in the *kharif* or rainy season. Groundnut varieties exhibit a wide variability in their germination behaviour.

Due to untimely rains and floods in the coastal ecosystems of India that is more pronounced due to climate change, the standing mature crop gets trapped in these untimely rains and in several instances caught in the floods/submergence. The genotypes which are non-dormant are the worst affected due to vivipary and deteriorate physically and physiologically by undergoing pre-harvest sprouting in the field itself. About 20 – 50 percent losses in the field (low productivity) is due to the in-situ germination (viviparous germination) due to the lack of seed dormancy (Reddy, 1982, Nagarjun and Radder, 1983a) [18, 13]. Again, being an oilseed crop, groundnut is a poor storer. Sometimes the germination per cent comes to below IMSCS level within 3 to 4 months depending on the ambient storage conditions. Since storage of groundnut seeds under dehumidified refrigerated conditions though expensive, is effective for maintaining high germinability, but the real problem in this case is that the seed is to be sown immediately after removal from controlled storage, which is often not possible in the present system of seed distribution.

The perfect solution to the problem would be to study the techniques of dormancy induction by application of certain dormancy inducing chemicals, maleic hydrazide (Shelar *et al*., 2014) [22] and to study the impact of a dormancy inducing chemical on various biochemical traits that could be used to predict the seed vigour or its storability.

Maleic hydrazide as a growth inhibitor is used to induce seed dormancy 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 or storability of seeds.

Seed dormancy is defined as a state in which seeds are prevented from germinating even under environmental condition normally favourable for germination. since it involves the resting state, little deterioration of seeds occurs in storage.

For assessing seed longevity or seed storability, several biochemical traits need to be analyzed. Franck (1950) [6] during the ISTA Congress, established the ISTA Biochemical and Seedling Vigour Committee and challenged it with two principal objectives: (i) define seed vigour, and (ii) develop standardized vigour test methods to assess this quality parameter.

Certain cellular and biochemical changes are closely associated with the extent of loss of seed vigour, many of which become evident prior to the loss in germination. Dehydrogenase activity or Tetrazolium test (Perry, 1981) [15] is more routinely used for a quick estimation of seed viability (or potentiality to germinate) and a more critical evaluation of the intensity and pattern of staining can also provide additional information regarding the vigour level of a seed lot. Tetrazolium test is essentially based on the assessment of dehydrogenase enzyme activity. Dehydrogenase activity can also be quantified by colorimetric estimation of the red coloured product (triphenyl formazan) by using methyl cellosolve extracting agent. When the colour is completely extracted, its intensity is measured at 480 nm using a colorimeter. Seed vigour is found to be positively correlated with the intensity of colour. Dehydrogenase activity is found to be positively associated with vigour, field emergence and storability in most crops.

In general, with the advancement of the aging process or seed deterioration, there is more instability of cell membrane integrity, lipid peroxidation and more electrical conductance of seed leachate. When seeds are imbibed in water, a number of water-soluble substances leach out of the seed. The extent of solute leaching is dependent on the kind of seed and its physiological state. Enhanced permeability of cellular membranes is one of the primary symptoms of seed aging. Thus, seed lots low in vigour and viability leach out greater quantity of solutes, which include inorganic ions (electrolytes), water soluble sugars, amino acids, organic acids, etc. Degree of leaching can be detected, among other methods, by simple measurement of electrical conductance of seed leachate, which is directly proportional to the ionic concentration. High solute leakage or more electrical conductivity of seed leachate, an indicator of membrane permeability, is associated with low vigour, poor field emergence and poor storability in most crops. (Presley, 1958) [16].

There are reports of positive association of seed dormancy with seed longevity in different crops. Such an association could be made use in enhancing storability by predicting the impact of induced seed dormancy on various biochemical traits of groundnut seeds. (Swain (1999) and Bajpai *et al.* (2017)) [24, 3].

The information on the effect of different concentrations of maleic hydrazide on the biochemical traits for assessing the storability of groundnut seeds is lacking. Keeping this in view, the present investigation “Effect of foliar spray of maleic hydrazide on biochemical traits of groundnut seeds” was undertaken.

