

Dormancy of the Seed in the different varieties.

By experiments were laid out
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I. Introduction. Dormancy is characteristic of several agricultural crops and refers to the resting period required to give complete germination on sowing from the time of maturity at harvest. Seeds of certain varieties of plants are dormant and require some resting period for germination while others are non-dormant and sprout if sown soon after harvest. Some seeds even germinate while on the plants themselves if conditions are favourable.

Two varieties of the groundnut are cultivated in Madras, viz., the spreading or runner variety, which occupies over 80 percent of the area under the crop in the province and the bunch or peanut variety. The seeds of the former have a dormancy period of two to two and a half months while those of the latter have no dormancy or resting period.

The main rainfed or winter crop of the groundnut is raised between June and December and the summer or irrigated crop between February and August. The spreading variety is largely sown for both these crops. Seed material for the summer crop usually sown in the second fortnight of February is taken from the preceeding rainfed crop harvested in December. The interval available for the seeds to complete their resting period is just sufficient in a normal cropping year. But when the season is abnormal, sowing and harvest of the rainfed crop may be delayed for over a month and the period available between the harvest of the rainfed crop and the sowing of the summer crop will not be sufficient to complete the resting period. This will affect the germination of the summer crop, resulting in defective stand and uneven growth of plants. The necessity, therefore, for a spreading variety of the groundnut with a shorter period of dormancy is obvious.

The bunch variety is exclusively cultivated in certain tracts like Pollachi in the Coimbatore district, Guntur and parts of Bellary and Kistna. On account of its short duration of three and half months, it fits in well as a first crop in dry lands where facilities exist for raising another short crop in a year. It has also the advantage of easy harvest and can be grown in tracts where only the south-west monsoon rains are predominant. Thus, though this variety is cultivated in a very limited area in this province, it cannot be replaced by the long duration spreading variety.

The groundnut crop by its very nature of fruiting underground cannot be harvested without sufficient moisture in the soil. Rains at the time of harvest are often either too low resulting in imperfect harvest at increased cost or excessive when harvests have to be delayed till the

Government to-day. The condition. In the latter circumstances, war purposes was engaged. The sprouting of the seed occurs in the bunch inevitable reaction of germinated seed is quite useless, while the production levels are of poor quality with low oil content. Agricultural losses are considerable in certain years. Loss by germination heights. At about 80 percent of the produce was estimated to have been lost in the field. In the year 1938 at the Groundnut Research Station, Tindivanam (South Arcot district) due to heavy rains in November, the harvests of the bunch types had to be delayed by a few days. It was then found that in some varieties, as high as 80 percent of seeds had germinated. The need for a dormant, short duration bunch type is therefore great.

2. Review of previous work. No serious attempt appears to have been made so far to study the problem of dormancy in the groundnut. Stokes and Hull (1930) in their study of progenies of crosses between the Spanish and the runner types of groundnuts found the dormancy of the runner type to be incompletely dominant over the non-dormant nature of the Spanish type, and that the dormancy of the runner type is not due to the impervious seed coat as was originally supposed. They also pointed out that seed dormancy is essential in a satisfactory "hogging off" variety and also in varieties for market growing when frequent rains occur during the harvesting period.

The problem of seed dormancy has been thoroughly investigated in wheat and to a less extent in barley and oats. Scholze (1933) experimented with a large number of wheat varieties and reported the absence of any relationship between the length of dormancy and the winter or the spring habit or earliness of ripening. Dormancy was also found not associated with the moisture content of the grain. Freistedt (1935) conducted extensive tests over a number of years on the dormancy of both spring and winter barleys and found the characters to be recessive on the genetic analysis of F₂ progenies of four crosses. Harrington and Knowles (1940) have pointed out that "dormancy as a character has achieved a position of breeding significance". The limitations met with in the groundnut types also confirm this view.

3. Experimental work. Preliminary experiments on seed dormancy were conducted at the Groundnut Research Station, Tindivanam, (South Arcot district) with the material available in the bunch and the spreading varieties, numbering over 80 units in 1936—37 and 1937—38. The results showed that in the bunch types fairly high germination of 50 to 80 percent was obtained immediately after harvest. There is a gradual rise and maximum germination of over 90 percent was obtained in about a week to ten days after harvest, and slow increase was noted till about two to two and a half months after the harvest, when high percentage

of germination was obtained. Differences in the degree of presence or absence of dormancy were also noted among the different varieties.

