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

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SUMMARY

As a continuation of a previous article, a more detailed study was made of a number of phenomena which occurred in groundnut plants when fructification was inhibited by removing the flowers. In the plants treated this caused a very marked increase in intensity of flowering. At the same time it was noticed that a marked periodicity occurred. The cumulative flowering curves of treated and untreated plants diverge at such an early period that it may be assumed that in the case of plants flowering in the normal way inhibition of flowering occurs already after fertilization, and not after fructification has started.

INTRODUCTORY

A previous article (see BOLHUIS, 1958) discussed the effect which removal of the flowers or prevention of fructification has on the flowering and vegetation period of groundnut plants of the Schwarz 21 variety. It was then found that inhibition of fructification is not only a marked stimulus to the intensity of flowering and the total number of flowers produced, but that it also effected a very marked increase in the duration of the vegetation period of the plants. In connection with certain phenomena that were observed, especially as regards the intensity of flowering and the moment at which the latter reflects the influence of the non-formation of fruits, it seems desirable to study in more detail certain aspects of the results of these experiments.

INTENSITY OF FLOWERING

In his 1954 article SMITH already pointed out that after the flowers and fruits had been removed from his plants they continued to flower in proportion to the high intensity of flowering they had exhibited in the middle of the flowering period. It is particularly unfortunnate that SMITH should have conducted his experiments with plants which had already completed a certain amount of fructification, so that physiological changes may already have occurred in the plants and influenced the further course of the experiments.

FORTANIER also found that the intensity of flowering was greatly increased in plants of which he had removed the gynophores in order to prevent fruiting. He gives no details of the daily totals. SMITH supplies these, however, observing that periodic fluctuations occurred in the greatly increased intensity of flowering. He offers no explanation of this.

The phenomenon referred to by SMITH also occurred to a very marked degree in the three experiments which were carried out at Buitenzorg. In order to illustrate this, Fig. 1 shows a part of the flowering trend of one of these experiments in which this trend is compared with the intensity of flowering of two series of ten plants, the flowers of one series having been removed sufficiently early to prevent fructification. It can be seen from this figure that the graphs run practically parallel for the first eleven days, after which they diverge. The plants with fruits have then already passed the flowering climax (40 flowers a day) and ten days afterwards flowering ceases.

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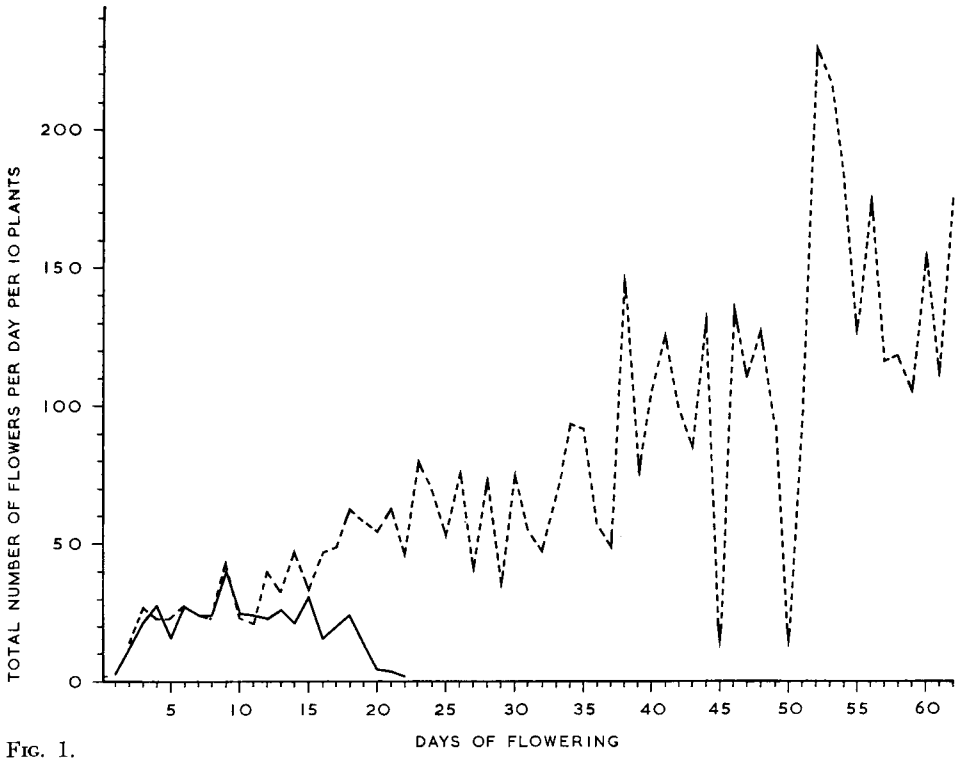

FIG. 1.

