

## DEVELOPMENT OF CUCUMBER SEED FROM FLOWERING TO MATURITY

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*Keywords:* Seed moisture content, Germinability, Seed length, Seed dry weight, Development, Physiological maturity.

### RINGKASAN

Kajian pembentukan biji timun (varieti MTi 2) telah dijalankan. Bunga-bunga ditanda dan buah dipetik selang sehari sehingga buah matang. Sifat-sifat yang dikaji termasuk kandungan kelembapan biji, keupayaan bercambah, panjang dan berat biji kering. Kematangan fisiologi didapati berlaku 31 – 33 hari selepas peringkat bunga dan pada kandungan kelembapan 38 peratus. Ini merupakan masa yang paling baik untuk kutipan biji benih setelah mengambil kira corak pembentukan biji dan faktor kerosakan di ladang. Biji segar mempunyai keupayaan percambahan 17 hari selepas berbunga dan corak percambahan menunjukkan kewujudan masa rehat.

### INTRODUCTION

Harvest date has great influence on seeds during processing, storage quality and field emergence. The seeds should reach the right stage of maturity at harvest to ensure good quality and establishment after germination. Considerable number of studies on seed development and maturation had been carried out on grasses (MACLISTER, 1943; GRABE, 1956) and grain cereals (HARLAN and POPE, 1922; BARTEL, 1941; ALDRICH, 1943; FREY, RUAN and WIGGANS, 1958). Similar studies had also been done on seeds of cotton (SIMPSON, 1935; JAMES and SAMIR ABDEL-AL, 1965; THIAGARAJAN and RAMASAMY, 1979), safflower (LEININGER and URIE, 1964), few forest species (BARTEL, 1972; 1974; BONNER, 1976), rubber (SAKHIBUN, CHIN and HOR, 1981), long bean (CHIN, 1981) and okra (CHAUHAN and BHANDARI, 1971). From these studies, various factors had been found to be associated with maturation. They were seed moisture content, seed size, dry matter content and germinability. ALDRICH (1943) in his studies on corn found that dry matter weight of the grain was the best criterion of relative and actual maturities in corn. On the other hand, BONNER (1976) observed that at physiological maturity, as indicated by

normal germination, carbohydrate content in acorns of shumard and white oaks was 25% and 40% respectively.

The understanding of events taking place during seed development and maturation would be very useful in seed operations. This would be an advantage in deciding the right stage or time to harvest for highest seed yield and quality. Information is lacking for vegetable seeds as such this study was conducted to obtain information on the development and maturation of cucumber seed.

### MATERIALS AND METHODS

Cucumber (variety MTi 2) was field planted in December 1984. The seeds used were taken from foundation seed lot originated from breeder seed obtained from MARDI Station, Jalan Kebun, Kelang. Cultural practices as recommended by MARDI were followed. On 11 January 1985 about 300 freshly opened female flowers were randomly tagged to allow periodic harvest of developing fruits until maturity. The first harvest was done on the fifth day after tagging. Three fruits were harvested on alternate day for a duration of six weeks. On each harvest, seeds from the three fruits were extracted and pooled. Samples were

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taken for subsequent maturity tests and measurements. Fresh and oven-dried seeds were tested for germination according to the procedures recommended in ISTA rules (ANON., 1985). For moisture determination, seeds were oven-dried at 105°C for 24 hours and moisture content was computed from the differences in weight before and after drying and expressed as a percentage of the original wet weight of the seeds. For dry matter weight, sample consisting of 30 seeds were placed in the oven at 105°C for 24 hours. The seed length was obtained from the average measurement of 30 seeds. All tests and measurements were replicated four times. At every harvest, the skin colour of all the fruits were also recorded.

### RESULTS AND DISCUSSION

Five days after the flowering stage, the developing seeds had very high moisture content of above 90% (Figure 1). As the seeds developed the moisture content

decreased gradually until the 25th day, after which it remained quite constant throughout the rest of the development. This trend was also observed in other seed types. In a two-year study on sorghum seeds, KERSTING, STICKLER and PAULI (1961) reported that the moisture content was above 80% after pollination and dropped to below 20%, 50 days later. Similarly in corn, the seed moisture content was 74.3% 20 days after fertilization and by the time of husking which was 123 days after anthesis, it had decreased to 22.1% (KOEHLER, DUNGUN and BURLISON, 1934).

