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Seed Dormancy is a Necessary Phenomenon in Groundnut

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Abstract

Groundnut is an important oilseed crop grown throughout the year. Groundnut having three types of growth habit, Spanish and Valencia habit types does not have fresh seed dormancy, while Virginia types having longer seed dormancy. Lack of seed dormancy in the Spanish bunch and Valencia varieties have a major problem of *in-situ* germination resulting from unpredictable rainfall at crop maturity while prolonged seed dormancy in Virginia types prevents farmers to use own seed immediately after harvest for sowing purpose and also having longer duration than Spanish bunch cultivars. Therefore, Spanish bunch cultivars are most suitable because of fit well in the *kharif*, *rabi* and summer seasons with at least three week fresh seed dormancy to avoid pod losses due to unpredictable rainfall at the time harvesting.

Introduction

Groundnut (*Arachis hypogaea* L.) is an important oilseeds crop cultivated throughout the tropical, subtropical and temperate regions growing more than 100 countries of the world. It is grown globally in nearly 28.0 million ha with a total production of about 46.0 million tons and productivity of about 1642 kg/ha during 2016-17 to 2018-19. On the basis of averages for the triennium (2017-20), in India, groundnut is annually cultivated on an area of 48.35 lakh ha which gives a production of 86.92 lakh tons with an average yield of 1790 kg/ha. Currently, about 80% of groundnut area lies in six major states *viz.*, Gujarat, Andhra Pradesh, Rajasthan, Karnataka, Tamil Nadu and Maharashtra and while the remaining area is confined in Madhya Pradesh, Telangana, Uttar Pradesh and West Bengal. Groundnut is a mainly is a *kharif* season rainfed crop which accounts an about 84% of the total area and 80% of total production with lower productivity as compared to irrigated (*Rabi*-Summer seasons). *Rabi*-Summer groundnut is mainly grown in seven major states *viz.*, Karnatka, Tamil Nadu, Maharashtra, Telangana, Andhra Pradesh, Gujarat and West Bengal which account for about 90.7% of area and 91.1% of production of total *rabi*-summer area of about 7.9 lakh ha with total production of about 14.9 lakh tons and productivity of about 1887 kg/ha during 2016-17 to 2018-19 in India. Last two decades (2001 to 2021), a total 117 groundnut cultivars have been released in India, among them majority of Spanish bunch cultivars (76) and rest of which were Virginia bunch (29) and Virginia runner cultivars (12). Therefore Spanish bunch cultivars are predominant in Indian condition due to fit well in all the three seasons and groundnut cropping systems.

Seed dormancy is failure or delayed germination of mature and viable seed under conditions favourable for germination or it can be defined as it is a phenomenon in which mature and

viable seeds fail to germinate under conditions favourable for germination. Seed dormancy in groundnut has its advantages and disadvantages. It is advantageous where unexpected rainfall at the time of crop maturity as it prevents pre-harvest sprouting of seeds in the standing crop and disadvantageous when farmers want to use the fresh harvested seed of post-rainy season for next immediate rainy season for growing the crop cannot do so if the dormancy is more than one month in groundnut. Among the total cultivated area of post-rainy season (*rabi*-summer) which is 100 percent predominated by Spanish bunch cultivars due to their earliness, synchronous maturity and easy harvesting but sub-species *fastigiata*, Spanish (subsp. *fastigiata* var. *vulgaris*) and Valencia (subsp. *fastigiata* var. *fastigiata*) habit types normally does not have fresh seed dormancy while Virginia (subsp. *hypogaea* var. *hypogaea*) types have longer life cycle with having seed dormancy. Spanish bunch varieties have a major problem of *in-situ* germination due to unpredictable rainfall at the time of harvesting resulting about 10-20% loss in pod yield. In India, prolonged seed dormancy is an undesirable character in Spanish bunch groundnut varieties because of its adaptability in the *kharif*, *rabi* and summer seasons. To fit groundnut in these cropping seasons requires cultivars with short duration with uniform maturity. Spanish bunch and Valencia type varieties have short duration but have a major problem of *in-situ* germination due to unpredictable rains, prolonged rainy season and irrigation at the time of crop maturity to enable easy harvest and to avoid pod loss. Hence under such conditions at least three week fresh seed dormancy would be required in Spanish bunch groundnut cultivars grown in rainy and post rainy seasons to avoid yield losses.