On the other hand, we see an increase in flowering intensity in the case of plants which have had no fructification, rapidly followed by the periodicity referred to by SMITH. It is noticeable that the periodic fluctuations become continually greater with increasing daily numbers of flowers. Thus it may occur that the numbers of flowers per day increased to 230, viz. an average of 23 flowers per plant, whereas only 12 flowers had formed on the previous day. This periodicity cannot readily be accounted for. It might be thought as being due to moisture deficiencies, but as the plants were watered regularly in the absence of rain, this can hardly be considered the determining factor. Nor do I think it likely that it was due to a shortage of assimilation products, seeing that no particularly great amount of assimilates is required for flowering. I am more inclined to regard it as a complex phenomenon in which the conditioning elements are the moisture and assimilates required, and the exhaustion of a factor which stimulates flowering.

As stated earlier, the graph of the plants without fructification, shown in Fig. 1, only represents a fraction of the data obtained in this experiment as it was terminated 212 days after planting, on which date the plants were still quite green. It did, however, appear from the further course of the experiment that the intensity of flowering, after reaching a very high level as shown in Fig. 1, gradually fell to a lower level in which there were a few occasional high flowering apexes.

Like SMITH, I was also unable to establish any relationship between the fluctuations in the intensity of flowering and such meteorological data as the number of hours of sunshine on preceding days.

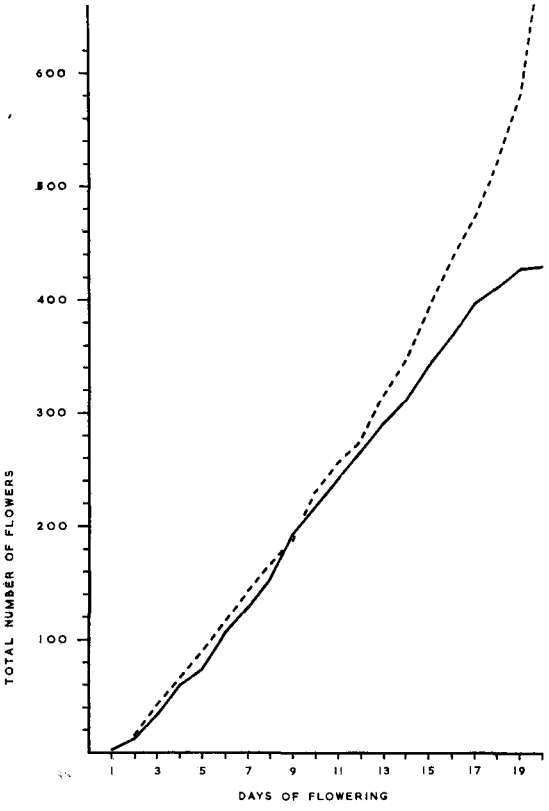

FIG. 2.

