

Seed dormancy in *Cucumis sativus* L. (Tempoh rehat bagi biji benih *Cucumis sativus* L.)

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Key words : varieties, light, seedcoat, imbibition, gas permeability, water permeability, inhibitor

Abstrak

Kehadiran tempoh rehat pada biji timun bergantung pada varieti. Dua varieti yang diuji iaitu MTi 1 dan MTi 2 didapati mempunyai tempoh rehat masing-masing selama 70–80 dan 60–70 hari. Varieti Bukit Mertajam tidak mempunyai tempoh rehat dan bercambah hampir atau melebihi 80% selepas dipetik. Kalium nitrat (KNO_3) pada kepekatan 0.1% menambah kadar percambahan tetapi tidak mengatasi masalah tempoh rehat sepenuhnya. Cahaya dan pembuangan sebahagian kulit biji juga menambah percambahan tetapi masih tidak mendapat percambahan yang sepenuhnya.

Abstract

Seed dormancy in cucumber is a varietal characteristic. Two of the varieties tested, MTi 1 and MTi 2, were found to have dormancy period of 70–80 and 60–70 days, respectively. Germination in variety Bukit Mertajam was either close to or above 80% immediately after harvest. KNO_3 at a concentration of 0.1% increased germination percentage but did not completely overcome dormancy. A slight increase in germination was also obtained in the presence of light and with the partial removal of the seedcoat.

Introduction

Dormancy is known to occur in many types of seeds, especially those of weed and forest species. It is a mechanism for survival but its presence could also give problems in seed testing and research work. This phenomenon has long intrigued man and work on delayed germination had been reported as early as the 19th century. Many investigations on various seed types had been carried out ever since. In the family *Curcubitaceae*, detailed studies on dormant seed of *Cucurbita pepo* have been reported (Brown 1940).

During routine germination testing on the foundation seed lots in MARDI, it was noticed that cucumber seed from different

varieties did not germinate readily upon harvest. The failure to germinate in otherwise good, healthy seed indicated the possibility of dormancy in some of the varieties tested. As these varieties are grown throughout the year in different regions of the country, it is pertinent to determine the occurrence and duration of dormancy in each of the varieties. This information is useful for efficient planning of a production programme to ensure the timely availability of readily germinable seeds. Studies were also conducted on three cucumber varieties to determine the effects of potassium nitrate (KNO_3), light and seedcoat on germination of the dormant seeds.

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Materials and methods

Occurrence of dormancy and the effects of KNO₃ solution (0.1%) on germination

Studies on variety MTi 2 were carried out in 1984 and 1986, variety Bukit Mertajam in 1987, while variety MTi 1 was tested in 1988. In all the cases, cucumber fruit was harvested when the skin turned brown. The seeds were scraped out and separated from the pulp after 24 h of natural fermentation. The seed moisture content was then reduced to 8–9% by oven drying. About 2 kg of cleaned seed was kept in sealed plastic boxes. Samples were withdrawn for germination test at 5-day intervals and after one month at 10-day intervals. Seeds were germinated on paper towel at alternating temperatures of 20/30 °C (Anon. 1985). Samples were prepared in two duplicates using water as well as 0.1% solution of KNO₃ to wet the paper throughout the duration of the tests, except for variety MTi 2 which was not given the KNO₃ treatment (1984 test). Evaluation was carried out on the eighth day after sowing and dormancy was considered to have ceased when the germination count exceeded 80%.

Water uptake in dormant seeds

This experiment was conducted on cucumber seed variety MTi 2. Two sets of samples were used for the imbibition study. Sample 1 was taken from dried seed lots 25 days after harvest, and sample 2 from seeds of a previous harvest which were known to be no longer dormant from the results of the germination tests done. Samples were placed on wet paper medium as in the germination tests under conditions of alternating temperatures of 20/30 °C. Seeds were withdrawn and weighed after 4, 6, 12 and 24 h. Fifty seeds were used in each of the eight replications, which were laid out in a completely randomized design experimental layout.

