OBSERVATIONS ON THE FLOWERING AND FRUCTIFICATION OF THE GROUNDNUT, *Arachis hypogaea IV*[1])

G. G. BOLHUIS
Laboratory of Tropical Agriculture, Wageningen

SUMMARY

Experiments made at Buitenzorg (Java) proved that by clipping the flowers at the base of the calyx-tube at 8.30 in the morning, practically no pollen tubes yet had passed the clipping point. Clipping three hours later hardly had any effect as on that moment nearly all the pollen tubes had passed. When assuming that anthesis takes place at 3.30 in the morning and germination of the pollen on the stigma starts immediately afterwards it can be calculated that the pollen tubes grow in a rate of about 7.5 mm per hour.

INTRODUCTION

In the second article of this series (BOLHUIS, 1958) mention was made of the possibility that pollen tubes already at 7 o'clock in the morning should have passed the point where the calyx tube was clipped. This offered an explanation for the formation of some pods on plants on which fructification was prohibited by clipping the flowers in the early morning.

It is generally accepted that in the groundnut, at least in the tropics, pollination takes place between 3 and 4 a.m. (see BOLHUIS, 1954). The exact moment not being known it is quite possible that in certain flowers one or more anthers have shed their pollen earlier, which could be the explanation of the pollen tubes having already passed the clipping point at 7 o'clock. For the study of this problem two experiments were started. In these experiments the flowers of five series of ten plants were clipped at the base of the calyx tube at various times in the morning. The plants used belonged, as in the other experiments, to the variety Schwarz 21.

FIRST EXPERIMENT

In this experiment flowers were clipped at 6.30, 7, 7.30, 8 and 8.30 in the morning. Planting was done on June 23rd and the harvest followed on September 17th, i.e. the age of the plants was 85 days. At that moment all plants were still entirely green and in full bloom. On the date of harvest the observations were terminated because it was already evident that none of the plants should die off at a somewhat normal time and practically no gynophores could be found. At the harvest it appeared that some fructification had occurred, in this series we counted 1, 2, 0, 1 and 2 pods respectively.

Taking into account the total number of flowers clipped, viz. 4132, 4640, 4878, 5164 and 4988 respectively, the percentages of pods are entirely negligable.

From these figures it appears that at 8.30 only a very few pollen tubes had passed the clipping-point. We may therefore assume that the few pods found in these and earlier experiments are not due to mistakes but are caused by pollen tubes which had passed before the clipping of the calyx tube.

1) Received for publication December 16, 1958.

SECOND EXPERIMENT

Subsequently to the above mentioned experiment another one was started wherein the flowers were taken away at later times in the morning. From the same number of series of ten plants flowers were clipped at resp. 8.30, 9.30, 10.30, 11.30 and 12.30. Planting was done on September 20th, harvesting took place at December 31st, the age of the plants thus being 100 days. At the harvest all plants of series 1 and 2 were still green and partly in full bloom, in the other series part or nearly all of the plants were dying or had already died off. An overall picture of the condition of the plants at the harvest is given in table 1.

Table 1 Condition and state of flowering of the plants at harvest.

Nr. of plant	Time of clipping									
	8.30		9.30		10.30		11.30		12.30	
	cond.	flow.	cond.	flow.	cond.	flow.	cond.	flow.	cond.	flow.
1	green	+	green	+	dying	—	dying	—	dead	—
2	,,	+	,,	—	,,	—	dead	—	,,	—
3	,,	+	,,	+	,,	—	dying	—	,,	—
4	,,	+	,,	+	,,	—	,,	—	,,	—
5	,,	+	,,	+	green	—	dead	—	,,	—
6	,,	+	,,	—	dying	—	,,	—	,,	—
7	,,	+	,,	+	green	+	,,	—	,,	—
8	,,	+	,,	—	,,	+	green	—	dying	—
9	,,	+	,,	+	,,	—	dead	—	dead	—
10	,,	+	,,	+	dead	—	,,	—	,,	—

Besides observations on the condition and state of flowering the number of the pods present on the plants were counted. The pods were divided in mature and immature ones, the last group including also gynophores which just started fructifying.

The results are collected in table 2.

Table 2 Numbers of mature and immature pods on the various plants.

Nr. of plant	Time of clipping									
	8.30		9.30		10.30		11.30		12.30	
	nr. of pods		nr. of pods		nr. of pods		nr. of pods		nr. of pods	
	mat.	imm.	mat.	imm.	mat.	imm.	mat.	imm.	mat.	imm.
1	—	1	—	3	7	10	6	10	6	9
2	—	1	—	6	3	13	7	9	8	6
3	—	—	—	5	5	13	7	10	6	8
4	—	—	—	10	1	9	4	12	8	10
5	—	—	—	6	3	10	4	8	5	9
6	—	—	—	9	2	9	6	6	10	8
7	—	—	—	8	1	3	7	9	4	11
8	—	—	—	7	3	4	4	8	6	12
9	—	—	—	—	—	8	4	6	8	6
10	—	2	—	—	2	7	6	9	4	9
Total	—	4	—	54	27	86	55	87	65	88

From the tables 1 and 2 it becomes evident that at 8.30 only a few pollen-tubes have passed the clipping point. At later stages the number increases rapidly and it is clear that at 11.30 the time has been reached where the clipping of the flowers has practically no influence on the time of dying off of the plant. Also the number of pods is no more increasing in an appreciable degree.

Growth of pollen tubes

From the above mentioned results it is evident that at about 11 o'clock in the morning the greatest part of the pollen tubes have aready passed the base of the calyx tube. Assuming that anthesis took place at 3.30 and that germination of the pollen on the stigma followed immediately, we can put the time elapsing between anthesis and the passing of the pollen tube at the base of the calyx tube at about 8 hours. Measurements of a number of calyx tubes yielded an average length of 53 mm (shortest 38 mm, longest 65 mm). When we add another 7 mm for the distance of the stigma to the calyx tube, the average length of the way which has to be passed by the pollen tubes is 60 mm. As this distance is covered in about 8 hours the average rate of growth of the pollen tubes must be about 7.5 mm per hour.

This is in accordance with the results of another experiment in which a series of normal flowering plants was allowed to grow next to a series the flowers of which were clipped close under the corolla and a third series the flowers of which were clipped halfway the calyx tube. The clipping was done at 6.30 in the morning. The plants of the untreated series had already died off at the harvest at an age of 105 days, whereas the plants of the second series were in the same condition three weeks later. The plants of the last series, however, had to be harvested at an age of 240 days when they were still entirely green and in full bloom. Evidently at 6.30 the pollen tubes had not yet passed halfway the calyx tube.

References

Bolhuis, G. G.: Hybridation artificielle de l'arachide. *Oléagineux* IX, 6, p. 417–419, 1954.
– –: Observations on the flowering and fructification of the groundnut, Arachis hypogaea II. *Netherlands Journ. Agric. Sc.* 6.4, p. 245–248, 1958.