Progressive Research – An International Journal
Volume 13 (1) : 19-23, (2018)
Print ISSN : 0973-6417, Online ISSN : 2454-6003

Society for Scientific Development in Agriculture and Technology
Meerut (U.P.) INDIA

IDENTIFICATION OF SPANISH BUNCH ADVANCED BREEDING LINES HAVING FRESH SEED DORMANCY IN GROUNDNUT (*Arachis hypogaea* L.)

Narendra Kumar*, B.C. Ajay, M.C. Dagla, A.L. Rathanakumar, Radhakrishnan T., M.Y. Samdur, R.K. Mathur, P. Manivel, Chuni Lal, A.D. Makwana and B.M. Chikani

ICAR-Directorate of Groundnut Research, Ivnagar Road, PB No.5, Junagadh-362 001, Gujarat, India

**Corresponding author, E-mail: narendrapb09@gmail.com*

ABSTRACT

Fresh seed dormancy in Spanish bunch groundnut has a significant influence on pod yield and quality. It is required to avoid economic loss in the form of in-situ germination during unpredictable rainfall at maturity. A study was carried out using 35 Spanish bunch groundnut genotypes to identify fresh seed dormant genotypes. Analysis of variance revealed that significant genotypic differences and genotype × year interaction for germination per cent. Association studies showed that significant correlation coefficients between duration of fresh seed dormancy and intensity of fresh seed dormancy. The result revealed that three advanced breeding lines*viz*., PBS-12171, PBS-12169 and PBS-18035 had more than four weeks duration of fresh seed dormancy, highest intensity and degree of fresh seeddormancy during 2012 and 2013 season. Therefore, these genotypes were identified as new sources of fresh seed dormancy and could be used as donor parent in breeding programme to develop high yielding Spanish bunch cultivars with 2-3 week fresh seed dormancy in groundnut.

Key words : *Fresh seed dormancy, groundnut, advanced breeding lines, Spanish bunch, genetic variation.*

Groundnut (*Arachis hypogaea* L.) is a major oil seed crop grownthroughout the tropical and warm temperateregions of the world. There are two major subspecies of groundnut that differ in their life cycle. Subspecies *fastigiata*var. *vulgaris*,is a short season crop and are generally without seed dormancy and sub-species*hypogaea* var. *hypogaea*, have longer life cycle with seed dormancy (1). Spanish types are grown predominantly in semi-arid regions of Asia and Africa, where growing season is short. The primaryadvantages of Spanish types are their shortgrowing season and bunch-type growth habit and usually mature within90 to 120 days after sowing, whereas most Virginia type cultivars take 120 days or more to mature (2). The erectbunch cultivars of ssp.*fastigiata* are popular in the short growingconditions because of their early maturity and easy harvesting. Lack of seed dormancy inthe erect bunch varieties is a major problem resulting in 20-50% loss in pod yield due to in-situ germination (3). Persistence of fresh seed dormancy in groundnut also has a significant influence on crop establishment and seed vigour, though it depends on cultural practices followed (4). In India, groundnut is cultivated in the *rabi*-summer period, rainy and post-rainy seasons and prolonged seed dormancy is an undesirable character; however, a short period (10-15 days) fresh seeddormancy is required in the Spanish type of groundnut to prevent in situ seed germination in the field due to unseasonal rains at the time of crop maturity (5). Therefore, evaluation of Spanish advanced breeding materials or genotypes are required to identify genotypes with 3-4 week seed dormancy period in ssp. *fastigiata* background, which can be utilized in breeding programmeto develop short duration Spanish groundnut varietieshaving fresh seed dormancy to avoid yield losses dueto in situ germinationin field due tounpredictable rains at the time of harvesting. The genetic variability for seed dormancy in ssp. *fastigiata*has been well demonstrated by (6, 7). The objectives of this study were to evaluate Spanish advanced breeding lines for germination percent, intensity, duration and degree of fresh seed dormancy andto study genetic variability in genotypes for fresh seed dormancy.

