Studies on the Germination-Promotion in Sugarcane Buds

——The Effects of Hot Water Pre-Sowing Treatments at 35°C on the Germination-Promotion in Sugarcane Buds——

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Abstract

Pre-sowing treatments of hot water at 35°C for sugarcane buds were conducted in the three different periods, that is, on October 3, November 6 and December 4. In the cases of the treatments on October 3 and December 4, the germination-speed in treatments at 35°C for 30 and 60 minutes in both the middle and bottom buds was slightly superior to the other plots, thus a slight effect of germination-promotion on sugarcane buds was observed.

INTRODUCTION

Concerning the breaking of the rest of buds in various plants, immersing the buds into a waterbath at 35°C has been known as Molisch's method. For improving the germination-percentage, such treatments have been conducted in sugarcane. Mukherjee[1] reported that pre-sowing treatment of sugarcane-setts dipped in hot water (35°C) for a period of ten minutes improved the germination of buds very appreciably; while temperatures higher than 35°C injured the buds. To date, the reports on such treatments done at 35°C for germination-promotion in sugarcane buds are relatively few, although there have been many reports of the use of water at 50°-52°C. Accordingly as the first experiment of germination-promotion for sugarcane buds, the authors conducted some experiments on the effects of pre-sowing treatments in hot water at 35°C on the germination-promotion of buds.

MATERIALS AND METHODS

Owing to the lack of the variety in which the germination of buds was bad, variety NCO. 310 in which germination of buds is generally good, was used. Sugarcane grown in Tane Island was harvested in the three different periods, that is, October 2, November 4 and December 3 in 1980. After harvesting, the cut sugarcane stalks were wrapped in straw mats, and were reserved at room temperature. Hot water treatments (35°C) were conducted on the next day of the harvest, with the exception of the one harvested on November 4 (treated on the 2nd day after the harvest). The sugarcane stalks were

divided into the three parts: top, middle and bottom. The middle and bottom were used. These two parts of the stalks were further cut into three sections which each contain one bud with 1.5 cm above and below. The three cut sections containing one bud at the middle and bottom parts from the one stalk respectively were obtained, and thus 10 sugarcane stalks were used for the respective plots. One plot was made of 30 buds in total. In the hot water (35°C) treatments, cut stalks to which one bud was attached were put in the wire-netting and were immersed in the regulating waterbath for 10, 30 and 60 minutes. In the first control, no immersion was made of the cut stalks, and in the second control, cut stalks were immersed into water for 30 minutes. After the hot water treatments, stalks were planted with the buds upwards in the beds containing river-sands, and the upper parts of the stalks were covered with the river-sands in 5 mm thickness. Suitable tap-water was given to the river-sands in the plant beds. All the plant-beds were put in a dark incubator at 30°C. When buds emerged on the river-sands, it was regarded as germination. Germination-investigation was conducted everyday after planting. On the 5th day after the incubation at 30°C, the growth-rates of the buds germinated in each plot were measured.

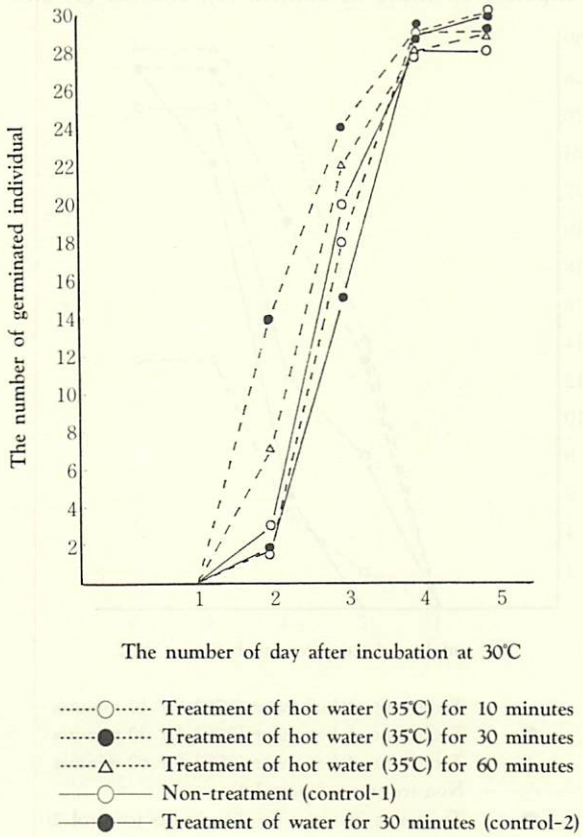

Fig. 1 The number of germinated individual in cases of hot water (35°C) treatments conducted for 10, 30 and 60 minutes and in cases of control-1 and control-2, in the middle buds on October 3. The total number of the buds was 30.

