Plant Archives Vol. 25, Supplement 1, 2025 pp. 65-68 e-ISSN:2581-6063 (online), ISSN:0972-5210

Plant Archives

Journal homepage: http://www.plantarchives.org
DOI Url : https://doi.org/10.51470/PLANTARCHIVES.2025.v25.supplement-1.009

INFLUENCE OF TESTA AND COTYLEDONS IN INDUCTION OF FRESH SEED DORMANCY IN GROUNDNUT (*ARACHIS HYPOGAEA* L.)

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(Date of Receiving : 12-07-2024; Date of Acceptance : 19-09-2024)

ABSTRACT

Groundnut is an important oilseed crop rich in proteins, oil, carbohydrates, and fats. A small period of dormancy is imperative in groundnut to prevent pre-harvest sprouting. In this study, the role of seed coat and cotyledons on induction of seed dormancy in groundnut were determined. Eighteen groundnut genotypes with varying seed dormancy were subjected to germination test with testa and without testa. Highest germination percentage was recorded in seeds without seed coat compared to the seeds with intact seed coat. From results it is revealed that there was a minor variation among the germination percentage in seed with and without seed testa and both didn't reach minimum germination percentage (70%), hence it may be concluded that the dormancy in groundnut is controlled both by the seed coat and seed.
Keywords **:** Testa, Cotyledon, Dormancy, Groundnut.

Introduction

Groundnut, also known as the 'King of Oilseeds' and is rich in proteins, oil, carbohydrates, and fats. In India, groundnut is a vital oilseed, ranking first in area and second in production after soybean. China leads in production (18.38 million tonnes), followed by India (10.13 million tonnes) (*Agricultural Market Intelligence Centre,* PJTSAU). Despite its significance, groundnut production encounters challenges like pre-harvest sprouting due to unpredictable rains, high humidity and temperature fluctuations at the time of harvest leading to 10-20% losses in pod yield and degradation in quality (Nautiyal *et al*. 2001). The Spanish cultivars are the widely cultivated varieties in groundnut, however they do not show dormancy leading to pre-harvest sprouting which is undesirable as it leads to significant seed loss in both quantity and quality. Observations have shown that in situ germination in bunch types can cause a 20-40 percent reduction in yield, as well as decreased seed quality and storability (Reddy *et al*., 1985). Seed dormancy is the temporary suspension of seed development (Simpson, 2007; Nautiyal, 2023), helps in preventing premature germination under untimely rains, making it essential to breed groundnut cultivars resistant to pre-harvest sprouting. Thus a short period of dormancy for a period of 2-3 weeks in Spanish cultivars is desirable to combat the problem of pre-harvest sprouting. The aim of the work reported here was to identify the role of the seed coat and cotyledons on dormancy of groundnut genotypes.

Materials and Methods

Seed collection

The experimental material consists of 8 advanced breeding lines and 10 groundnut varieties with dormancy ranging from 7-35 days (Table 1). These genotypes were harvested at physiological maturity and kept for germination after 7 days of harvest. Pods were randomly selected and shelled with enough care to prevent damage to the kernels while removing from the pods.

Table 1 : List of 18 groundnut genotypes

S.No	Genotype	S.No	Genotype
1	GJG 32	10	K-Chitravathi
2	GJG 33	11	K - Amaravathi
3	KDG 128	12	TG 85
4	BSR 2	13	PLM 10811
5	ICGV 171002	14	PLM 8666
6	ICGV 171024	15	PLM 8620
7	PLM 8623	16	PLM 8625
8	PLM 7836	17	PLM 7851
9	Nithya Haritha	18	PLM 7835

The experiment was conducted in factorial completely randomized design with genotypes as factor one and type of seed as factor two at the laboratory in Dept. of Seed Science and Technology, Seed Research and Technology Centre (SRTC), PJTSAU, Hyderabad. The testa of the seed was removed carefully using a sharp needle without damaging the cotyledon. The seed with and without testa were kept for germination test as prescribed by the International Seed Testing Association (2020), using between the paper method in two replications of 100 seeds for each genotype. Seed samples were placed in a controlled germination room maintained at 25±1°C temperature and 95±3% relative humidity. On the day of final count *i.e.,* 10^{th} day, the number of normal seedlings was counted, following the guidelines outlined in ISTA and the germination (%) was calculated by using the following formula.

$$\text{Germination per cent} = \frac{\text{Number of normal seedlings}}{\text{Total number of seeds}} \times 100$$

