

Original Research Article

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Identification of Fresh Seed Dormancy in Bunch Type Groundnut Genotypes (*Arachis hypogaea* L.)

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ABSTRACT

Fresh seed dormancy in bunch type groundnut has a significant influence on pod yield, oil and protein 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 32 bunch type groundnut genotypes and 5 groundnut cultivars to identify fresh seed dormant genotypes. Analysis of variance revealed that significant genotypic differences for germination percent. Character Association studies showed that significant correlation coefficients between duration of fresh seed dormancy and intensity of fresh seed dormancy. The result observed that five groundnut genotypes viz., TG-26, ICGV-13558, ICGV-13214, ICGV-13237, ICGV-8110 had more than four weeks duration of fresh seed dormancy and highest intensity of fresh seed dormancy during 2018 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 bunch type cultivars with 2-3 week fresh seed dormancy in groundnut.

Keywords

Fresh seed dormancy, Groundnut and Genetic variation

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Introduction

Groundnut is a species of the legume family Fabaceae which comprises important edible oil seed crops in the world. Groundnut is classified into two subspecies based on morphological characteristics (Kaprovicak and Gregory, 1994). Sub-species *fastigiata* var. *Vulgaris*, is a short season crop,

sequential branching habit and are generally without seed dormancy. sub-species var. *hypogaea*, have longer life cycle and alternate branching habit with seed dormancy.

Spanish types are grown predominantly in semi-arid regions of Asia and Africa, where growing season is short. The primary advantages of Spanish types are their short

growing season and bunch-type growth habit usually mature within 90 to 120 days after sowing, whereas most Virginia type cultivars take 120 days or more to mature.

The erect bunch cultivars of *ssp.fastigiata* are popular in the short growing conditions because of their early maturity and easy harvesting.

Yield losses due to *in situ* germination in erect bunch varieties have been estimated to range between 20% and 40% (Reddy *et al.*, 1985; Nagajun and Radder, 1983). Thus, a short period of seed dormancy is necessary to reduce these losses.

Seed dormancy has been defined as the failure of an intact, viable seed to complete germination under favourable conditions (Bewley, 1997). Appreciable dormancy observed in the freshly harvested seeds of several bunch groundnut cultivars is called fresh seed dormancy.

In groundnut, seed dormancy has been reported to be controlled by two hormones: abscisic acid which inhibits sprouting and ethylene which is accumulated in storage to break dormancy to allow germination (Ketring and Morgan, 1971, 1972).

In India groundnut is cultivated in rainy season and prolonged seed dormancy is an undesirable character; however, a short period (10-20 days) fresh seed dormancy 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 maturity.

The objectives of this study were to evaluate bunch type groundnut genotypes for germination percent, intensity, duration of fresh seed dormancy and to study genetic variability in genotypes for fresh seed dormancy.

Materials and Methods

Plant material and field experiment

The experimental material consisted of 32 bunch type groundnut genotypes and 5 cultivars of groundnut viz. TG-26, Grinar-2, Grinar-3, Mallika and JGN-3. These genotypes were harvested at maturity.

To study fresh seed dormancy, a sample of mature pods was randomly collected and shelled immediately from each genotype.

Enough care was taken to prevent any damage of the seed testa, cotyledons and embryo while removing seeds from pods.

A total 32 bunch type groundnut genotypes and five cultivars were evaluated during summer 2018 at Research Farm, Department of Genetics and Plant Breeding, RVSKVV, College of Agriculture, Gwalior (M.P.) (26° 13' N Latitude and 78° 14' E Longitude) in sandy loam soil. The experiment was laid out in randomized complete block design with three replications.

Each replication consisted of 20 fresh harvested seeds sown at 2 to 3cm deep for each genotype. The seeds of each genotype were sown at 45 cm spacing between rows and 10 cm between plants.

The soil moisture was maintained at field capacity during the growth period of 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. Fresh seed dormancy parameters were estimated using the method suggested by Kumar *et al.*, (1991).

Germination percentage

The percentage of germinated seeds for entry at a given date were calculated by the following formula:

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

Intensity of fresh seed dormancy

The intensity of dormancy was measured as percentage of non-germinated seed at seven days after sowing.

$$\text{Intensity of dormancy (\%)} = 100 - \text{Germination percentage}$$

Duration of fresh seed dormancy

Duration of dormancy was measured by days taken to attend 50 per cent germination by a genotype.

