Flowering and Fruiting of Peanut Plants

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The peanut is one of the principal economic plants as a resource for edible oil and protein. From its first cultivation in Japan to the present day over one century has passed.

The subterranean fructification, geocarpy, is the most salient feature of seed production in peanut plants. Because of its feature, the fructification of peanut plants is severely affected not only by terrestrial environmental factors, but also by subterranean environmental factors.

However, information on the effects of environmental factors on the reproductive process is comparatively deficient. To gain more information on this subject, the author has carried out several experiments. Although the study is still in progress, results[3,4,5] obtained so far will be presented in this paper.

Flowering

Appearance of the first flower of peanut plants is observed at a relatively early growing stage. Number of days from the planting date to the first flowering is affected by air temperature during that period. By an experiment performed in air-controlled cabinets with artificial light, results as shown in Fig. 1 were obtained. Fig. 1 illustrates that as daily mean temperature rose from 20°C to 30°C, leaf emergence rate on the main stem was remarkably accelerated, and number of days required for the first flowering was shortened from 38 days to 25 days in subsp. *hypogaea* such as Chiba-handachi and Chiba No. 43 and from 35 days to 24 days in subsp. *fastigiata* such as Java No. 13. Furthermore, it was found out that when an extremely early maturing variety recently bred, Tachimasari, was grown at the daily mean temperature of 30°C, the first flower bloomed only 21 days after planting. Takahashi et al.[6] reported that, in subsp. *fastigiata* or inter-subspecific hybrid such as Tachimasari, the flower bud had been already formed in seed embryo. From those results, it was considered that the effect of increased air temperature is not related to the promotion of floral bud differentiation, but to the promotion of floral organ development.

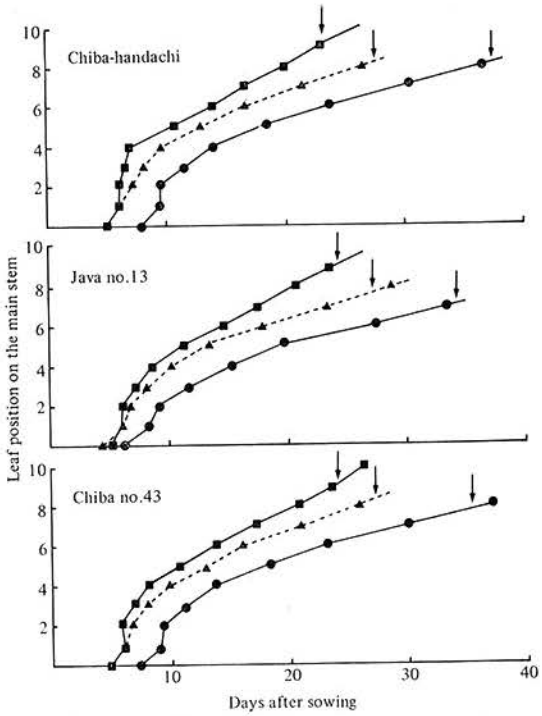

Fig. 1. Effect of air temperature on leaf emerging on the main stem and first flowering.

Note: -•- Daily mean temperature of 20°C
-▲- Daily mean temperature of 25°C
-■- Daily mean temperature of 30°C

Arrows in the figure indicate first flowering.

Based on these relations between the first flowering and the air temperature after planting, it was considered that the first flowering dates of peanut plants might be forecasted by knowing the daily mean temperature after planting. Then, the effective heat summation required for the first flowering was calculated using the data on flowering of Chiba-handachi planted at different times. The effective heat summation which was obtained by integrating daily mean temperatures minus 12°C was found most suitable for forecasting the first flowering date and it was 417.3±12.8°C.

