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Induction of dormancy in non-dormant varieties of groundnut

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A field experiment was conducted at Seed Research and Technology Centre, Hyderabad to induce dormancy in groundnut using maleic hydrazide (MH) during *rainy season*, 2010 and 2011. A non - dormant, bunch type of groundnut variety Narayani was utilized. Two foliar sprays of MH at different concentrations *viz*., 500, 750, 1000 and 1250 ppm were imposed at 60 and 90 days after sowing. Significantly higher germination of 80.0 and 81.73% immediately after harvest were recorded by untreated control seed lots during 2010 and 2011 seasons, respectively. The treatment of 1250 ppm of MH showed the lowest germination percent of 32.33 during 2010, while it was 36.33 during 2011, followed by 1000 ppm of MH at 60 and 90 days after sowing. Similarly, the same treatment had the least seedling vigour index of 1201 while that of untreated plot was 1905 during 2010 and 2012 during 2011. It was found that two foliar sprays of MH at 1250 ppm at 60 and 90 days after sowing would induce dormancy in non-dormant bunch type groundnut cultivar up to 30 days and protects the seed from *in situ* germination due to untimely rains at the time of harvest.

Key words: Pre-harvest sprouting, chemicals methods, induction of dormancy, groundnut.

INTRODUCTION

Groundnut (*Arachis hypogea* L.) is an important crop among oil seeds, as it can be consumed and utilized in diverse ways. Groundnut seeds are rich in oil and protein. Groundnut is grown on nearly 23.95 million ha worldwide with the total production of 36.45 million tons with an average yield of 1520 kg / ha in 2009 (FAO, 2011). In India, it occupies an area of 6.41 million ha with a production of 9.36 million tones, which accounts for a productivity of 1460 kg/ha during 2007 to 2008 (Anonymous, 2008). In India, 70% of the groundnut area and 75% of the production are concentrated in the four states namely, Gujarat, Tamilnadu, Andhra Pradesh and Karnataka. In groundnut, the sub species *fastigiata,* which includes the *Spanish* and *Valencia* are the most preferred groundnut sub species in the semi-arid tropics, which accounts for about 60% of the world's groundnut production area. Most of the popularly cultivated varieties in southern India are non-dormant and harvesting these cultivars in *rainy season* poses the problem of sprouting in the field and subsequently deterioration of the quality of the kernel to a tune of 20 to 50% (Varman and Raveendran, 1991). This problem becomes more obvious if harvesting is further delayed. Yield losses due to *in situ* germination in bunch type of groundnut varieties have been estimated to range between 20 and 40% by Reddy et al. (1987) and Nagarjun and Radder (1983). Thus, a

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short period of seed dormancy is necessary to reduce these losses. Kumar et al. (1991) reported that the cultivation of sub species *fastigiata* generally lacked dormancy while those of sub species *hypogea* were characterized by long dormancy periods.

Maleic hydrazide (MH) (Diethanolamine salt of 1, 2-dihydroxy-3,6 pyridazine-dione), a growth inhibitor has been successfully used to induce dormancy and thus to reduce sprouting losses in potato, sugarbeet, onion, carrot and rice. Vaithialingam and Rao (1973) reported that induction of dormancy in TMV-2, a bunch groundnut variety by the foliar application of MH-30, in a field trial conducted at Coimbatore. Nagarjun and Radder (1983) and Gupta et al. (1985) also reported that foliar application of MH could induce dormancy in bunch type of groundnut varieties in the field trials. Spraying of MH at 250 ppm at 60 days after sowing (DAS) was as effective as higher concentration sprayed at later stages in inducing seed dormancy in bunch type groundnut (Nagarjun and Radder, 1983). Similarly, Naitiyal (2004) observed that foliar application of MH at 1000 ppm at 60 days after crop emergence was superior in induction of dormancy in groundnut. However, the information available on the effect of MH in inducing seed dormancy in groundnut is meager and inconclusive. Therefore, the present study was taken up to observe the effect of MH to induce dormancy in a bunch groundnut cultivar and also to standardize its dosage and time of foliar application.