Results and Discussion

Analysis of variance revealed that significant genotypic differences for germination (Table 1). Germination percentage of genotypes averaged over is presented in Table 2. At 14th days, an average lowest germination per cent

was observed in the genotypes TG-26, ICGV-8110, ICGV-13237, ICGV-13214, ICGV-13565, ICGV-13574, ICGV-13558 and ICGV-13564 while highest germination percent was observed in genotypes ICGV-13564, ICGV-X-1400-65-F₂, JGN-3 and ICGV-13229.

Intensity of fresh seed dormancy

Intensity of dormancy ranged from 4.2 to 100%. The highest (100%) intensity of dormancy was recorded in ICGV-13567, ICGV-13558, ICGV-13214, ICGV-13237, ICGV-8110 and TG-26 genotypes. While the lowest have recorded in ICGV-13564 (4.2%), ICGV-X-140065-F₂(4.5%) and JGN-3 (5.9%). This large variation could be due to genetic variation among the genotypes.

Duration of fresh seed dormancy

Genotypes tested showed different durations of dormancy and it ranged from 7 to >35 days. Genotypes TG-26 had highest >35 days duration of dormancy followed by ICGV-13574, ICGV-13558, ICGV-13555, ICGV-8705, ICGV-13565, ICGV-13208, ICGV-13214, ICGV-9885, ICGV-13230, ICGV-13233, ICGV-13237, ICGV-8110, Girnar -3 and Girnar-2 had >28 days duration of dormancy.

Table.1 ANOVA for germination percentage at seven days after sowing

Source of variation	Degree of freedom	Sum of squares	Mean sum of squares	F value
Replication	1	8.38	8.38	19.41
Germination percentage	37	62416.86	1733.80**	4017.23
Error	37	15.54	0.43	-
Total	74	62440.77		-

CV= 0.097%, ** significant at 1%

Table.2 Duration of dormancy, intensity of dormancy and mean value of germination percentage in 37 groundnut genotypes

Genotypes	Mean Value of germination percentage (%)	Duration of dormancy(days)	Intensity of dormancy(%)
ICGV-13564	95.8	7	4.2
ICGV-13567	0	28	100
ICGV-X-1400-65-F ₂	95.5	7	4.5
ICGV- 13574	0	>28	100
ICGV-13558	0	>28	100
ICGV-13562	3.6	28	96.5
ICGV-13554	2.2	>28	97.8
ICGV-13555	1.8	>28	98.2
ICGV-13560	59.5	10	40.5
ICGV-13575	8.6	28	90.4
ICGV-13557	17.2	21	82.9
ICGV-8705	2.2	>28	97.8
ICGV-13565	0	>28	100
ICGV-13208	0.8	>28	99.2
ICGV-13214	0	>28	100
ICGV-9885	2.4	>28	97.6
ICGV-13219	7.8	28	92.2
ICGV-13226	19.97	21	80.03
ICGV-13227	10	28	90
ICGV-13230	1.5	>28	98.5
ICGV-13233	0.6	>28	99.4
ICGV-13235	29.6	10	70.4
ICGV-13237	0	>28	100
ICGV-13229	92.4	7	7.6
ICGV-13240	6.94	28	93.06
ICGV-8010	17.96	21	82.04
ICGV-13243	19.1	21	80.9
ICGV-13246	15.3	21	84.7
ICGV-8110	0	>28	100
Grinar-3	0.67	>28	99.33
Girnar-2	1.92	>28	98.08
Mallika	21.78	14	78.22
ICGV-13545	24.4	10	75.6
PBS-12200	27.3	10	66.7
JGN-3	94.1	7	5.9
PBS-12201	17.6	14	82.4
TG-26	0	>28	100

In contrast, non-dormant genotypes such as ICGV-13564 and JGN-3 had lowest 7 days dormancy duration. It was also observed that intensity and duration of dormancy had significant correlation; it means more the intensity of duration longer was the duration of dormancy. Bunch type groundnut genotypes and cultivars evaluated for fresh seed dormancy showed significant genetic variation for germination percent, duration and intensity of fresh seed dormancy in groundnut. It was concluded that five groundnut genotypes *viz.*, TG-26, ICGV-13558, ICGV-13214, ICGV-13237, ICGV-8110 had more than four weeks duration of fresh seed dormancy and highest intensity of fresh seed dormancy.

Therefore, these genotypes were identified as new sources of fresh seed dormancy in groundnut.

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