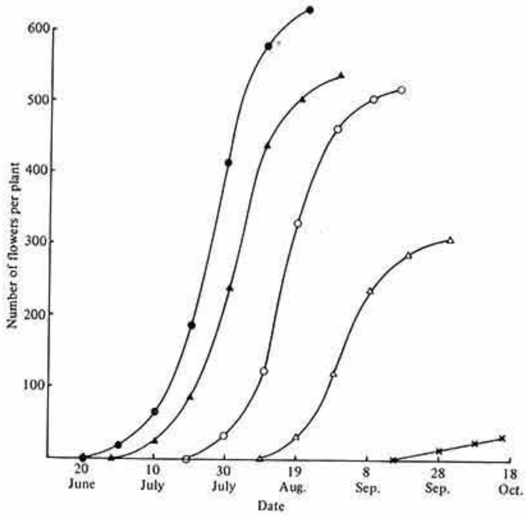

Fig. 2. Flower production in peanuts planted at various times.
Note: –•– Planting time of Apr. 15
–▲– Planting time of May 15
–○– Planting time of June 14
–△– Planting time of July 14
–×– Planting time of Aug. 14

Fig. 2 shows the flowering patterns of peanuts planted at different times. It is apparent that the earlier the planting time, the more flowers were produced over a longer period of time. For example, the flowering duration of the peanut planted at the middle of April extended over 63 days and the total number of flowers per plant reached 633, while the peanut planted at the middle of August put forth only 34 flowers during a flowering duration of 31 days.

The flowering of peanut progresses in parallel with vegetative growth. Consequently, it was considered that the number of flowers depends on the extent of vegetative growth, especially on the development of branches. In the planting date experiment mentioned above, it was recognized that there was high correlation (r=0.992**) between dry weight of shoots at harvest and the total number of flowers.

Peg elongation

After flowering, peg elongation and penetration into the soil are necessary for the fruiting of peanut plants. The terrestrial elongation of pegs became remarkable from a week after flowering and its ultimate length reached 15–16 cm about 4 weeks after flowering. There is a tendency that the peg elongation was reduced with a delay in flowering date. The subterranean growth of pegs ceased at about 4 cm below the soil surface.

Table 1. Mean value and coefficient of variation (CV) of the peg length of pod

Variety	Mature pod		Immature pod	
	Mean	CV	Mean	CV
	cm	%	cm	%
Chiba-handachi	9.8	31.1	10.7	32.2
Java No. 13	6.6	46.1	8.8	37.0
Chiba No. 43	10.2	27.0	11.2	29.9

As shown in Table 1, length of the pegs bearing pods was shorter in Java No. 13 than in Chiba-handachi and Chiba No. 43. This varietal difference in length of fruiting pegs is closely related to the varietal difference of branching system. Varieties such as Chiba-handachi and Chiba No. 43 having alternate branching system bear the effective flowers on higher nodes of the branch in comparison with those such as Java No. 13 having sequential branching system. So that the longer peg elongation is necessary in the former to cause peg penetration into the soil.

Table 1 also shows that the length of the pegs bearing immature pods was longer than that of the pegs bearing mature pods. This result indicates that with the flowers produced on lower nodes nearer to the base shorter pegs are sufficient for penetration, and as a result their pods mature earlier than those of the flowers produced on upper nodes that require longer pegs.

Pod development

The podding zone of the peanut is located at the upper soil layer, about 4 cm below the soil surface. Therefore, environmental factors such as soil temperature and soil moisture are more variable in the podding zone than in rooting zone which occupies the deeper layer.

To examine the effect of environmental factors in the podding zone on the pod development of peanut plants, three experiments were carried out, by separating artificially the podding zone from the rooting zone.

In an experiment performed in 1969 to investigate the effect of soil temperature on the pod development, the podding zones were kept at various temperatures, 15°C, 23°C, 32°C and 39°C, during a period of 7 weeks after the peg penetration into the soil. A summary of the results is shown below.