Based on these findings systematic experiments were laid out during the years 1939—40 and 1940—41. Six representative types in each of the bunch and the spreading varieties with the following characters were selected for the study.

TABLE I.

Varieties.	Register Number.	Size of Pods.	Kernelled nature	Seed coat colour	Remarks.
A. BUNCH.					
1. Gudiyatham	... A. H. 30	Small	1—2	Light Rose	Commonly cultivated bunch variety cultivated in Pollachi tract.
2. Small Japan	... 34	..	1—2	Dark Red	
3. Volete	... 35	Very small	1—2	Light Rose	
4. Valencia	... 60	Medium	1—4	Dark Red	
5. Improved Spanish	70	Medium (3 occasional)	1—3	Light Rose	
6. Corientes I.	... 810	Small (4 occasional)	1—4	Light Rose	
B. SPREADING.					
1. Local Mauritiws	... A. H. 1	Small	1—2	Rose	Commonly cultivated spreading variety.
2. Texas	... 10	Big	1—3	Rose	
3. West African	... 16	Medium	1—3	Rose	Improved variety under distribution.
4. Saloum	... 25	Medium (3 occasional)	1—3	Rose	
5. Louga	... 26	Very Small	1—2	Rose	
6. Native Tanganyika.	73	Medium	1—3	Rose	

The lay out adopted was a split plot design replicated four times separately for the bunch and the spreading varieties. Intervals of sowing were randomised within blocks and the types within sub-blocks. Sowings were done in plots measuring 2' x 1½' laid out in the field at fifty seeds per plot, per sowing. The plots were regularly and uniformly watered and germination counts made every morning. For purposes of statistical analysis the total number of seeds that had germinated up to and inclusive of the tenth day after sowing was alone taken as non-dormant for the reason that groundnut sown in this field, germinates completely by the tenth day. In the first year's experiment there were ten sowings at two-day intervals after harvest, for the bunch series and seven sowings at ten-day intervals for the spreading. The experiment was repeated in the second year on the same lines with sowing for the spreading series continued at ten-day interval up to 100th day after the harvest.

4. Results. (i) *Varietal*.—The germination data were statistically analysed by the method of analysis of variance. Differences between varieties, sowings and interactions attained the level of significance in both the years. The results are presented below.

TABLE II.
Dormancy test of Bunch Varieties — Produce of 1939—40 Rainfed Crop.
Mean germination percentage.

Varieties.	Period in days from harvest to starting of the tests.										Mean
	2	4	6	8	10	12	14	16	18	20	
A. H. 32	64.0	94.0	97.0	98.5	96.5	98.5	97.5	98.0	97.5	97.5	93.9
34	44.0	94.5	98.0	99.0	97.5	97.5	98.0	97.5	99.0	97.0	92.3
55	93.0	95.0	96.5	97.5	97.5	98.5	97.5	97.5	98.0	99.0	94.0
60	67.0	96.5	98.0	97.6	99.6	98.5	98.5	99.0	97.5	97.5	94.9
70	72.0	98.0	99.0	98.0	98.5	99.5	100.0	99.0	98.5	99.0	96.2
810	64.0	98.5	99.0	99.0	99.0	97.5	98.0	96.0	100.0	97.5	94.9
Mean	62.4	96.1	97.9	98.2	98.1	98.3	98.3	97.9	98.4	97.9	...

	Standard error	Critical difference
Sowings	1.10	3.18
Varieties	0.64	1.78
Body of the table	2.03	5.63

Conclusions.

Sowings	18, 14, 12, 8, 10, 20, 16, 6, 4, 2
Varieties	70, 60, 810, 55, 32, 34

TABLE III.
Dormancy Tests of Bunch Varieties — Produce of 1940—41 Rainfed Crop.
Mean germination percentage.

Varieties.	Period in days from harvest to starting of the tests										Mean
	2	4	6	8	10	12	14	16	18	20	
A. H. 32	78.5	81.5	87.0	75.5	81.5	89.5	89.0	92.0	94.0	94.0	85.6
34	64.0	69.0	85.0	83.5	80.5	81.0	86.0	93.5	91.0	92.0	82.6
55	78.5	78.0	85.5	85.5	89.0	93.0	88.0	94.0	94.0	92.5	88.1
60	86.5	82.0	88.5	89.5	91.0	92.0	88.0	87.5	90.0	95.5	89.1
70	76.0	78.5	78.0	83.0	89.5	92.5	87.5	93.0	92.0	94.0	86.4
810	80.0	73.0	86.0	79.5	83.5	84.5	86.5	92.0	92.5	95.0	85.2
Mean	77.3	77.1	84.2	83.3	85.8	88.8	87.5	92.0	92.3	93.8	...