MATERIALS AND METHODS

Plant material and field experiment : The experimental material consisted of 33 Spanish advanced breeding lines with two high yielding popular varieties recommended for Gujarat in summer season *viz*., TAG 24 and Dh 86. These genotypes were harvested at maturity as indicated by blackening of inner parenchyma of the pod(Miller and Burns, 1971). To study fresh seed dormancy, a sample of maturepods was randomly collected and shelled immediately from each genotype. Enough care was taken to prevent any damage ofthe seed testa, cotyledons and embryo while removing seeds from pods.Before sowing, the seed were treated with carbendazim (3g/kg of seed) fungicides to protect from soil-borne diseases. A total 33 advanced breeding lines and two varieties were evaluated during summer 2012 and 2013 at Directorate of Groundnut Research, Junagadh, Gujarat (Lat. 21°31' N, Long. 70°36' E) in medium black calcareous soil. The experiment was laid out in randomized complete block design with three replications. Each replication consisted of 20fresh harvested seeds sown at 2 to 3cm deep for each genotype. The seeds of each genotype were sown at

Table-1: Analysis of variance for germination percentage at weekly intervals.

	DF	7 DAS	10 DAS	14 DAS	21 DAS	28 DAS
Year	1	1.52	2.36	0.32	0.02	0.02
Rep (Year)	4	0.01	0.01	0.04	0.02	0.01
Genotype	34	0.18**	0.29**	0.30**	0.25**	0.22**
Genotype x Year	34	0.06**	0.05**	0.04**	0.02**	0.02**
Residual	136	0.02	0.03	0.02	0.01	0.01
Total	209	0.06	0.08	0.07	0.05	0.04

**Significance at P< 0.01 level.

Table-2: Germination percentages of entries tested at weekly internals in the field after the harvest over two years.

Genotype	2012					2013				
	7th DAS	10th DAS	14th DAS	21st DAS	28th DAS	7th DAS	10th DAS	14th DAS	21st DAS	28th DAS
Dh-86	24.4ho	73.3ae	82.2ad	86.7ag	93.3ad	3.3fg	53.3ci	86.7ad	96.7ab	100.0a
PBS-12009	31.1fn	57.8ch	82.2ad	91.1ae	91.1ad	26.7be	53.3ci	90.0ad	96.7ab	96.7ab
PBS-12018	20.0jo	57.8ch	91.1ad	91.1ae	93.3ad	20.0bg	33.3el	73.3ae	90.0ab	96.7ab
PBS-12029	15.6lo	57.8ch	88.9ad	91.1ae	95.6ac	30.0bd	50.0cj	93.3ac	96.7ab	96.7ab
PBS-12032	17.6ko	64.4bg	71.1bf	57.8hi	88.9ad	36.7bc	50.0cj	66.7ce	70.0cd	83.3ac
PBS-12038	51.1bh	91.1ab	100.0a	100.0a	100.0a	60.0a	76.7ac	100.0a	100.0a	100.0a
PBS-12066	15.6lo	33.3gj	55.6eg	80.0ag	80.0ce	20.0bg	33.3el	80.0ad	96.7ab	96.7ab
PBS-12067	33.3en	46.7ei	71.1bf	77.8bg	82.2be	16.7cg	26.7fl	76.7ae	86.7ac	90.0ac
PBS-12074	33.3en	46.7ei	77.8ae	82.2bg	95.6ac	3.3fg	20.0jl	70.0be	76.7bd	80.0bc
PBS-12092	62.2bd	68.9af	82.2ad	84.4bg	86.7ae	33.3bd	43.3dj	63.3de	80.0ad	80.0bc
PBS-12116	48.9bi	91.1ab	100.0a	100.0a	100.0a	6.7eg	30.0dj	66.7ce	90.0ab	93.3ab
PBS-12163	48.9bi	64.4bg	93.3ad	95.6ac	95.6ac	0.0g	20.0jl	86.7ad	96.7ab	96.7ab
PBS-12167	8.9ho	37.8fi	82.2ad	95.6ac	93.3ad	3.3fg	6.7l	66.7ce	86.7ac	90.0ac
PBS-12168	31.1fn	57.8ch	68.9cf	68.9gh	71.1e	0g	26.7fl	83.3ad	86.7ac	86.7ac
PBS-12169	22.2io	31.1hj	37.8g	44.4i	51.1f	0g	10.0kl	20.0g	26.7fg	33.3e
PBS-12171	2.2o	2.2g	2.2h	6.7j	4.4g	0g	3.3l	6.7g	6.7g	6.7f
PBS-12172	24.4ho	75.6ae	95.6ac	100.0a	97.8ab	3.3fg	23.3il	80.0ad	86.7ac	86.7ac
PBS-12175	71.1bc	95.6ab	100a	100.0a	100.0a	26.7be	60.0af	100.0a	100.0a	100.0a
PBS-13003	15.6lo	28.9hj	48.9bg	71.1dh	97.8ab	30.0bd	36.7el	53.3ef	76.7bd	80.0bc
PBS-13020	28.9go	57.8ch	95.6ac	93.3ac	93.3ad	23.3bf	60.0ag	96.7ab	96.7ab	96.7ab
PBS-13021	40.0dm	55.6dh	77.8ae	82.2ag	77.8de	3.3fg	3.3l	33.3fg	66.7d	80.0bc
PBS-13022	44.4dk	80.0ae	95.6ac	97.8ab	97.8ab	13.3dg	26.7fl	63.3de	93.3ab	93.3ab
PBS-18004	46.7cj	88.9ac	97.8ab	100.0a	97.8ab	33.3bd	56.7bh	90.0ad	100.0a	100.0a
PBS-18006	20.0jo	48.9ei	77.8ae	82.2ag	88.9ad	26.7be	40.0dk	73.3ae	90.0ab	90.0ac
PBS-18029	57.8bf	75.6ae	91.1ad	91.1ae	88.9ad	36.7bc	63.3ae	96.7ab	100.0a	100.0a
PBS-18033	31.1fn	46.7ei	73.3af	84.4ag	93.3ad	0g	3.3l	16.7g	50.0e	63.3d
PBS-18035	13.3mo	20.0if	40.0g	44.4i	51.1f	0g	6.7l	13.3g	33.3f	36.7e
PBS-18037	42.2dl	64.4bg	82.2ad	88.9af	84.4ae	33.3bd	56.7bh	80.0ad	83.3ad	90.0ac
PBS-18038	62.2bd	100a	100.0a	100.0a	100.0a	13.3dg	63.3ae	83.3ad	96.7ab	96.7ab
PBS-18045	31.1fn	48.9df	66.7df	77.8bg	82.2be	20.0bg	43.3dj	70.0be	70.0cd	73.3cd
PBS-18055	97.8a	100a	100.0a	100.0a	100.0a	60.0a	86.7ab	93.3ac	93.3ab	93.3ab
PBS-18057	28.9jo	48.9ei	75.6ae	75.6ch	80.0ce	3.3fg	56.7bh	80.0ad	86.7ac	86.7ac
PBS-18062	60.0be	82.2a	100.0a	100.0a	100.0a	16.7cg	50.0cj	76.7ae	80.0ad	80.0bc
PBS-18064	73.3b	88.9ac	97.8ab	97.8ab	97.8ab	40.0b	70.0ad	100.0a	100.0a	100.0a
TAG-24	53.3bg	84.4ad	95.6ac	95.6ac	93.3ad	70.0a	90.0a	93.3ac	96.7ab	96.7ab

