Variations in Some Characteristics of Cassava Stems during Storage Prior to Taking Cuttings

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Introduction

In cassava production, high yield can be achieved by the use of good quality stems[1,3-5]. Before planting cassava stems, it happens that they are stored for some time due to the delayed land preparation or unfavorable climatic conditions, such as drought, low temperature or heavy rain. The period during which the planting materials can preserve their viability is related to the storage conditions[2,6,7,10] and to the varietal tolerance to storage[1,7]. In general, planting materials can be successfully stored for periods of up to 30 days in Thailand[9], Malaysia[9], Colombia[7] and Brazil[1], when they were stored in shady and well-ventilated places such as under trees[1,7,10].

In Thailand, the newly recommended variety, Rayong 3, has stems of inferior quality which show germination ability of the cuttings lower than that of the old recommended variety, Rayong 1[8]. Therefore, to compare the storage tolerance of stems of Rayong 3 with that of Rayong 1, changes in some characteristics of cuttings during stem storage were examined.

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Materials and methods

This study was performed at the Field Crop Research Institute, Department of Agriculture of Thailand, from April 1 to June 9 in 1984. Varieties used were Rayong 1 and Rayong 3. Rayong 1 which was selected from local varieties in Thailand in 1975 is characterized by an erect plant type and vigorous growth. Rayong 3 was newly released in 1983 due to its high starch and dry matter content of the tuber and high yield potential. Materials were taken from 10 month-old plants of both varieties and kept vertically in the open-air shade under trees. The length of the stems stored was 130 to 150 cm in Rayong 1 and 60 to 80 cm in Rayong 3. Climatic conditions during the storage are shown in Table 1. The mean temperature and relative humidity were relatively high and rainfall started from the end of April at the beginning of the rainy season.

Cuttings, about 20 cm in length, were taken from the middle part of stems for the study. In Rayong 3, cuttings were taken from the middle part without a large sprout. Respiratory rate of cuttings was measured by the chamber method[8] immediately after the cuttings were prepared. Four cuttings were placed in a measuring chamber, and the measurement was repeated 3 or 4 times with different samples. Fresh weight, dry weight,

Table 1. Climatic conditions during 70 days (Apr. 1—Jun. 9 1984) of stem storage

Factor	Apr. 1 —Apr. 10	Apr. 11 —Apr. 20	Apr. 21 —Apr. 30	May 1 —May 10	May 11 —May 20	May 21 —May 30	May 31 —June 9
Mean temperature (°C)	30.5	30.5	29.4	30.6	29.3	30.1	29.2
Mean relative humidity (%)	77.0	77.3	79.5	74.8	81.0	77.4	81.0
Cumulative rainfall (mm)	0	0	40.6	13.8	26.7	0.4	39.1

Source: Climatic data at Bangkhen Rice Experimental Station.

water content, and volume density (the ratio of fresh weight to volume)[8] were examined using 12 or 16 cuttings that were used for the measurement of respiratory rate.

Results and discussion

Fresh weight of cuttings is shown in Fig. 1. It gradually decreased in both varieties during the storage period, but the decrease was greater in Rayong 3 than in Rayong 1. The loss in fresh weight influenced significantly the germination ability of cuttings. The critical value of this parameter was 12.5% loss of the initial fresh weight which approximately corresponded to the germination rate of 80%[10].

The percentage of the dry weight to the initial weight of both varieties decreased with the duration of stem storage, but the decrease was more conspicuous in Rayong 3 than in Rayong 1 (Fig. 1). At around 50 days after harvest, the percentage of the dry weight markedly decreased in both varieties.