Seed length increased very rapidly in the first nine days after flowering to reach 10.48 mm long and then remained within the range of 10.48 – 13.50 mm (Figure 1). Dry matter accumulation began to increase only after the seed had attained its matured size. This increment was gradual and the maximum was reached about 31 – 33 days from flowering (Figure 1). SHAW and

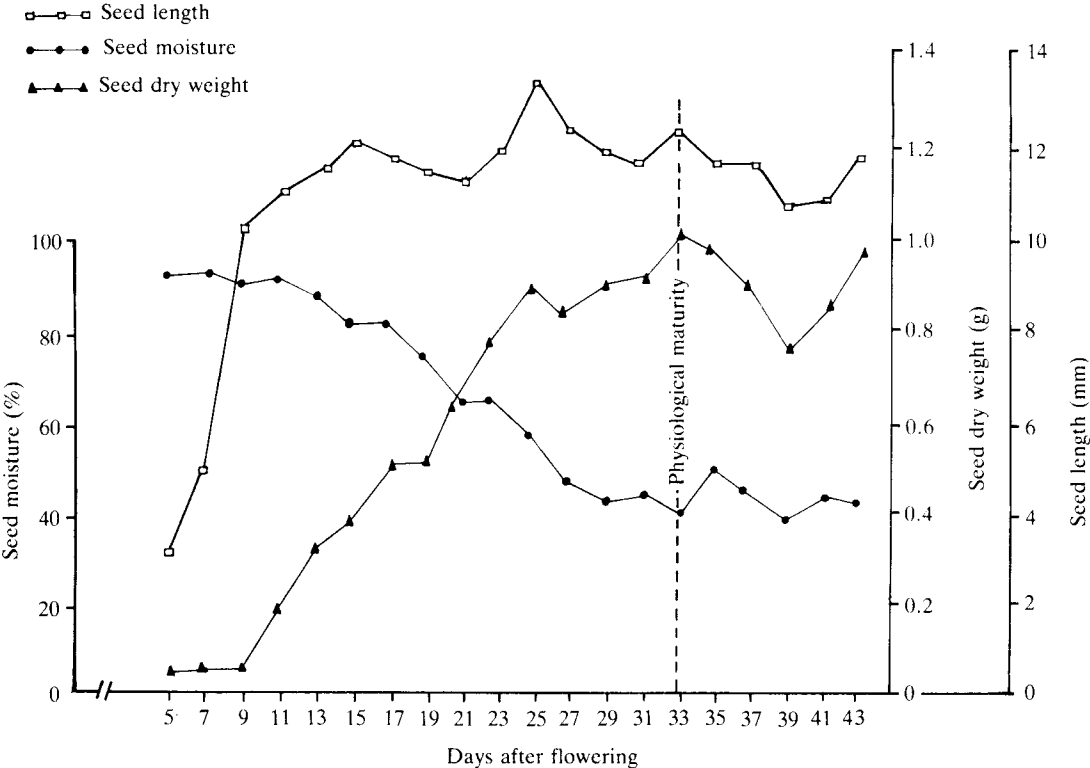


Figure 1. Development of cucumber seed at various intervals from flowering.

LOOMIS (1950) in their works on corn described development at this point as the physiological maturity.

Some of the seeds were found to be capable of germination 17 – 21 days after flowering. The ability to germinate before physiological maturity was also observed in the other seed types. Seeds of barley (HARLAN and POPE, 1922) and bromegrass (GRABE, 1956) could germinate as early as five days after pollination. In this investigation, it was found that the germination curves for both dried and fresh seeds showed similar pattern (Figure 2). There were sudden rises in germination percentage on the 21st and 23rd day for the dried and fresh seeds respectively, reaching the peak on the 25th day after flowering. At this point, 90% of the seeds had germinated. However, the germination dropped sharply after the 25th day and by the 33rd day, less than 10% of the seeds had germinated. This phenomenon had not been reported in the maturation studies of other seeds in the literatures reviewed. The ungerminated seeds did not show any sign of death or disease. Lost in the ability to germinate in the seemingly viable seeds suggested the possible occurrence of dormancy. One of

the possible causes of dormancy is impermeability of seed coat. Dormancy of this nature was reported to be caused by cutin deposit in the nucellar layer of the seed coat of watermelon (THORNTON, 1968) and suberin deposit in the testa of grasses' seeds (ANON., 1969). Impermeability could be due to gases or water. Another likely explanation for the cause of seed dormancy is chemical inhibition. Presence or sudden increase in the level of inhibitor might have prevented the germination process. Further investigation should be carried out to determine the real cause of the dormancy.