Table-3: Duration, intensity and scale of dormancy among the genotypes during 2012 to 2013.

Genotypes	Duration of dormancy (Days)		Intensity of dormancy (%)		Dormancy scale	
	2012	2013	2012	2013	2012	2013
Dh-86	10	10	75.6	96.7	6	7
PBS-12009	10	10	68.9	73.3	5	6
PBS-12018	10	14	80.0	80.0	6	6
PBS-12029	10	10	84.4	70.0	7	5
PBS-12032	10	10	82.4	63.3	7	5
PBS-12038	7	7	48.9	40.0	4	3
PBS-12066	14	10	84.4	80.0	7	6
PBS-12067	10	10	66.7	83.3	5	7
PBS-12074	10	14	66.7	96.7	5	7
PBS-12092	7	10	37.8	66.7	3	5
PBS-12116	7	10	51.1	93.3	4	7
PBS-12163	7	14	51.1	100	4	8
PBS-12167	10	14	91.1	96.7	7	7
PBS-12168	10	10	68.9	100.0	5	8
PBS-12169	>28	>28	77.8	100.0	6	8
PBS-12171	>35	>35	97.8	100.0	7	8
PBS-12172	10	14	75.6	96.7	6	7
PBS-12175	7	10	28.9	73.3	3	6
PBS-13003	14	14	84.4	70.0	7	5
PBS-13020	10	10	71.1	76.7	6	6
PBS-13021	7	21	60.0	96.7	4	7
PBS-13022	7	14	55.6	86.7	4	7
PBS-18004	7	10	53.3	66.7	4	5
PBS-18006	10	10	80.0	73.3	6	6
PBS-18029	7	10	42.2	63.3	4	5
PBS-18033	10	14	68.9	100.0	5	8
PBS-18035	28	28	86.7	100.0	7	8
PBS-18037	7	10	57.8	66.7	4	5
PBS-18038	7	7	37.8	86.7	3	7
PBS-18045	10	14	68.9	80.0	5	6
PBS-18055	7	7	2.2	40.0	1	3
PBS-18057	10	10	71.1	96.7	6	7
PBS-18062	7	10	40.0	83.3	3	7
PBS-18064	7	7	26.7	60.0	3	4
TAG-24	7	7	46.7	30.0	4	3