RESULTS

The treatments were conducted on October 3. In the case of incubation at 30°C after hot water treatments, the germination-speed in the middle buds treated in hot water for 30 and 60 minutes was slightly superior to those of the non-treatment (control-1), water-treatment (control-2) and hot-water-treatment for 10 minutes (Fig. 1). In the bottom buds (Fig. 2), the germination-speed of the buds treated with hot water for 30 and 60 minutes was slightly superior to those of the other treatments and non-treatment (control-1). In the hot water treatments made on November 6, germination-conditions of the respective treatments with exception of the first control were about the same in those of the middle buds (Fig. 3). In the first control, both the germination-speed and the germination-percentage were noted to be bad. On the other hand, in the bottom buds (Fig. 4), water treatment (control-2) and hot water treatments made for 30 and 60 minutes were slightly superior to the non-treatment (control-1) and the hot water treatment for 10 minutes. In the case of the treatments on December 4, in the middle buds (Fig. 5), germination-speed in the hot water treatments for 30 and 60 minutes was slightly superior to those of control (1), control (2) and the treatment of

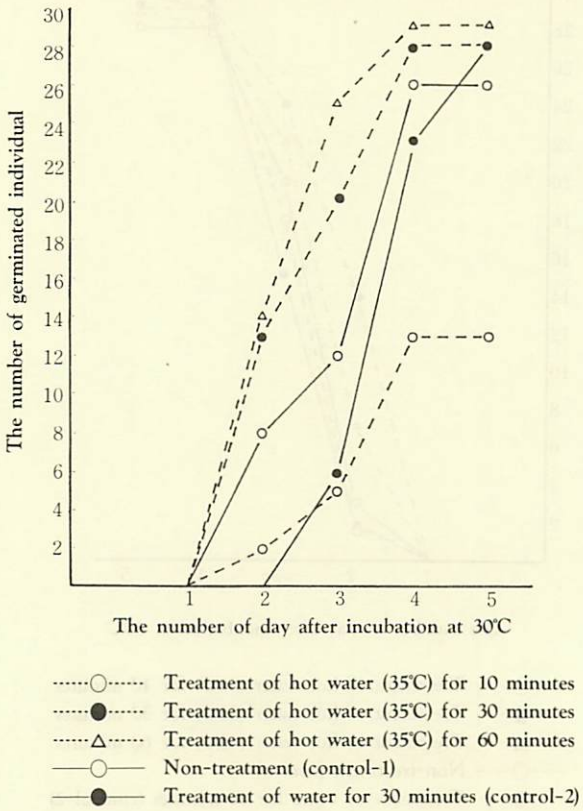

Fig. 2 The number of germinated individual in cases of hot water (35°C) treatments conducted for 10, 30 and 60 minutes and in cases of control-1 and control-2, in the bottom buds on October 3. The total number of the buds was 30.

hot water for 10 minutes. In the bottom buds (Fig. 6), the same result with the middle buds was observed. From the above results, with the hot water treatments on November 6, the effects of the respective treatments on the germination were not obvious. But, in the case of the two treatments on October 3 and on December 4, in both the middle and bottom buds, germination-speed in treatments of hot water for 30 and 60 minutes was slightly superior to those of the control-1, -2 and treatment of hot water for 10 minutes. It was observed that attainment to maximum germination-percentage in the hot water treatment for 30 minutes became late with the progress of age. In the case of the treatment on October 3 in young age, attainment to maximum germination-percentage was made on the 4th day in incubation at 30°C after hot water treatments in the middle and bottom buds. However in the case of the treatment on November 6, it was on 5th and on 6th day in incubation at 30°C after hot water treatments in the middle and bottom buds. With the non-treatment control-1 (Oct. 3), maximum germination-percentage was the 4th day after incubation at 30°C in both middle and bottom buds; it was 6th and 5th day in the case of November 6, and 8th and 6th day in the case of December 4. From these results, it was assumed that germination became more difficult with age. In the comparison of germination in middle and bottom buds, germination of the bottom buds was generally more difficult than that