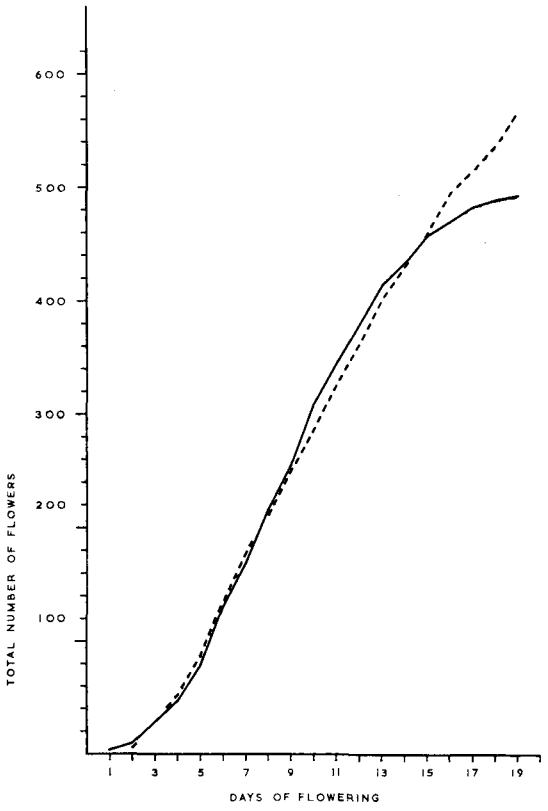

FIG. 3.

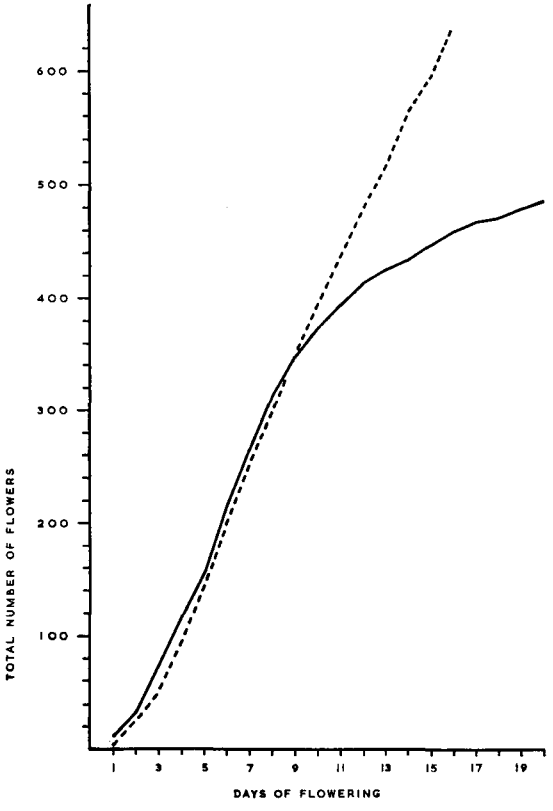

FIG. 4.

Time of effect

The graphs supplied by Smith and Fortanier show that the cumulative flowering curves of plants with and without fruits first run practically parallel, after which they diverge fairly rapidly. It was possible to plot graphs of this kind for three Buitenzorg experiments intended for different purposes; these graphs are shown in Figs. 2, 3 and 4. In all three cases the full line represents the cumulative number of flowers of plants completing flowering in the normal way, and the broken line that of plants of which fructification was inhibited; ten plants were used in each series.

Inspection of these three graphs reveals that in all three cases the curves run practically parallel during the first few days, after which they begin to diverge, although the date on which they diverge does not coincide in all three experiments. The experiments were begun on different dates; that shown in Fig. 2 was begun in mid-November and the first flowers appeared on 16th December, at the beginning of the wet season, that shown in Fig. 3 was begun in mid-February, at the end of the rainy season, the first flowers appearing on 13th March, while the experiment shown in Fig. 4 was begun in mid-September, the first flowers appearing on 16th October, at the end of the dry season. The interval between the commencement of flowering to the time at which the curves diverge is 15, 13 and 10 days respectively. It is difficult to decide to what extent seasonal fluctuations are responsible, but on the face of it there might be some justification for thinking them responsible.

Fig. 4 shows that the effect of removing the flowers, i.e. inhibiting fructification, is noticeable after only ten days. As is known, the interval between flowering and appearance of the gynophores is at least five days. Thereafter some days are required for these gynophores to penetrate into the soil to such an extent that fruiting is possible. We may therefore assume that a period of at least seven to eight days elapses between flowering and fruiting. Although apparently impossible in theory, it would seem that inhibition of flowering begins earlier than the actual fruiting, and may even commence at fertilization. Smith and Fortanier did not make sufficient allowance for this in their experiments since both authors allowed their plants to flower and fructificate before removing the gynophores which developed.

At this stage, however, fertilization has already taken place and the zygote is already able to exert its effect. As these experiments do not afford a complete explanation of the problem further investigation is deemed necessary.

References

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