	Standard error	Critical difference
Sowings	1.34	3.88
Varieties	0.96	2.66
Body of the table	3.02	8.38

Conclusions.

Sowings	20, 18, 16, 12, 14, 10, 6, 8, 2, 4
Varieties	60, 55, 701, 32, 810, 34

TABLE IV.

Dormancy Test of Spreading Varieties — Produce of 1939—40 Rainfed Crop.
Mean germination percentage,

Varieties.	Period in days from harvest to starting of tests							Mean
	10	20	30	40	50	60	70	
A. H. 1	15.5	47.5	82.5	84.5	94.0	95.0	96.0	73.6
10	5.0	12.5	57.0	71.0	91.0	93.5	96.0	60.9
16	7.0	26.5	65.5	71.5	86.5	90.5	91.5	62.7
25	3.5	10.0	30.5	51.0	79.5	80.5	83.0	48.3
26	6.5	13.5	44.5	61.5	82.0	84.5	84.5	53.9
73	51.0	70.0	78.5	90.5	94.5	95.5	97.5	82.5
Mean	14.8	30.0	59.8	71.7	87.9	89.9	91.4	

	Standard error	Critical difference
Sowing	1.06	3.15
Varieties	0.26	0.72
Body of the table	2.62	5.12

Conclusions.

Sowings	70,	60,	50,	40,	30,	20,	10
Varieties	73,	1,	16,	10,	26,	25.	

TABLE V.

Dormancy tests of Spreading Varieties. Produce of 1940—41 Rainfed Crop.
Mean germination percentage

Varieties	20*	Period in days from harvest to starting of the tests								Mean
		30	40	50	60	70	80	90	100	
A. H. 1	11.5	28.0	50.0	58.0	70.0	73.0	74.0	75.0	82.5	58.0
10	3.5	23.5	28.0	38.0	56.0	65.0	68.5	68.5	78.0	47.7
16	4.0	21.5	33.0	44.5	66.5	72.0	75.5	77.0	76.0	52.8
25	9.5	25.0	63.0	60.0	67.0	69.5	73.0	75.5	82.0	58.3
26	6.0	19.0	33.5	54.0	65.0	69.0	72.5	72.0	78.5	52.2
73	54.5	75.5	72.0	75.5	80.0	85.5	83.0	85.5	89.0	77.8
Mean	15.0	32.1	47.5	55.0	67.4	72.3	74.4	75.6	81.0	

	Standard error	Critical difference
Sowings	2.44	7.12
Varieties	1.32	3.66
Body of the table	3.94	10.92

Conclusions.

Sowings	100,	90,	80,	70,	60,	50,	40,	30,	20.
Varieties	73,	25,	1,	16,	25,	10.			

* The 10th day sowing did not give any germination and was therefore omitted from the analysis.

Bunch Varieties. In the first year of the experiment all sowings after the fourth day onwards gave germination of over 90 percent and were on par with each other. The freshly harvested seeds had high moisture content on the second day and a significantly low germination was noted in subsequent sowings till 93.8 percent was obtained for the 20th day sowing. Differences due to types though significant were of low magnitude. But A. H. 34 "Small Japan" recorded the longest period of dormancy among the bunch types. This, however, is not very popular with growers due to other considerations.

Spreading Varieties. In both the years of experiment a rapid increase in germination was noted for the first four sowings at ten-day intervals and the differences between the mean germination percentages for these four sowings were significant. In subsequent sowings the increase in the percentage of germination was much less. Unlike in the bunch series, marked differences between types were noted in this series and A. H. 73, "Native Tanganyika" gave over 50 percent germination for the first sowing and finally recorded the highest germination in both the years, showing thereby that it had shorter period of dormancy. But unfortunately this has certain undesirable characters as susceptibility to wilt etc. Types A. H. Nos. 10, 16, 25 and 26 gave the lowest germination both at start and at the end of the experiments in both the years indicating that these types required a longer resting period to give full germination. A. H. 1 "Local Mauritius" the commonly cultivated type was intermediate between these two groups.