Effects of light and seedcoat on germination

The seed samples (variety MTi 2 seed

harvested in 1986) were either left intact or a quarter of the seed apex was clipped to remove part of the seedcoat membranes. The samples were placed on paper towels for germination tests to be carried out in a growth cabinet at alternating temperatures of 20/30 °C. The fluorescent light in the cabinet was kept on throughout the tests. For the dark treatment, the germination boxes containing the seed were completely wrapped in black plastic sheets before being placed in the cabinet. Samples were withdrawn after 5, 10, 15 and 20 days for germination counts. The experiment was laid out in a factorial design with 2 x 2 combination treatments and replicated six times.

Results and discussion

Occurrence of dormancy and the effects of KNO₃ solution on germination

The postharvest germination patterns of the three cucumber varieties are shown in *Figure 1*: Seed from two of the varieties, viz. MTi 1 and MTi 2, showed a longer dormant period. Except for the unstable germination trends soon after harvest, germination was above 80% in the variety Bukit Mertajam. Results from trials in both years (*Figure 1*) for the untreated seed of variety MTi 2 showed similar germination trends. In the first 35 days after harvest, seed germination was erratic, then increased rapidly to reach 80% at 60–70 days from harvest. The difference in germination percentages between the years might be due to climatic conditions prior to harvest namely rainfall. Total rainfall for the 2 months coinciding with the seed development and maturation stages was higher in 1984 (630.0 mm) compared with 1987 (582.1 mm). The more humid conditions in the earlier trial probably resulted in reduced seed dormancy. This is in agreement with the findings of Shifriss and George (1965). In an earlier study on seed development and maturation using the same variety, it was found that there was a sudden drop in seed germinability from 90%