Materials and methods

The present investigation entitled “Effect of foliar spray of

maleic hydrazide on biochemical traits 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 cited in the Central Research Station, OUAT, BBSR located 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) [1]. 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 @ 20 kg 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

T0: Control (distilled water)
T1: Maleic hydrazide @ 250 ppm
T2: Maleic hydrazide @ 500 ppm
T3: Maleic hydrazide @ 750 ppm
T4: Maleic hydrazide @ 1000 ppm
T5: Maleic hydrazide @ 1250 ppm

Factor B: - Variety

V1: TG 37 A
V2: TG 38 B
V3: 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 is a 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.

Laboratory test

Assessment of storability of seeds

The harvested seeds of different varieties and treatments after thorough drying to 9% moisture content were packed in small gunny bags and stored under ambient conditions in the laboratory. Seed quality attributes in respect of enzyme activities were determined at monthly intervals up to 3 months.

Biochemical tests

Seeds of all the varieties receiving different treatments were subjected to the following biochemical analyses in order to examine the relationship between seed dormancy and the enzyme activity and biochemical constituents and thereby throw light on the biochemical factors controlling seed dormancy and storability in groundnut.

Estimation of dehydrogenase activity (OD/g dry weight)

The activity of dehydrogenase enzymes in freshly harvested as well as stored seeds of each variety and treatment was determined following the procedure of Kittock and Law (1968) [9]. After removal of seed coat, 500 mg of seed was soaked between moist blotters for 12 hours after which the seed was cut to small pieces with the help of a sharp razor. Then all the cut pieces were put into a test tube. To each tube, 2 ml of 0.2% of tetrazolium chloride solution was added and incubated in dark for 4 hours at 32 °C. After incubation, the excess TZ solution was decanted and the sample was thoroughly washed in distilled water. To each tube, 9 ml of methyl cellosolve was added and kept for 9 hours with occasional shaking for extraction of red colour formazan. The

colour intensity of the extract was measured at 470 nm with the help of spectrophotometer. The dehydrogenase activity was expressed in term of OD/g fresh weight of seed.

Estimation of free fatly acids (mg/ g dry weight)

Free fatty acid content of oil of different varieties was estimated by titration method following the procedure of Sadasivam and Manickam (1992) [20] with slight modification. Oil from kernels of different varieties was extracted by Soxhlet extraction method. The neutral solvent was prepared by mixing 25 ml ether, 25 ml of 95% ethyl alcohol and 1ml of 1% phenolphthalein solution and was neutralised with 0.1 N NaOH. Accurately weighed 7.05 g oil was dissolved in 50 ml of neutral solvent in a 250 ml conical flask to which few drops of phenolphthalein solution were added, and titrated against 0.1 N NaOH with constant shaking till the pink colour persisted for one minute. Percentage of free fatty acid was calculated on the basis of NaOH used in the titration. The quantity of free fatty acids was calculated using following formula.

Free fatty acid (%) = ml of 0.25 N NaOH required in the titration.

Electrical conductivity (EC) (dSm^{-1})

Two replications of 10 g seeds each were drawn, prewashed well with distilled water to remove the adhering particles and the surface water was removed by blotting with tissue paper. Cleaned seeds were soaked in distilled water of standardized soaking volume (40 ml) and duration (12 hrs) and electrical conductivity of seed leachates was measured by electrical conductivity meter (Agrawal, 1993) [1].

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) [14]. 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 significance (Snedecor and Cochran, 1967) [23].

Results

Dehydrogenase activity (OD/g dry weight)

The mean OD values of three groundnut varieties receiving different treatments over a period of three months in storage are presented in Table -1. The results indicated absence of significant variations among the varieties, treatments (except after 3 months) and also the interaction effects in respect of this character during all period of storage.

The results indicated gradual decrease in OD values with advancement of storage upto three months. The initial mean OD values of the varieties (0.816) after one month was decreased to 0.763 and then decreased to 0.587 and 0.369 after two and three months of storage, respectively.