45 cm spacing between rows and 10 cm between plants. The soil moisture was maintained at field capacity during the growth periodof the test (30 DAS) by irrigation. The observations were recorded on number of seeds germinated at every day until the end of experiment.

Estimated parameters : Fresh seed dormancy is characterized by its intensity and duration.Two parameters were studied in the present investigation for genotypes at two seasons *viz*., intensity and duration of dormancy. The percentage of germinated seeds for entry at a given date was calculated by the following formula :

$$\text{Germination (\%)} = \frac{\text{Number of germinated seeds}}{\text{Total number of seeds}} \quad 100$$

The intensity of dormancy was measured as percentage of non-germinated seed at seven days after sowing and duration of dormancy was measured by days taken to attend 50 per cent germination by a genotype. These parameters were estimated using the method suggested by Kumar *et al*. 1991. Degree of dormancy was classified according to the scale devised by (8).

Statistical analysis : Analysis of variance was performed using the statistical package DSAASTAT (Onofri, 2007).

The partitioning of means was made with Duncann's multiple range Test at 5% probability level.

RESULTS AND DISCUSSION

Analysis of variance has revealed significant genotypic differences and genotype × year interaction for germination (Table-1). Presence of interaction effect indicates that germination percent varies from one year to other which could be attributed to environmental conditions. Germination percentage of genotypes averaged over two seasons is presented in Table 2. At 7th days, an average lowest germination per cent was observed in the genotypes PBS-12171(1.1%) followed by PBS-12167 (6.1%) and PBS-18035(6.7%) in both the seasons while highest germination percent was observed in genotypes PBS-18055 (78.9%), followed by TAG-24 (61.7%) and PBS-18064 (56.7%). Though germination percent may slightly vary from season to season. It could be due to environmental conditions like temperature and moisture, others non-genetic factors (9). At 14th day germination percentage increased significantly in all the genotypes and it was highest in Dh-86 (79.4%0, PBS-12172 (73.9%) and PBS-13020 (70%) while genotypes PBS-12171 having lowest germination (3.3%) followed by PBS-12169 (17.8%) and PBS-18035 (20%). At 21stand 28thday, all the genotypes having germination per cent more than 50% except genotypes PBS-12171 having 5.6% germination while genotypes PBS-12169 (29.6% and 42.2%) and PBS-18035 (32.6 and 43.9%) hadalso least germination at 21st and 28th days respectively. Therefore these advanced breeding lines could be used as new sources of fresh seed dormancy.

Intensity of fresh seed dormancy : According to (10) intensity of dormancy is defined as the percentage of seeds that not germinated seven days after the harvest. Intensity of dormancy ranged from 2.2 to 97.8% and 0.0 to 70% during 2012 and 2013 respectively (Table-3). The genotypes PBS-12171 and PBS-12167 had highest more than 91.1% intensity of dormancy while the genotype PBS-18055 having lowest intensity of dormancy during both the year. This large variation could be due to genetic variation among the genotypes. These findings are in agreement with the results of (10).