It is seen that in the second year of the experiment the percentages of germination obtained for successive sowings were lower for the corresponding sowings of the first year. These variations are due to the seasonal effects on the groundnut crop.

To sum up, the bunch variety gives good germination in about a week after harvest (the harvested produce being well dried) while the spreading types require a resting period of two to two and a half months after harvest.

(ii) *Inheritance of seed dormancy.* It is evident from the above data that the bunch varieties can generally be classed as non-dormant and the spreading varieties as dormant, the variation in the dormancy period among them being not of much magnitude or of any great agricultural importance. Seed dormancy appears to be an inherited character in groundnut and the logical step to increase the dormancy period in the bunch varieties or reduce that in the spreading varieties for agricultural purposes will be to undertake cross breeding between desirable varieties and evolve suitable types to meet the needs of different

localities. Although no specific crosses were done to work out the inheritance of seed dormancy in groundnuts, the inheritance of seed dormancy was followed in crosses between the non-dormant bunch and the dormant spreading purelines made for studying the inheritance of certain other economic characters. The results pertaining to two crosses are tabulated below:—

TABLE VI.

Inheritance of Seed dormancy in Groundnut (1940—41 Rainfed Season.)
Germination percentages on 10th day of sowing.

Particulars.	Germination percentage of parents & F-1 Progeny 0-10 days.	Frequency distribution of F-2 families with germination percentages of									
		0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100
A. H. 32 [○] Parent											
in cross 283	94.0										
F-1 of Cross 283	55.0										
A. H. 29 [△] Parent											
in cross 283	2.0										
F-2 of Cross 283				2	2	1	6	6	...	20	
A. H. 34 [○] in											
Cross 295	94.0										
F-1 of Cross 295	60.0										
A. H. 1 [△] in											
Cross 295	3.0										
F-2 of Cross 295		1	...	1	2	5	5	6	10

It is observed from the above table that the dormancy of the seeds of F-1 progeny is intermediate between those of the parents and a wide range of variation is met with in the F-2 families with a large number of families resembling the more dormant parent. It is evident that multiple factors are responsible for the expression of dormancy. The presence of dormancy was studied in 110 bunch selections isolated from F-3 progenies of nine crosses. The results presented in the following table reveal that some of the selections possess a high degree of dormancy.

TABLE VII.

Frequency distribution of selections from crosses with germination percentage of										
0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	
19	18	15	13	8	10	9	6	4	8	

These selections are under comparison for their yield, duration etc. Two or three extracts have been found to combine the bunch habit of growth and dormant nature of seeds. They are awaiting district trials in the tracts where the introduction of such a strain would be appreciated. The breeding work is being continued to isolate strains with the desired degree of dormancy.

Summary.

Two varieties of groundnuts are cultivated in Madras. They are the spreading runner type known as Mauritius and the bunch or erect type known as Spanish or Peanut. Of these, the spreading variety occupies about 80 percent of the total area under groundnut in the Province, while the rest of the area is sown to the bunch variety. Seeds of the spreading variety are dormant and take about 2 to 2½ months (from harvest) to give good germination. The seeds of the bunch variety have no dormancy or resting period and sprout almost immediately after maturity.

In the tracts where the bunch variety is largely cultivated heavy rains are received at harvest time which results in the delay of the harvest. During such seasons the seeds of the bunch variety sprout in the field resulting in great loss to the cultivator. In the case of the spreading varieties which are used both for the main crop and the summer crop following it, the seed from the rainfed or winter crop cannot be used for the summer crop unless it is rested for a period of 2 to 2½ months.

The dormancy or resting period required by seeds has been tested in the case of six representative bunch and six spreading varieties of groundnuts by actual germination studies.

The seeds of the bunch varieties have been found to give a high percentage of germination in about 10 days after harvest showing that they are essentially nondormant forms. The seeds of the spreading varieties on the other hand required about 2 to 2½ months for giving good germination. They are in other words dormant. Dormancy therefore appears to be a varietal character.

The inheritance of seed dormancy in groundnut was observed in a few varieties and their hybrid progenies. The seeds of F-1 progenies were found to be intermediate in behaviour between the two parents while the F-2 segregation showed great variability and indicated that multiple factors are responsible.

References.

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