Among the treatments, the highest OD values was observed in T_5 and lowest in T_0 (control) throughout the entire storage period. A gradual increase in OD values with corresponding increase in MH concentration was observed after three months of storage.

However, varietal differences in respect of this character were noticed during the subsequent stages of measurement. Among the varieties, Devi exhibited relatively higher OD values during the entire period of storage followed by TG 38 B and TG 37 A.

Table 1: Effect of MH application on dehydrogenase activity (OD/g dry weight) of seed at monthly intervals during storage

Variety/ Treatment	Months after storage															
	0				1				2				3			
	V_1	V_2	V_3	MEAN	V_1	V_2	V_3	MEAN	V_1	V_2	V_3	MEAN	V_1	V_2	V_3	MEAN
T_0 (Control)	0.618	0.798	0.597	0.671	0.887	0.499	0.510	0.632	0.425	0.414	0.499	0.446	0.187	0.204	0.210	0.200
T_1 (250 ppm)	0.798	0.644	0.613	0.685	0.674	0.613	0.699	0.662	0.389	0.599	0.401	0.463	0.213	0.298	0.319	0.277
T_2 (500 ppm)	0.849	0.749	0.819	0.806	0.698	0.714	0.748	0.720	0.575	0.534	0.598	0.569	0.298	0.301	0.399	0.333
T_3 (750 ppm)	0.913	0.816	0.899	0.876	0.799	0.809	0.869	0.826	0.530	0.670	0.780	0.660	0.387	0.400	0.413	0.400
T_4 (1000 ppm)	0.626	0.996	1.090	0.904	0.658	0.913	0.964	0.845	0.516	0.677	0.712	0.635	0.443	0.499	0.510	0.484
T_5 (1250 ppm)	0.506	1.140	1.210	0.952	0.465	1.090	1.130	0.895	0.789	0.590	0.868	0.749	0.568	0.549	0.445	0.521
Mean	0.718	0.857	0.871	0.816	0.697	0.773	0.820	0.763	0.537	0.581	0.643	0.587	0.349	0.375	0.383	0.369
	S.Em (±)		CD (5%)		S.Em (±)		CD (5%)		S.Em (±)		CD (5%)		S.Em (±)		CD (5%)	
Variety	0.1000		NS		0.1200		NS		0.0550		NS		0.0240		NS	
Treatment	0.1420		NS		0.1700		NS		0.0780		NS		0.0350		0.1030	
V × T	0.2460		NS		0.2950		NS		0.1360		NS		0.0600		NS	

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

Free fatty acid (mg/ g dry weight)

The mean FFA values of three groundnut varieties receiving different treatments over a period of three months in storage are presented in Table-2. The results indicated presence of significant variations among the varieties and treatments in respect of this character during one and two months of storage while there was presence of significant variations among the interaction effects only after three months of storage.

The results indicated gradual increase in FFA values with advancement of storage up-to three months. The initial mean FFA values of the varieties (0.88 mg/g), after one month was increased to 0.97 mg/g and then increased to 1.07 mg/g and 1.17 mg/g after two and three months of storage, respectively.

During the initial month of storage, the mean FFA values among the varieties, ranged from 0.82 mg/g (Devi) to 0.95 mg/g (TG 37 A) with an overall mean value of 0.88 mg/g and among the treatments, the mean FFA values ranged from 0.86 mg/g (T_5) to 0.91 mg/g (T_0).

After one month of storage, the mean FFA values among the varieties ranged from 0.90 mg/g (Devi) to 1.05 mg/g (TG 37 A) with an overall mean value of 0.97 mg/g and among the treatments, the mean FFA values ranged from 0.94 mg/g (T_5) to 1.00 mg/g (T_0). After two months of storage, the mean FFA values among the varieties ranged from 0.99 mg/g (Devi) to 1.15 mg/g (TG 37 A) with an overall mean value of 1.07 mg/g and among the treatments, the mean FFA values ranged from 1.04 mg/g (T_5) to 1.10 mg/g (T_0). After three months of storage, the mean FFA values among the varieties ranged

from 1.09 mg/g (Devi) to 1.27 mg/g (TG 37 A) with an overall mean value of 1.17 mg/g and among the treatments, the mean values ranged from 1.14 mg/g (T_5) to 1.21 mg/g (T_0) indicating gradual decrease in FFA values with increase in the dose of MH applications.