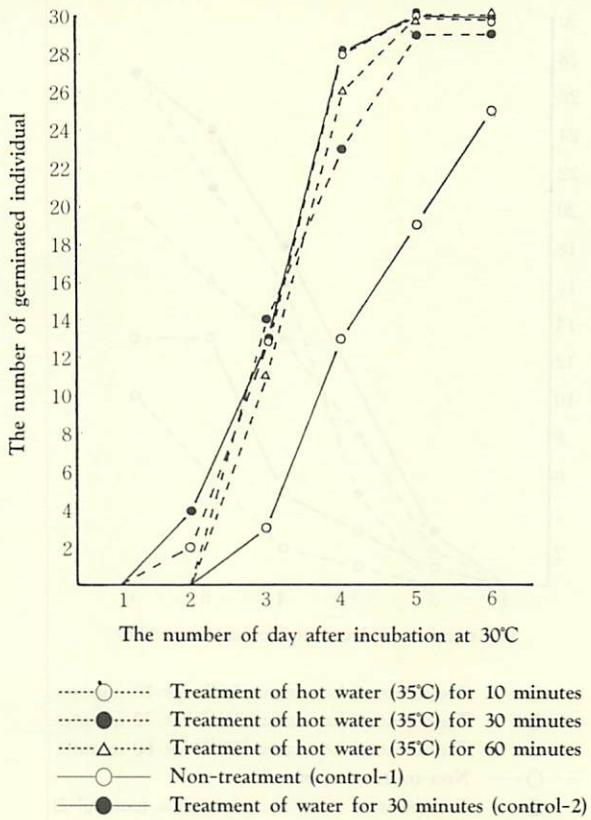

Fig. 3 The number of germinated individual in cases of hot water (35°C) treatments conducted for 10, 30 and 60 minutes and in cases of control-1 and control-2, in the middle buds on November 6. The total number of the buds was 30.

of the middle buds, though this is not shown in the figure. Growth-rate on the 5th day after incubation at 30°C was 3cm (on October 3), 1.9cm (November 6) and 1.2cm (December 4) in the middle buds in case of the non-treatment (control-1), and in the bottom buds the rate was 2.0cm, 1.3cm and 0.7cm, respectively. From the above results, it was observed that growth-rate on 5th day after incubation at 30°C became worse with age in both the middle and bottom buds.

DISCUSSION

Mukherjee (1960) reported that the treatment of hot water at 35°C for ten minutes improved the germination of buds. Using the above results, the authors conducted some experiments of hot water treatment (35°C) of short time, for sugarcane buds ; and observed the effects of the germination-promotion of buds. In general, treatment of hot water at 35°C has been known as Molisch's hot waterbath treatment[2], the time of the treatment is 9-12 hours, and the resting of buds in most plants is broken by such treatment. In the experiments of the authors, hot water treatments were adopted for a short time, that is, for 10, 30 and 60 minutes. In the treatments on October 3,

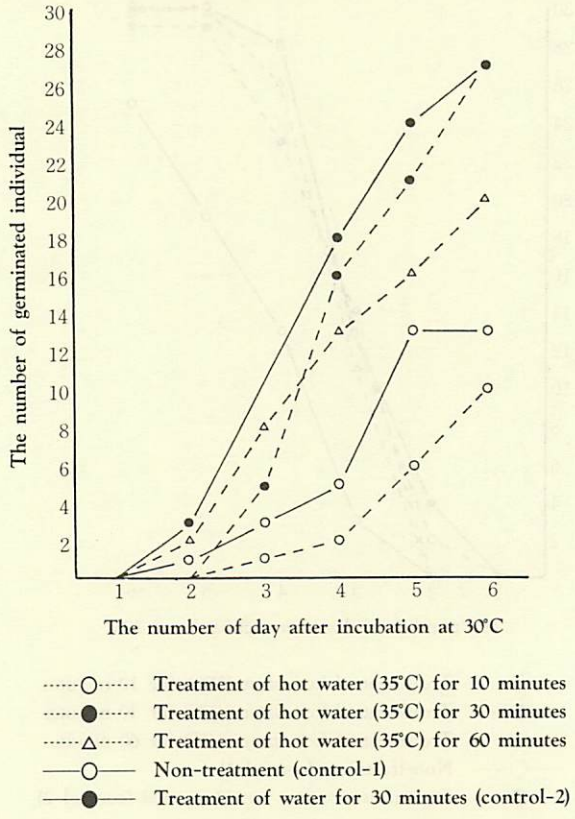

Fig. 4 The number of germinated individual in cases of hot water (35°C) treatments conducted for 10, 30 and 60 minutes and in cases of control-1 and control-2, in the bottom buds on November 6. The total number of the buds was 30.

November 6 and December 4, the treatments for 30 and 60 minutes at 35°C on October 3 and on December 4 were slightly more effective for germination-speed in both the middle and bottom buds. Authors assumed that the treatments for 30 and 60 minutes at 35°C were effcetive for inactivizing the growth-inhibitors in buds and for making germination in sugarcane buds easy. No effects of germination-promotion could be observed in the treatment for 10 minutes at 35°C. This result was different from that of Mukherjee (1960). For the purpose of observing the effects of hot water treatments on the germination in sugarcane buds, the authors considered that the variety in which germination is bad should be used in this experiment, but as there was no variety of bad germination, variety NCO. 310 of ordinary germination was used. Therefore, it was not possible for us to observe considerable effects of germination-promotion, but it was ascertained that germination-speed in treatments for 30 and 60 minutes was slightly superior to that in other plots containing control 1 and 2. The effects of germination-promotion in treatments at 35°C for 30 and 60 minutes were observed, and it was assumed that treatments of longer time might be more effective than those of short time.