It is a well established fact that at physiological maturity, seed would be at its highest vigour. Safflower seed was found to be physiologically matured at 28 days after flowering and at this stage it also had maximum percentages of oil, germination and iodine number (LEININGER and URIE, 1964). However, at physiological maturity, seed moisture content is too high for harvesting as in cotton (56%) (JAMES and SAMIR ABDEL-AL, 1965), okra (56%) (CHAUHAN and BHANDARI, 1971) and bromegrass (47%) (GRABE, 1956). Seeds harvested at too high a moisture content could increase the cost and time of drying.

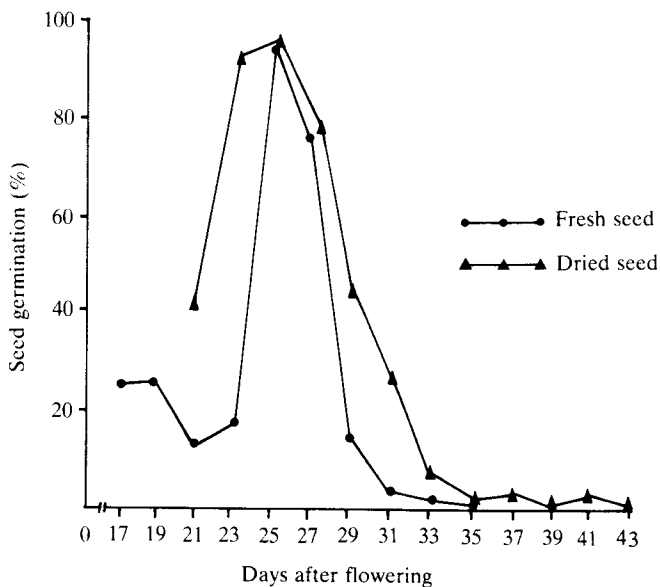


Figure 2. Germination of cucumber seed at various intervals from flowering.

For this reason these seeds are normally allowed to dry on the plant to below 30% moisture content before they are harvested. In this study, the moisture content of cucumber seed at physiological maturity was 38% (Figure 1) and remained quite stable thereafter. Perhaps the seed moisture would not drop further or would take a long time to do so as the seeds are embedded in the mucilage and surrounded by the juicy mesocarp. It is thus no advantage in this case to delay the harvest beyond the point of physiological maturity. Furthermore at this stage, the fruit could be very heavy (up to 1 kg) and unless good support is given, it would end up resting on or touching the ground and become rotten, thus delayed harvest would likely increase the loss. However, the germination percentage at the point of physiological maturity was as low as 10% and thus the seeds harvested could not be used for immediate sowing. The maximum seed germination (90%) occurred on the 25th day after flowering (Figure 2) and before the attainment of maximum dry weight. These immature seeds, though having good germination would likely produce weak and less vigorous seedlings that have poor chance of survival under less favourable environment. Another disadvantage of harvesting at this point is the high moisture content of seed (52%) which could give rise to drying problems.

In conclusion, taking into account seed moisture content, germinability and risk of field deterioration, the best harvesting time for cucumber seed would be 31 – 33 days after flowering at the point of physiological maturity. At this stage, the fruit would be dark brown with lots of netting pattern on the skin surface (Table 1). Seeds obtained could be dormant and that after – ripening or treatment would be required to break the dormancy before the seeds could be used for sowing.