Thus, varietal differences in respect of this character were noticed during the subsequent stages of measurement. Among the varieties, Devi exhibited relatively lower FFA values during the entire period of storage followed by TG 38 B and TG 37 A.

Table 2: Effect of MH application on free fatty acid (mg/ g dry weight) of seed at monthly intervals during storage

Variety/Treatment	Months after storage															
	0				1				2				3			
	V_1	V_2	V_3	Mean	V_1	V_2	V_3	Mean	V_1	V_2	V_3	Mean	V_1	V_2	V_3	Mean
T_0 (Control)	0.99	0.91	0.83	0.91	1.08	1.00	0.92	1.00	1.19	1.10	1.01	1.10	1.31	1.21	1.11	1.21
T_1 (250 ppm)	0.97	0.89	0.83	0.90	1.07	0.98	0.91	0.99	1.17	1.08	1.00	1.08	1.29	1.19	1.10	1.19
T_2 (500 ppm)	0.96	0.89	0.82	0.89	1.05	0.98	0.90	0.98	1.16	1.07	0.99	1.07	1.27	1.18	1.09	1.18
T_3 (750 ppm)	0.94	0.87	0.82	0.88	1.04	0.96	0.90	0.96	1.14	1.06	0.99	1.06	1.25	1.16	1.09	1.17
T_4 (1000 ppm)	0.93	0.86	0.81	0.87	1.03	0.94	0.89	0.95	1.13	1.04	0.98	1.05	1.24	1.14	1.08	1.15
T_5 (1250 ppm)	0.92	0.85	0.80	0.86	1.01	0.93	0.88	0.94	1.11	1.02	0.97	1.04	1.22	1.12	1.07	1.14
Mean	0.95	0.88	0.82	0.88	1.05	0.96	0.90	0.97	1.15	1.06	0.99	1.07	1.27	1.17	1.09	1.17
	S.Em (±)		CD (5%)		S.Em (±)		CD (5%)		S.Em (±)		CD (5%)		S.Em (±)		CD (5%)	
Variety	0.076		NS		0.008		0.024		0.009		0.026		0.010		NS	
Treatment	0.107		NS		0.012		0.035		0.012		0.037		0.014		NS	
V × T	0.186		NS		0.020		NS		0.022		NS		0.025		0.074	

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

Electrical conductivity (EC) (dSm^{-1})

The mean EC values of three groundnut varieties receiving different treatments over a period of three months in storage are presented in Table-3. The results indicated presence of significant variations among the varieties in respect of this character during all period of storage except at 0 month of storage However, the treatment effects showed significant variations at two and three months of storage. There was presence of non-significant variation among the interaction effects. The initial mean EC values of varieties were 0.084 which gradually increased to 0.144 after three months of storage.

During the initial month of storage, the mean EC values among the treatments ranged from 0.080 (T_0) to 0.088 (T_5). After one month of storage, the mean EC values were increased from 0.084 to 0.094. Among the treatments, the values ranged from 0.090 (T_5) to 0.098 (T_0) indicating higher conductivity values in seed leachates of control. After two months of storage, the mean EC values was increased to 0.124. Among the treatments, the values ranged from 0.118 (T_5) to 0.131 (T_0) indicating gradual decrease in mean EC values with increase in the dose of MH application After two months of storage, the mean EC values increased from 0.124 to 0.144. Among the treatments, the values ranged from 0.139 (T_5) to 0.150 (T_0) at 3 months of storage indicating gradual decrease in EC values with increase in the dose of MH applications.