Basis of Seed Dormancy in Groundnut

Genetic, environmental factors (temperature, growing season, rainfall etc.), hormones and seed coat, cotyledons and embryo play an important role in regulation of dormancy in groundnut. Seed dormancy and germination involves a balance between inhibitory and stimulatory growth compounds in the seed. Dormancy in groundnut is mainly due to hormonal balance between abscisic acid and ethylene, which is produced by the embryo through the action of cytokinin during seed imbibition. Sengupta *et al.* (1979) reported seed dormancy period of spreading varieties was primarily due to presence of growth inhibitors in the embryo and partly due to seed coat factor. Abscisic acid has been associated with dormancy in groundnut because of this hormone could be detected in both developing and mature seeds and it inhibits germination in groundnut (Sharma *et al.*, 1987). Bandyopadhyay *et al.* (1999) reported that seed dormancy in groundnut is regulated mainly by testa (a maternal tissue) in the Spanish type and by cotyledons, and embryonic axis (both zygotic tissue) as well as testa in Virginia type.



Figure 1: Genotypic variability for fresh seed dormancy in Spanish bunch groundnut genotypes

Measurement Parameters of Seed Dormancy

There are different parameters of measuring the dormancy in groundnut. Duration of fresh seed dormancy was measured by days taken to attain 50 percent germination by a genotype and intensity of fresh seed dormancy was measured as percentage of non-germinated seed at seven days after sowing. Degree of dormancy is measured by scale. The duration of dormancy is mainly governed by the intensity of dormancy and environmental factors. These both parameters are related to each other. Genotypes having high intensity of dormancy (> 90%) at ideal environmental conditions would be more desirable rather than having low intensity with long duration of dormancy. From practical point of view, high intensity (> 90%) along with 2-3 week duration is very important rather than at seven days after harvest.

Induction of Dormancy

Various growth retardants *viz.*, Maleic hydrazide and Abscisic acid, γ -radiation treatments etc. play very important role in induce dormancy in groundnut. It was reported that foliar application of maleic hydrazide @ 1000 to 1250 PPM at 60 and 90 days after sowing induce fresh seed dormancy in Spanish bunch cultivars. Foliar application of 150 PPM of abscisic acid at pod maturation stage induces dormancy up to 16 days in non-dormant bunch type groundnut cultivar KCG 2 (Gowda *et al.*, 2015).

Methods of Breaking Seed Dormancy

Prolonged seed dormancy in groundnut is an undesirable trait because of it is cultivated all the seasons in India. Dormancy in groundnut is mainly control by a balance between growth inhibitors in the embryo, promoters growth compounds in the seed and partly due to seed coat factors. Various methods have been found to break dormancy and accelerate germination in groundnut but currently soaking of seed in 0.05% ethrel or ethephon (2-chloroethyl phosphonic

acid) solution for 12 hours is widely used for breaking seed dormancy in groundnut. Shobha *et al.* (2020) reported that seed incubation at temperature of 25-40 °C over a moist substratum for two days and soaking of groundnut seed in ethrel @ 200 PPM for six hours breaks dormancy and increased germination percent above minimum seed certification standards (70%).

Table 1: List of Spanish bunch groundnut cultivars having fresh seed dormancy

S I . No.	Cultivars	Recommended state	Recommended season
1	TMV 5	Tamil Nadu	Kharif
2	TMV 9	Tamil Nadu	Kharif
3	Co 1	Tamil Nadu	Kharif, Rabi
4	TG 17	Maharashtra	Kharif, Summer
5	Dh 8	North Karnataka	Kharif
6	VRI 1	Tamil Nadu	Kharif, Rabi-summer
7	Tirupti 3	Andhra Pradesh	Kharif, Rabi-summer
8	TG 26	Gujarat, North Maharashtra, Madhya Pradesh	Kharif, Rabi-summer
9	TPG 41	All India	Rabi-summer
10	Girnar 3	Odisha, West Bengal and NEH region	Kharif
11	Kadiri Haritandhra	Karnataka, Maharashtra	Rabi-summer

Conclusion

Seed dormancy in groundnut is a necessary phenomenon required at least with three week duration would be most useful for cultivation of groundnut to fit well in all the cropping seasons in India as well as to avoid economic loss of the farmers in the form of *in-situ* germination.

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