When the podding zone was kept at 32°C, the swelling of ovaries began two days after and the pod size reached its maximum 3 weeks after the peg penetration into the soil. Keeping the podding zone at the temperature of 23°C or 39°C, commencement of swelling of ovaries was observed five days and seven days after the peg penetration, respectively. But, at the temperature of 15°C, days from peg penetration to ovary swelling were more than two weeks. The relation between the soil temperature in the podding zone and the pod development 7 weeks after the peg penetration is shown in Fig. 3. From those results, it was concluded

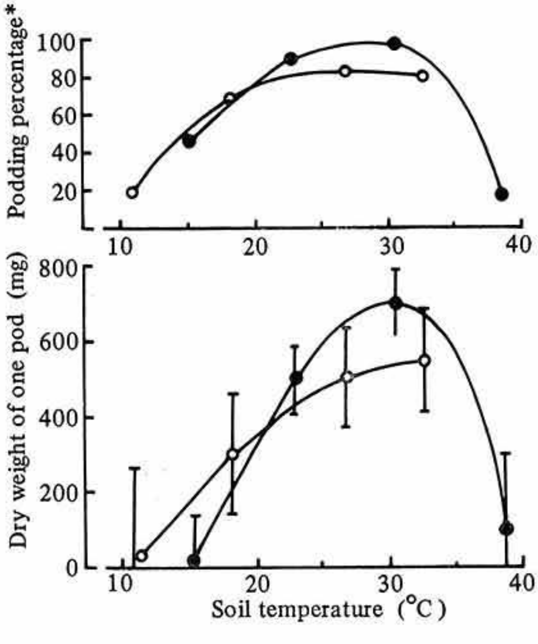

Fig. 3. Effect of soil temperature in the podding zone on the pod development

Note: *Percentage of the number of developed pods to the number of pegs examined.
∘ ; Result in 1968
• ; Result in 1969
Ɪ ; 95% confidence interval of mean

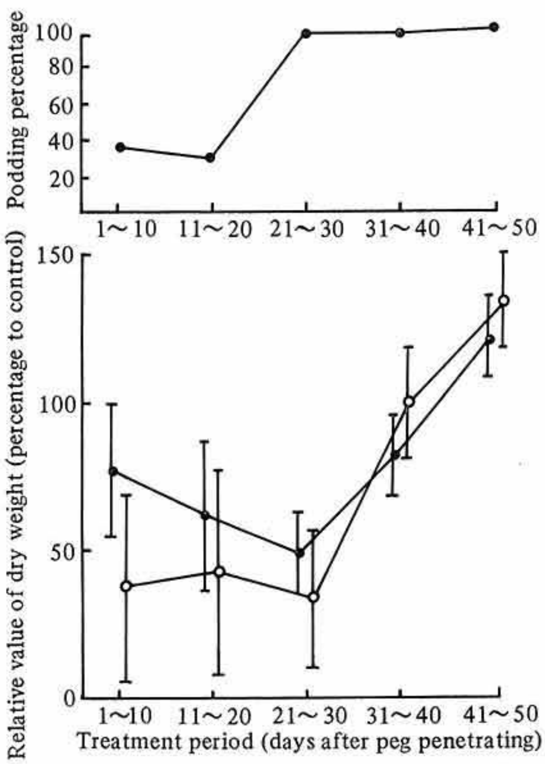

Fig. 4. Effect of the treatment with high soil temperature and low soil moisture content in the podding zone, given at various periods on pod development

Noto: • ; Dry weight of one pod
∘ ; Dry weight of one seed
Ɪ ; 95% confidence interval of mean

that optimum soil temperature in the podding zone for fruiting of the peanut was in the range of 31–33°C.

In the second experiment, the effect of soil moisture in the podding zone upon the pod development was investigated, changing the soil moisture content in the rooting zone. The experimental results indicated that regardless of the soil moisture content in the rooting zone, maximum pod development occured at the soil moisture content of 40% to the total soil volume in the podding zone.

To examine the time when the pod development is most seriously affected by the soil environment in the podding zone, the treatment combining high soil temperature (37–39°C) and low soil moisture content (6–8%) was applied to the podding zone in every 10 days after the peg penetration.

As shown in Fig. 4, the pod development was suppressed by the treatments given during the first 30 days, especially between 20 and 30 days after the peg penetration.

According to Brady[1], the effect of calcium supply to the podding zone was most evident when supplied during a period from 15 to 35 days after the peg penetration into the soil. Mizuno[2] also reported that maximum absorption of calcium by pegs occured from 20 to 30 days after the peg penetration.

According to the above results, it seems to be quite reasonable to consider that the most critical period in the pod stage for the fructification of the peanut is 20 to 30 days after the peg penetration.

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