The initial mean EC values among the varieties, treatments and interaction effects were found to be non-significant. However, varietal differences in respect of this character were noticed during the subsequent stages of measurement. Among the varieties, Devi exhibited relatively lower EC values during the entire period of storage followed by TG 38 B and TG 37 A. The treatment effects showed significant variations after two and three months of storage. Foliar application of MH resulted in vigour improvement (enhanced storability) as indicated by their lower mean EC values in comparison to the higher conductivity values in seed leachates of control and there was a decreasing trend in the EC values with increase in the dose of MH applications

Table 3: Effect of MH application on electrical conductivity (EC) (dSm^{-1}) at months intervals during storage

Variety/Treatment	Monthly intervals during storage															
	0				1				2				3			
	V_1	V_2	V_3	Mean	V_1	V_2	V_3	Mean	V_1	V_2	V_3	Mean	V_1	V_2	V_3	Mean
T_0 (Control)	0.080	0.080	0.079	0.080	0.105	0.095	0.095	0.098	0.133	0.131	0.128	0.131	0.153	0.151	0.147	0.150
T_1 (250 ppm)	0.082	0.083	0.082	0.082	0.103	0.094	0.093	0.097	0.131	0.129	0.125	0.128	0.151	0.149	0.143	0.148
T_2 (500 ppm)	0.086	0.081	0.080	0.082	0.100	0.092	0.091	0.094	0.129	0.127	0.121	0.126	0.148	0.147	0.141	0.145
T_3 (750 ppm)	0.084	0.085	0.085	0.085	0.097	0.091	0.090	0.093	0.128	0.125	0.119	0.124	0.147	0.144	0.139	0.143
T_4 (1000 ppm)	0.089	0.089	0.084	0.087	0.096	0.090	0.087	0.091	0.123	0.119	0.115	0.119	0.147	0.141	0.136	0.141
T_5 (1250 ppm)	0.090	0.088	0.086	0.088	0.095	0.089	0.085	0.090	0.122	0.120	0.113	0.118	0.144	0.138	0.134	0.139
Mean	0.085	0.084	0.083	0.084	0.099	0.092	0.090	0.094	0.128	0.125	0.120	0.124	0.148	0.145	0.140	0.144
	S.Em (±)		CD (5%)		S.Em (±)		CD (5%)		S.Em (±)		CD (5%)		S.Em (±)		CD (5%)	
Variety	0.0045		NS		0.0018		0.0053		0.0016		0.0048		0.0020		0.0050	
Treatment	0.0064		NS		0.0025		NS		0.0023		0.0068		0.0020		0.0070	
V × T	0.0111		NS		0.0043		NS		0.004		NS		0.0040		NS	

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

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 effect of foliar spray of maleic hydrazide on biochemical traits of groundnut seeds. The experiment was laid in factorial RBD with three varieties, six treatments and three replications.

The experimental materials consisted 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 and 1250 ppm. The recommended package of practices was adopted for raising the seed crop.

The storability of seeds was assessed basing on the biochemical traits (dehydrogenase activity, free fatty acids and electrical conductivity tests). Among the biochemical seed vigour parameters, Dehydrogense enzyme activity (OD values) of seed at monthly intervals during storage exhibited complete absence of significant variations among the varieties, treatments (except after 3 months) and also the interaction effects in respect of this character during all period of storage. The Free fatty acid (FFA values) of seed at monthly intervals during storage exhibited significant variations among the varieties and treatments during one and two months of storage while there was presence of significant variations among the interaction effects only after three months of storage. The Electrical conductivity (EC) values of seed leachate exhibited significant variations among the varieties during all period of storage except initial month of storage and among the treatments at two and three months of storage.

The Varietal differences in respect of biochemical traits was noticed during the subsequent stages of storage. Among the varieties, Devi exhibited relatively lower FFA & EC values and higher OD values during the entire period of storage followed by TG 38 B and TG 37 A.

In the present investigation, it is apparent that foliar application of the dormancy inducing chemical like maleic hydrazide (MH) T5 @ 1250 ppm had highest OD (dehydrogense enzyme activity) and least FFA (Free fatty acid) and EC (Electrical conductivity) content as compared to the untreated seeds during the subsequent period of storage. Thus, this treatment helps in maintaining higher Germinability and vigour of seeds during storage.

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