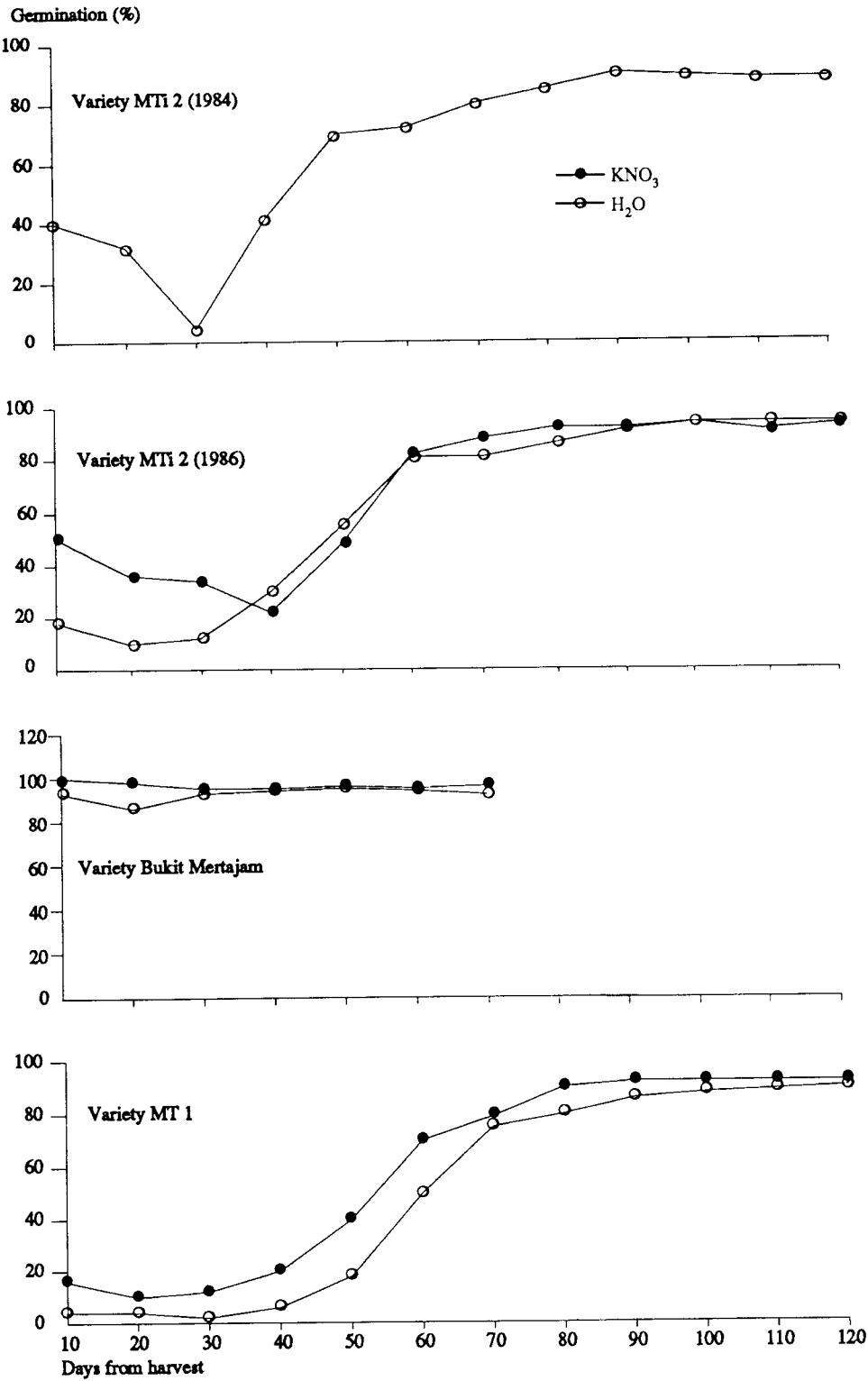


Figure 1. Seed germination of three cucumber varieties

to below 10%, 25 days after flowering. Germination remained low until the time of harvest (Halimathul Saadiah and Junaidah 1986). However, in variety Bukit Mertajam (Figure 1) more than 80% of the seed germinated immediately after harvest, despite less rainfall (246.2 mm). Lower germination was detected during the dormant period in the third variety tested, MTi 1 (Figure 1). Less than 10% of the seed germinated within a month after harvest although total rainfall during seed development and maturation was relatively high (460.6 mm). Germination increased sharply thereafter, achieving over 80% germination at 70–80 days after harvest. Results from these trials indicate that dormancy in cucumber seed is also a varietal characteristic, ranging from almost non-existent to 2.5 months.

Treatment with 0.1% KNO_3 solution increased germination in MTi 2 and MTi 1 (Figure 1), but did not significantly overcome dormancy. Germination increased to above 20% and 10% in MTi 2 and MTi 1 respectively but germination was not accelerated in both cases, although KNO_3 is known to break dormancy in other species (Anon. 1985). However, in the less dormant variety Bukit Mertajam, more than 90% germination was obtained soon after harvest when the seeds were similarly treated

(Figure 1). Thus 0.1% KNO_3 solution did not effectively break dormancy in the dormant cucumber seed of the varieties tested.

Water uptake in dormant seed

The course of imbibition for the first 24 h was monitored in dormant and non-dormant seed. During the first 4 h, water was absorbed rapidly by both the dormant and non-dormant seeds, thus raising the seed moisture content from less than 10% to 28%. The rate of absorption was slower thereafter and at the end of 24 h, moisture content was 41.24% and 43.36% in the dormant and non-dormant seed respectively (Figure 2). Throughout the period, there was no significant difference in moisture content between the dormant and non-dormant seed. The seedcoat is known to have a great influence on water absorption in seeds. In a few species, the nature of the seedcoat restricts water absorption resulting in delayed germination or dormancy. In this study, there was no apparent difference in seedcoat permeability to water between the dormant and non-dormant seed, as the rate of imbibition was similar in both cases.