MATERIALS AND METHODS

The experiment was conducted at field plots of Seed Research and Technology Centre, Rajendranagar, Hyderabad, during rainy season, 2010 and 2011. The non dormant, bunch type of groundnut variety namely, Narayani was utilized in the current study. Two foliar sprays of maleic hydrazide at different concentrations *viz*., 500, 750, 1000 and 1250 ppm were given to the crop at 60 and 90 days after sowing. The experiment was laid out in a factorial randomized block design with three replications. The gross plot size was 4 × 3 m and the net plot size was 3.8 × 2.6 m. The row to row spacing was 30 cm, while the plant to plant spacing was 10 cm. Observations were recorded on germination, root length, shoot length, total seedling length and seedling vigour index (SVI) based on seedling length at regular intervals till the germination of the treated seed lots becomes equal to the untreated control with the harvested produce. The germination percent was tested using between paper method of testing suggested by International Seed Testing Association (1985). The seedling vigour index was calculated by multiplying the germination per cent with mean seedling length. The induction of dormancy was tested by conducting the germination test immediately after harvest and was continued till the germination percent of both control as well as the treated lots declines to 5% below the minimum seed certification standards (MSCS) and the interval of testing was five days. The dormancy duration was computed as the period from harvest till the germination percent of the treated seed lots becomes equal to the untreated control. The mean values of the data were statistically analyzed following factorial Randomized Block Designs (RBD) using Windostat software version 8.6.

RESULTS AND DISCUSSION

The data on germination percentage indicated significant differences between control and MH treated seed lots. Significantly higher germination of 80.0 and 81.73% immediately after harvest were recorded by untreated control seed lots during 2010 and 2011 seasons, respectively, as shown in the Table 1. However, the treatment 1250 ppm of MH showed the lowest germination percent of 32.33 during 2010, while it was 36.33 during 2011, followed by 1000 ppm of MH during both the seasons. The germination percent recorded at 5 days interval showed that spray of MH at 1250 ppm could restrict the germination of groundnut cultivar Narayani for 30 days (Table 1). From the current study, it has been further noticed that there was an increased trend with respect to germination percentage as the number of days of harvest increased. The lower germination percent observed in the MH treated plots for a period of 30 days may be due to the blockage of any of the sequential processes involved in the germination. The research work of Bewley and Black (1982) revealed that the application of an inhibitor (MH) could bring about certain changes in the physiological and biochemical processes like alteration in promoter to inhibitor ratio, moisture content of the seed, water absorption capacity of the seeds, protein content and oil content of the seed, which are responsible to make the seed dormant by way of arresting the growth of the embryo. Another important conception was that, the dormant and non-dormant states of the seed were dependant on relative levels of inhibitors and promoters present in the seed. The results obtained in the present investigation are in confirmation with the earlier reports of Naitiyal (2004) and Nirmala (2006), who reported that MH spray at 1000 ppm induced the dormancy in non-dormant groundnut genotypes. Similarly, Jayadeva (2008) also reported that foliar application of MH at 1000 ppm at 60 and 90 days after sowing could induce dormancy up to 45 days in groundnut varieties, SB-X1 and TG-26 while only five days dormancy could be induce in TAG-24.

The seed without foliar spray of MH that is, control seed lot recorded higher seedling vigour index (Based on seedling length) during all the periods of testing (Table 2). During *rainy season*, 2010, immediately after harvest the seed harvested from control plots (No foliar spray of MH) recorded significantly superior seedling vigour index (SVI) of 1905. However, MH spray @ 1250 ppm recorded the least SVI of 1201 followed by 1000 ppm concentration (1324). Similar trend of higher SVI was shown by seed lots which were harvested from control plots with out foliar spray of MH during 2011 also. The SVI of untreated seed of untreated plot was 2012 immediately after harvest and it reached to a tune of 2235 after 35 days of harvest. As seen in case of germination percent, it has been noticed that there was an increased trend with respect to SVI also as the number of days after harvest

Table 1. Effect of pre harvest foliar spray of maleic hydrazide (MH) on seed germination per cent at different days after harvest in groundnut.

	Days after harvest (2010)								
	0	**5**	**10**	**15**	**20**	**25**	**30**	**35**	**Mean**
Control	80.00(63.44)	81.77(64.75)	82.33(65.12)	83.66(66.19)	86.33(68.28)	86.33(68.28)	88.31(70.00)	90.66(72.24)	84.92
500 ppm MH	58.33(49.78)	65.00(53.73)	81.77(64.75)	84.41(66.74)	88.31(70.00)	87.11(68.95)	88.31(70.00)	92.33(73.89)	80.69
750 ppm MH	49.33(44.60)	60.32(50.94)	80.00(63.44)	81.77(64.75)	84.41(66.74)	86.33(68.28)	86.33(68.28)	88.31(70.00)	77.1
1000 ppm MH	42.33(40.57)	51.77(46.03)	65.00(53.73)	66.22(54.45)	80.00(63.44)	83.66(66.19)	86.33(68.28)	86.33(68.28)	70.2
1250 ppm MH	32.33(35.24)	36.33(37.05)	51.77(46.03)	60.32(50.94)	66.22(54.45)	65.68(54.15)	80.66(63.94)	81.77(64.75)	59.38
Mean	52.46	59.04	72.17	75.28	81.05	81.82	85.99	87.88	74.46
	S.E.D±	C.D (5%)							
Treatment	0.58	0.25							
Days	0.76	0.66							
Interaction	1.32	1.14							