The water content of stems is also one of the important factors determining the viability of the cuttings during storage[4,6,10]. Leihner (1984)[6] reported that germination rate started to decline abruptly when water content fell below 60%. In our observation of water content for 70 days, the water content ranged from 72.7 to 65.9% in Rayong 1 and from 63.6 to 53.1% in Rayong 3 (Fig. 2). There was a large difference in the water content between these two varieties even before the storage, as already observed in our previous study[8]. This difference seems to be associated with the basic varietal properties of stems. In particular, the water content in Rayong 3 readily decreased to 60% at around

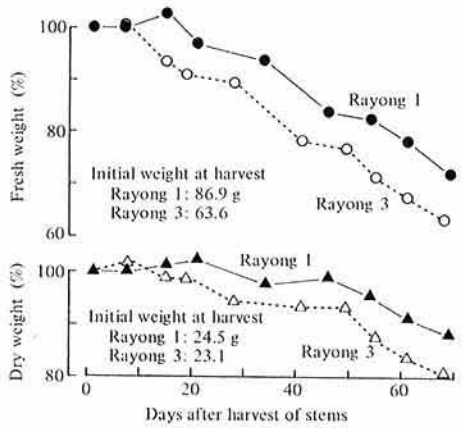

Fig. 1. Variations in the percentage of fresh and dry weight to the initial weight of cassava cuttings (20 cm in length) taken from the middle part of stems of Rayong 1 and Rayong 3

20 days of the storage.

The volume density of cuttings also showed a great difference between the two varieties during the storage. Oka et al. (1987)[8] reported that the volume density of cuttings was the most suitable factor for estimating germination ability when the cuttings were planted after 7 days of stem storage either in dry or rainy season, and that the volume density of 0.8 g/cm^3 corresponded approximately to the survival rate of 80% in both seasons. In the present study, the volume density decreased to 0.8 g/cm^3 at about 60 and 20 days of storage in Rayong 1 and Rayong 3, respectively. It is noteworthy that the storage period estimated by the volume density agrees well with the period estimated on the basis of the fresh weight and water content.

The respiratory rate increased soon after the harvest of stems and then decreased, but it increased again in both varieties. However,

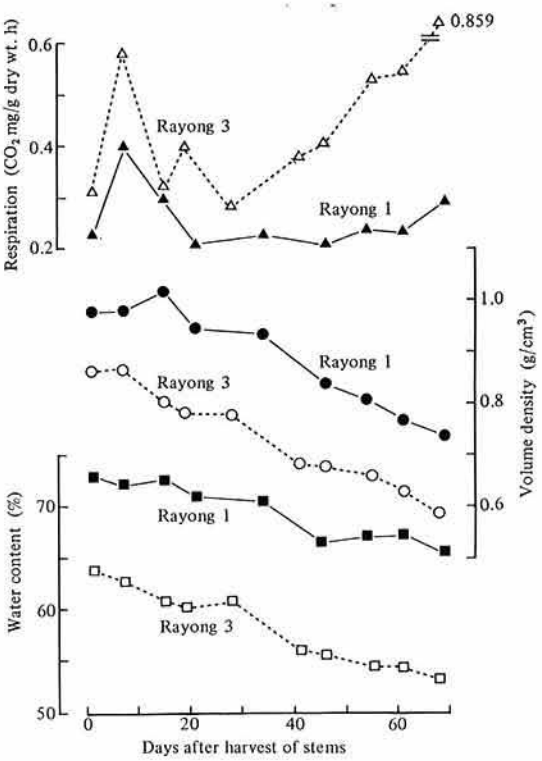

Fig. 2. Variations in respiratory rate, volume density, and water content of cassava cuttings, taken from the middle part of stems of Rayong 1 and Rayong 3

the final increase in Rayong 3 was much more remarkable than that of Rayong 1. This difference is mainly associated with the presence or absence of sprouts. The cuttings of Rayong 1 did not develop new sprouts during storage because sprouting occurs only at the top part. On the other hand, in Rayong 3 small axillary buds were prepared in the field before harvest and 5 to 7 buds appeared and increased in size irrespective of the part of stems. The marked increase in the respiratory rate observed during the later period of storage in Rayong 3 may be due to the increase in size of buds though the cuttings were taken from the middle part of the stems without a large sprout.

Sinthuprama (1980)[9] stated that the storage period not longer than 30 days is recommended so that the survival rate is not less than 80% using stems of Rayong 1 in Thailand. The results of the present study on fresh weight, water content, and volume density of the cuttings also suggest that the stems of Rayong 1 can be successfully stored at least for 30 to 40 days after harvest, whereas the storage period of more than 20 days may not be suitable for Rayong 3.

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