The intensity of dormancy is measured as percentage of non germinated seed at the end of germination test (Kumar *et al*., 1991). The viability of the seeds was determined by taking ten seeds from each genotype and subjecting them to preconditioning in water for 8 hours followed by soaking in 10 ml of 0.5% tetrazolium chloride solution and incubation for 2 hours. Following incubation, the tetrazolium chloride solution was removed, and the kernels were examined. The stained kernels were counted, and the mean percentage was expressed.

$$\text{Seed Viability\%} = \frac{\text{No. of seeds stained}}{\text{Total No. of seeds kept for staining}} \times 100$$

Results and Discussion

The germination percentage in groundnut genotypes varied significantly and ranged from 0 to 94% (Table 2). Among genotype GJG 32 recorded a highest germination percentage of 94% while no germination was observed in PLM 10811 (0%) and PLM 7835 (0%). Genotype BSR 2 (93.2%) was on par with the best genotype (GJG 32). The germination percentage among the type of seed used also showed significant variation. Seeds without testa recorded highest germination percentage (61%) compared to with testa (60%) (Table-2). However the mean germination percentage of seeds in presence and absence of testa recorded below standard germination percentage. Interactive effect of genotype and type of seed used also showed significant variation and it ranged from 0 to 96%. Highest germination was observed in GJG 32 with seed coat followed by GJG 32 and BSR 2 without seed coat, which were found to be on par with the best treatment. A lowest germination per cent of zero was observed in PLM 10811 and PLM 7835 with and without seed coat indicating the role of both testa and cotyledons on induction of seed dormancy in groundnut, hence we can state that two dormancy mechanisms appears to control dormancy in groundnut and it can also vary with the genotypes due to individual genotypic makeup. The results are in conformity with the findings with Nautiyal *et al* (1994*)* who stated different parts of a seed involved in imposing dormancy including the seed coat, embryo, and cotyledon. Similar role of the seed coat and the endosperm on seed dormancy was also reported in *Sisymbrium officinale* L. (Iglesias-Fernandez et al. 2007), by embryo and other imposed by seed coat and embryo in capeweed (Ellery and Chapman, 2000) and by embryo & / or cotyledon in *Grevillae wilson* (Morris *et al.*, 2000).

Table 2 : Germination % of groundnut genotypes with and without testa

Genotype	With Testa	Without Testa	Mean	Seed Viability (%)
GJG 32	95	93	94	98
GJG 33	86	83	85	98
KDG 128	78	77	78	99
BSR 2	92	94	93	97
ICGV 171002	66	71	69	98
ICGV 171024	92	92	92	97

PLM 8623	73	73	73	100
PLM 7836	85	89	87	99
Nithya Haritha	64	53	59	95
K-Chitravathi	18	24	21	94
K - Amaravathi	8	5	7	97
TG 85	61	60	61	98
PLM 10811	0	0	0	99
PLM 8666	59	55	57	99
PLM 8620	87	84	85	95
PLM 8625	57	73	65	100
PLM 7851	56	63	60	99
PLM 7835	0	0	0	100
Mean	60	61		98
CV %	**2.55**			**3.28**
	Genotype (G)	**Type of seed used (T)**		**G X T**
SE (m)	0.62	0.21		0.88
CD @ 5%	1.76	0.59		2.49

Contradictory to our findings, Kokila *et al.* (2021) study in CO 6 a dormant variety in groundnut reported seed coat as a site of dormancy with an increase of 56% in germination on removal of seed coat. The influence of seed coat structures on induction of dormancy was also suggested by Hanumanthappa *et al.* (2016) in rice and Dandoti *et al. (*2017) in linseed. However Del Bel (2024) study in B123 of sunflower genotype confirmed that the endosperm and seed coat are essential for the regulation of germination and dormancy.

The seed viability (%) was more than 90 per cent in all the genotypes under study. Intensity of seed dormancy in groundnut varied significantly as presented in Table 3. Among all the genotypes PLM 10811 and PLM 7835 recorded highest intensity of dormancy (100%) followed by K-Amaravathi (93.67%), K-Chitravathi (79.00%), while lowest was recorded in GJG 32 (6.00%) followed by BSR 2 (6.83%). Whereas PLM 8666, Nithya Haritha, PLM 7851, TG 85, PLM 8625, ICGV 171002, PLM 8623, KDG 128, GJG 33, PLM 8620, PLM 7836, ICGV 171024 recorded intensity of dormancy in range of 8.33% to 43.33%.

Intensity of fresh seed dormancy varied among the type of seed used. Seeds with testa (40.20%) recorded highest intensity of dormancy compared to seeds without testa (39.53%) as presented in the Table 3. Interaction effect of type of seed used and genotypes varied significantly with mean value ranging from 4.67% to 100%. Highest intensity of dormancy was observed in two genotypes with and without testa *viz.,* PLM 10811 (100%), PLM 7835 (100%) whereas lowest intensity was observed in GJG 32 with testa. Genotype BSR 2 (6%) was on par with lowest intensity of dormancy. Hull (1973) proposed that groundnut seed dormancy is mainly due to an impervious tough seed testa, while Toole et al (1964) suggested that the inhibitors in the seed coat contributed to dormancy.