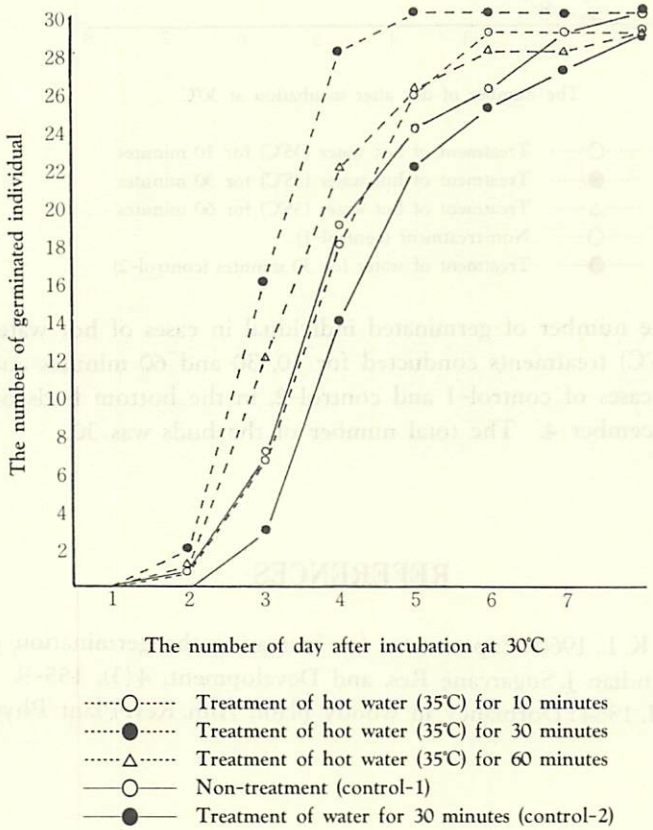

Fig. 5 The number of germinated individual in cases of hot water (35°C) treatments conducted for 10, 30 and 60 minutes and in cases of control-1 and control-2, in the middle buds on December 4. The total number of the buds was 30.

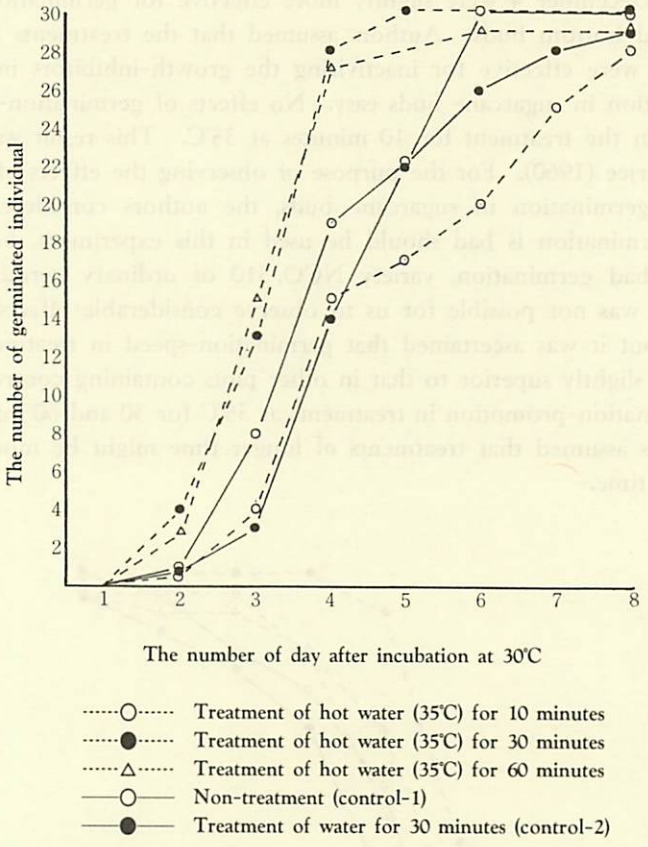

Fig. 6 The number of germinated individual in cases of hot water (35°C) treatments conducted for 10, 30 and 60 minutes and in cases of control-1 and control-2, in the bottom buds on December 4. The total number of the buds was 30.

REFERENCES

1) MUKHERJEE, K. L. 1960 : Experiments for increasing the germination percentage of sugar-cane. Indian J. Sugarcane Res. and Development, 4 (3), 155-9.
2) SAMISH, R. M. 1954 : Dormancy in woody plant. Ann. Rev. Plant Physiol., 5, 187.