	Days after harvest (2011)								
	0	**5**	**10**	**15**	**20**	**25**	**30**	**35**	**Mean**
Control	81.73(64.77)	83.33(65.12)	81.77(64.75)	84.66(66.97)	84.33(66.66)	84.15(66.50)	85.77(67.86)	86.33(68.28)	84.01
500 ppm MH	5.33(48.04)	65.44(53.97)	80.66(6.94)	81.66(64.67)	85.33(67.45)	86.33(68.28)	87.11(68.95)	86.33(68.28)	78.52
750 ppm MH	59.66(50.59)	63.33(52.71)	79.00(62.72)	82.33(65.12)	84.41(66.74)	83.66(66.19)	84.41(66.74)	84.00(66.42)	77.60
1000 ppm MH	41.66(40.22)	49.33(44.60)	52.66(47.12)	63.66(52.95)	75.00(60.00)	80.66(63.94)	83.33(65.88)	86.33(68.28)	66.58
1250 ppm MH	36.33(37.05)	42.00(40.40)	55.66(48.27)	60.66(51.18)	64.11(53.66)	62.66(65.42)	70.00(60.00)	83.44(65.96)	59.35
Mean	54.94	60.69	69.95	74.59	78.64	79.49	82.12	85.27	73.21
	S.E.D±	C.D(5%)							
Treatment	0.25	0.50							
Days	0.66	1.30							
Interaction	6.14	2.26							

(Figures in the paranthesis are the arc sine values).

Table 2. Effects of pre harvest foliar spray of maleic hydrazide (MH) on seedling vigour index (SVI) at different days after harvest (cv. Narayani).

	Days after harvest(2010)								
	0	**5**	**10**	**15**	**20**	**25**	**30**	**35**	Mean
Control	1905	1926	1976	2093	2145	2173	2208	2220	2080.7
500 ppm MH	1691	1730	1821	1803	1926	1979	2014	2076	1880.0
750 ppm MH	1556	1596	1623	1674	1721	1750	1822	1851	1699.1
1000 ppm MH	1324	1344	1453	1501	1602	1679	1721	1746	1546.2
1250 ppm MH	1201	1223	1272	1343	1379	1427	1476	1501	1352.7

Table 2. contd.

Mean	989	1011	1093	1123	1122	1322	1421	1422	1187.8
	S.E.M±	C.D (5%)							
Treatment	9.65	121							
Days	12.47	214							
Interaction	24.69	326							

	Days after harvest (2011)								
	0	**5**	**10**	**15**	**20**	**25**	**30**	**35**	**Mean**
Control	2012	2064	2122	2012	2173	2202	2203	2235	2127.8
500 ppm MH	1763	1803	1872	1901	1893	1946	1993	2053	1903.0
750 ppm MH	1623	1647	1734	1812	1872	1864	1903	1946	1800.1
1000 ppm MH	1372	1346	1421	1503	1564	1623	1691	1725	1530.6
1250 ppm MH	1254	1247	1293	1335	1391	1422	1476	1493	1363.8
Mean	1604.8	1621.4	1688.4	1712.6	1778.6	1811.4	1853.2	1890.4	1745.1
	S.E.M±	C.D (5%)							
Treatment	7.54	114							
Days	16.54	136							
Interaction	19.23	248							

increased. Among the various concentrations studied, 1250 ppm of MH was found to be effective as growth retardant to reduce SVI which could be considered as a sign of induction of dormancy. The decline in seedling vigour index could be due to lower germination percent as well as poor seedling growth as a result of MH spray. The current findings are in accordance with the results of Jayadeva (2008).

Conclusion

Two foliar sprays of maleic hydrazide at 1250 ppm at 60 and 90 days after sowing would induce dormancy in non-dormant bunch type groundnut cultivar up to 30 days (4 weeks) and protects the seed from *in situ* germination due to untimely rains at the time of harvest of the crop.

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