Duration of fresh seed dormancy : Genotypes tested showed different durations of dormancy and it ranged from 7 to >35 days duringboth the year. An advanced breeding line PBS-12171, had highest >35 days duration of dormancy followed by PBS-12169 and PBS-18035 had 28 days duration of dormancyduring both the years (Table 3). In contrast, non-dormant genotypes such as PBS 12038, PBS 18038, PBS-18055, PBS-18064 and TAG-24 had lowest <7 days dormancy duration in both the years. These results were in agreement with the findings of (11). It was also observed that intensity and duration of dormancy had significant correlation during 2012 (57.4**) and 2013 (55.6**); it means more the intensity of duration longer was the duration of dormancy. Similar findings were also reported by (10). Degree of seed dormancy of genotypes was done as per the 0 to 8 scales of Landfort*et al*. 1965, wherein scale 0 indicates least dormant and scale 8 indicates most dormant genotype. Results revealed that most of the genotypes tested were grouped under scale 3 to 6 (non-dormant) and genotypes PBS-12171and PBS-18035 had highest average scale 7.5 hence, it is most dormant followed by genotypes PBS-12167 and PBS-12169 had average scale 7 during both the year (Table-3). Therefore, these genotypes identified as more fresh seed dormancy than other genotypes. The present results are in agreement with the observations made by (12).

CONCLUSION

Advanced breeding lines evaluated for fresh seed dormancy showed significant genetic variation forgermination percent at weekly intervals, duration, intensity and degree of fresh seed dormancy in groundnut. It was concluded that three advanced breeding lines PBS-12171, PBS-12169 and PBS-18035hadmore than four weekduration of fresh seed dormancy, highest intensity of fresh seed dormancy and degree of fresh seed dormancy during 2012 and 2013. Therefore, these genotypes were identified as new sources of fresh seed dormancy in groundnut.

ACKNOWLEDGEMENTS

The authors are grateful to Director, DGR for providing facilities and support for carrying out the research experiment.

REFERENCES

1. Nautiyal, P.C.; Bandyopadhyay, A. and Zala, P.V. (2001). In situ sprouting and regulation of fresh seed dormancy in Spanish type groundnut (*Arachis hypogaea* L.) *Field Crop Research, 70 :* 233-241.
2. Stalker, H. T. (1997). Peanut. *Field Crop Research. 53 :* 205-217.
3. Reddy, P.S. (1982). Problems of groundnut cultivation. *Indian Farming. 32(8):* 37-42.
4. Nautiyal, P.C.; Vasantha, S.; Suneja, S.K. and Thakkar, A.N. (1988). Physiological and biochemical attributes associated with the loss of seed viability and vigour in groundnut. *Oleagineux. 43:* 459-463.
5. Bandyopadhyay, A., Nautiyal, P.C., Radhakrishnan, T and Gor, H.K. (1999). Role of Testa, Cotyledons and Embryonic Axis in Seed Dormancy of Groundnut (*Arachis hypogaea* L.). *Journal of Agronomy and Crop Science. 182 :* 37-41.
6. Faye, I.; Daniel, F.; Jean-François, R.; Hodo-Abolo, T.; Ndoye, S.M.; Diop, A.T. and Ndoye, O. (2010). Inheritance of fresh seed dormancy in Spanish-type peanut (*Arachis hypogaea* L.): bias introduced by inadvertent selfed

flowers as revealed by micro-satellite markers control. *African Journal of Biotechnology. 9(13) :* 1905-1910.

7. Wang, M.L.; Chen, C.Y.; Pinnow, D.L.; Barkley, N.A.; Pittman, R.N.; Lamb, M. and Pederson, G.A. (2012). Seed dormancy variability in the U.S. mini-core collection. *Research Journal of Seed Science. 5(3):* 84-95.
8. Landfort, W.R.; Sowell, Jr. Massey G. and Corely, J.H. W.L. (1965). Catalogue of peanuts. USDA.
9. Toole, V.K.; Bailey W.K. and Toole, E.H. (1964). Factors influencing dormancy of peanut seeds. *Plant physiol. 39 :* 822-832.
10. Kumar, A.S.T.; Gowda, M.V.C. and Nadaf, H.L. (1991). Seed dormancy in erect bunch genotypes of groundnut (*Arachis hypogaea* L.) I. Variability for intensity and duration. *J. Oilseeds Res. 8 :* 166-172.
11. Pandya, R.B. and Patel, V.J. (1986). Dormancy in kernels of Spanish and Virginia bunch varieties of groundnut. *J. Oilseeds Res. 3(1):* 19-27.
12. Faye, I.; Ndoye, O. and Diop, T.A. (2009). Evaluation of Fresh Seed Dormancy on Seven Peanut (*Arachis hypogaea* L.) Lines derived from crosses between Spanish varieties: Variability *on intensity and duration. Journal of Applied Scienes Research. 5(7) :* 853-857.

Received : November-2017 Revised : December-2017 Accepted : December-2017