Table 1. Changes in the skin colour of the developing cucumber fruit

No. of days from flowering	Fruit colour
5	Green
7	Whitish green
9, 11	Green with little yellowing
13, 15	Yellowish green
17	Brownish yellow
19, 21, 23, 25, 27	Brown with little netting pattern
29, 31, 33, 35, 37	Darker brown with netting pattern
39, 41	all over the fruit

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#### ABSTRACT

The development pattern of cucumber seeds (variety MTi 2) was investigated. Flowers were tagged and harvestings were carried out at one day interval until fruit maturity. Characters studied included seed moisture content, germinability, seed length and seed dry weight. It was found that physiological maturity was reached 31 – 33 days after flowering at moisture level of 38 per cent. This would be the best time to do harvesting for seeds. after considering various developmental patterns as well as risks of field deterioration. Fresh seeds were capable of germination 17 days after flowering but the germination pattern suggests the occurrence of dormancy.

#### REFERENCES

- ALDRICH, R.S. (1943). Maturity measurements in corn and indication that grain development continues after premature cutting. *J. Am. Soc. Agron.* **35**, 667–80.
- ANON. (1969). Report of the grass seed sub-committee. *Proc. Ass. Off. Seed Analysts N. Am.* **59**, 20.
- (1985). The germination test. *Seed Sci. & Technol.* **13**(2), 421–63.
- BARTEL, A.T. (1941). Green seeds in immature small grains and their relation to germination. *J. Am. Soc. Agron.* **33**, 732–8.

- (1972). Maturation of sweetgum and American sycamore seeds. *Forest Sci.* **18**, 223–31.
- (1974). Maturation of acorns of cherryback, water and willow oaks. *Forest Sci.* **20**, 238–42.
- BONNER, F.T., (1976). Maturation of shumard and white oak acorns. *Forest Sci.* **22** (2), 149–54.
- CHAUHAN, K.S. and BHANDARI, Y.M. (1971). Pod development and germination studies in okra. *Indian J. agric. Sci.* **41**, 852–6.
- CHIN, H.F. (1981). The effect of time of harvesting on seed storability and subsequent performance of long bean. *Acta Horticulturae* **111**, 249–53.
- FREY, K.J., RUAN and WIGGANS. (1958). Dry weight and germination of developing oat seeds. *Agron. J.* **50**, 248–50.
- GRABE, D.F. (1956). Maturity in smooth brome grass. *Agron. J.* **48**, 253–6.
- HARLAN, H.V. and POPE, M.N. (1922). The germination of barley seeds harvested at different stages of growth. *J. Hered.* **13**, 72–5.
- JAMES, D.H. and SAMIR ABDEL-AL, M. (1965). Some aspects of seed and boll maturation in cotton. *Proc. Ass. Off. Seed Analysts N. Am.* **55**, 154–62.
- Kersting, J.F., STICKLER, F.C. and PAULI, A.W. (1961). Grain sorghum caryopsis development 1. Changes in dry weight, moisture percentage and viability. *Agron. J.* **53**, 36–8.
- KOEHLER, B., DUNGUN, G.H. and BURLISON, W.L. (1934). Maturity of seedcorn in relation to yielding ability and disease in infection. *J. Am. Soc. Agron.* **26**, 267–74.
- LEININGER, L.N. and URIE, A.L. (1964). Development of safflower seed from flowering to maturity. *Crop Sci.* **4**, 83–6.
- MACLISTER, D.E. (1943). The effect of maturity on the viability and longevity of the seeds of Western range and pasture grasses. *J. Am. Soc. Agron.* **35**, 442–53.
- SAKHIBUN, M.H., CHIN, H.F. and HOR, Y.L. (1981). Fruit and seed development in Hevea (Clone RRIM 600) in Malaysia. *J. Rubb. Res. Inst. Malaysia* **29**(2), 101–10.
- SHAW, R.H. and LOOMIS, W.E. (1950). Bases for prediction of corn yields. *Pl. Physiol.* **25**, 225–44.
- SIMPSON, D.M. (1935). Dormancy and maturation of cotton seed. *J. Agric. Res.* **50**, 429–34.
- THIAGARAJAN, C.P. and RAMASAMY, K.K. (1979). Studies on seed maturation in two short duration cotton var. MCU 7 and PRS 72. *Seed Research* **7**(2), 87–91.
- THORNTON, M.L. (1968). Seed dormancy in watermelon, *Citrullis Vulgaris* Shrad. *Proc. Ass. Off. Seed Analysts N. Am.* **58**, 80–4.