Effects of light and seedcoat on germination

The presence of light was significant in

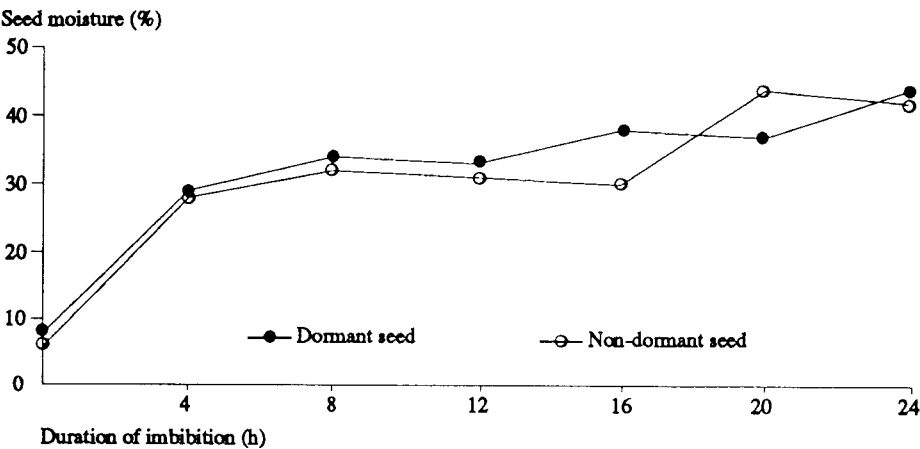


Figure 2. Imbibition of dormant and non-dormant cucumber seed

increasing the number of germinated seed on the 5th and 10th day after sowing but not on the 15th and 20th day. On day 5, mean germination increased from 14% in the dark to 29% under light. The increment on the 10th day was from 27% without light to 36% in the presence of light (Table 1).

Removing part of the seedcoat increased germination significantly on the 10th, 15th and 20th day from sowing. Mean germination in seed with the seedcoat clipped off were 36% and 41% on the 10th and 15th day respectively, as compared with 26% with the seedcoat intact (Table 1). The interaction effect of light and seedcoat was only significant on the 20th day after sowing. The germination was 20% higher in the presence of light and when part of the seedcoat was removed as compared with germination in the dark with the seedcoat intact.

Work on other cucurbits have shown that seed dormancy is related to seedcoat impermeability to gases. Clipping the seed of watermelon facilitated gaseous exchange, leading to increased germination (Thornton 1968). In *Cucurbita pepo*, gaseous exchange is controlled by the inner membrane despite the less permeable outer membrane (Brown 1940). Removal of the seedcoat in muskmelon increased oxygen uptake which resulted in improved germination (Pesis and Ng 1986). Rapid germination was also obtained with the removal of seedcoat in dormant *Citrullus colocynthis* seed (Koller et al. 1963). In this study, removal of the

cucumber seedcoat by clipping increased the number of germinated seed but did not remove dormancy completely. These results suggest that seedcoat impermeability to gases might not be the only factor causing dormancy. Light increased germination only slightly.

Shifriss and George (1965), in their work on cucumber variety Baroda, stated that dormancy was neither affected by seedcoat removal nor by red and infrared light. They found that dormancy could be broken by providing conditions of high humidity (90%) and temperature (50 °C), a situation which also caused seed deterioration. In another investigation on other cucumber varieties (Lockerman and Putnam 1981), an inhibitor was found to be associated with the seedcoat which suppressed germination and growth of seed of other species. This inhibitory effect was eliminated when the cucumber seeds were leached or fermented. There is a possibility that the inhibitor might have originated from the fruit juice. Presence of inhibitors in the variety MTi 2 is, therefore, possible. Fermentation and washing of the seeds during processing probably were not sufficient to leach out all the inhibitors present. However, further studies need to be carried out to determine the presence of these inhibitors in the varieties studied.

In conclusion, this investigation may suggest that dormancy in cucumber is a genotypic character. Light and seedcoat have some significant effects on germination.

Table 1. Effects of light and seedcoat on germination mean of dormant cucumber seed

Treatment	Germination (%) at 4 germination durations (days)			
	5	10	15	20
Light - seedcoat -	16a	30b	39a	48a
Light - seedcoat +	12a	23c	26b	21c
Light + seedcoat -	30a	42b	43a	41a
Light + seedcoat +	27b	29b	26b	33b

(-) light absent/ seedcoat partly removed

(+) light present/seedcoat intact

*Mean separation within columns at 5% level of probability by DMRT

Seedcoat impermeability to gases rather than to water seems more likely to delay germination. However, the presence of light and seedcoat removal do not overcome dormancy completely.

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