Conclusion

The maximum intensity of dormancy was reported in PLM 10811 and PLM 7835 in both with and without testa and a minor variation was observed in germination of seeds with and without testa, indicating the role of both testa and cotyledons on induction of seed dormancy in groundnut.

Table 3 : Intensity of fresh seed dormancy in groundnut genotypes with and without testa

Genotypes	**Intensity of fresh seed dormancy (%)**		
	With testa	**Without testa**	**Mean**
GJG 32	5	7	6
GJG 33	14	17	16
KDG 128	22	23	22
BSR 2	8	6	7
ICGV 171002	34	29	32
ICGV 171024	8	8	8

PLM 8623	27	27	27
PLM 7836	15	11	13
Nithya Haritha	36	47	42
K-Chitravathi	82	76	79
K - Amaravathi	92	95	94
TG 85	39	40	39
PLM 10811	100	100	100
PLM 8666	41	45	43
PLM 8620	13	16	15
PLM 8625	43	27	35
PLM 7851	44	37	40
PLM 7835	100	100	100
Mean	40.20	39.53	
CV %	**2.315**		
	Genotype (G)	**Type of seed used (T)**	**G X T**
SE (m)	**0.38**	**0.13**	**0.53**
CD @5%	**1.06**	**0.35**	**1.5**

References

Bewley, J.D. and Black, M. (1994). Seeds: Physiology of development and germination. New York, London, Plenum Press.

Dandoti, K., Shakuntala, N.M., Vasudevan, S.N., Macha, S. and Biradar, S.A. (2017). Mechanism and duration of seed dormancy in linseed genotypes. *Journal of Pharmacognosy and Phytochemistry*, **6**(4), 94-96.

Del Bel, Z., Andrade, A., Lindström, L., Alvarez, D., Vigliocco, A. and Alemano, S. (2024). The role of the sunflower seed coat and endosperm in the control of seed dormancy and germination: phytohormone profile and their interaction with seed tissues. *Plant Growth Regulation*, **102**(1), 51-64.

Ellery, A.J. and Chapman, R. (2000). Embryo and seed coat factors produce seed dormancy in capeweed (*Arctotheca calendula*). *Australian journal of agricultural research*, **51**(7), 849-854.

Groundnut outlook, May (2024) Agricultural Market Intelligence Centre, PJTSAU.

Hanumanthappa, D., Vasudevan, S., Kisan, B., Wali, V., Anil S. and Maruthi, K. (2016). Mechanism and duration of seed dormancy in paddy genotypes. *Environment and Ecology,* **34**(4C), 2236-2240.

Iglesias-Fernández, R. and Matilla, A.J. (2010). Genes involved in ethylene and gibberellins metabolism are required for endosperm-limited germination of Sisymbrium officinale L. seeds: germination in *Sisymbrium officinale* L. seeds. *Planta*, **231**, 653-664.

ISTA (2019). International rule for seed testing. Switzerland: The International Seed Testing Association (ISTA).

Kokila Indira, M.A., Vanitha, C. and Sundareswaran, S. (2021). Evaluation of role of testa, cotyledon and embryonic axis in manifestation of seed dormancy in groundnut varieties. *Pharma Innovation*, **10**(10), 1185-1188.

Kumar, T.S.A., Gowda, M.V.C. and Nadaf, H.L. (1991). Seed dormancy in erect bunch genotypes of groundnut (*Arachis hypoga*ea L.). I. Variability for intensity and duration.

Morris, E.C., Tieu, A. and Dixon, K. (2000). Seed coat dormancy in two species of *Grevillea* (Proteaceae). *Annals of Botany*. **86**(4), 771-775.

Nautiyal, P.C., Ravndra V. and Bandyopadyay, A. (1994). Peanut seed dormancy, *Food Legume Newsletter* (ACIAR) Australia, **22**, 2.

Nautiyal, P.C., Sivasubramaniam, K. and Dadlani, M. (2023). Seed dormancy and regulation of germination. *Seed science and technology*, 39-66.

Reddy, P.S., Zade, V.R., Deshmukh, S.N. (1985). CGS 1-19: a new Spanish bunch groundnut cultivar with fresh seed dormancy. *Journal of Seed Research*, **2**,103-106.

Simpson, G.M. (1990). Seed Dormancy in Grasses. New York: Cambridge University Press, 297.