POSSIBILITY OF EARLY-SEASON CULTURE OF WATER YAM (*DIOSCOREA ALATA* L.) IN YAKU ISLAND

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Abstract

Early-season culture of water yam (*Dioscorea alata* L.) was required in Yaku Island, because of the long growing period, the concentrating work at the harvesting time, the lack of storehouse and so on. Thus we tried to search the early-maturing strains and use a plant growth regulator that promote the tuber enlargement. Then we found out the extremely early maturing strains introduced from high altitude area in the Kingdom of Nepal. On the other hand, foliar applications of gibberellins promoted the tuber enlargement. These results suggest the possibility of early-season culture of water yam. Further research would be required to use the new strains and the plant growth regulator.

Key words: Early maturing-strain, Early-season culture, Gibberellins, Water yam, Yaku Island

Introduction

Water yam (*Dioscorea alata* L.) is cultivated commercially in Yaku Island, and strains of "Solo Yam" that Kagoshima University introduced from Indonesia (ISHIHATA et al., 1977, 1984) are cultivated in the town of Kamiyaku. In normal cultivation, "Solo Yam" is planted from the beginning to the end of April and is harvested from the beginning to the middle of December when the tuber has matured, occupying the field for a long time since the cultivation takes so long. This has become a problem because it makes crop rotation with other crops difficult. In addition, as the work is concentrated at the time of harvest, labor supply and the lack of storage space are also causing problems. Breeding of an early-maturing strain with a short growth period may solve these problems. However, water yam has very rarely flowers, and hybridization has rarely been attempted anywhere in the world (ONWUEME, 1978). Thus, we searched for an early- maturing strain with early harvesting time and examined the possibility of chemical control with a plant growth regulator that might promote the tuber enlargement.

Materials and Methods

Experiment 1. Searching for an early-maturing strain

Searching for an early-maturing strain: We first tried to determine the earliness of the water yam strains that had been collected and preserved by at Kagoshima University since the latter half of the 1970s (ISHIHATA et al., 1977). We chose some representative strains, planted their seed tubers in the field at the beginning of May, and investigated the tuber enlargement by keeping records over time.

Late-maturing strains of water yam tend to be found in tropical lowlands where cultivation temperatures are less limited. We hence assumed that early-maturing strains could be found in the tropical or subtropical zone highlands where cultivation temperature is rather limited. Thus, we introduced

water yam strains cultivated in the highlands of the Kingdom of Nepal (600 to 1,800m above sea level) to Kagoshima and planted their seed tubers in the field at the beginning of May, as for the tubers of Kagoshima University, to investigate the tuber enlargement with elapsed time.

Experiment 2. Promoting tuber enlargement with a plant growth regulator

Use of a plant growth regulator: Preliminary examination showed that applying a general plant hormone, gibberellins (GAs), to foliage promoted water yam tuber enlargement. We then used two strains in the experiment, "Arata" a native of Kagoshima, and "Solo Yam" introduced from Indonesia. At the beginning of July, we applied GAs in concentrations of 0, 10, 100 and 1,000ppm to foliage to investigate the best GAs concentration for promoting tuber enlargement.

The tubers were planted in 10-liter cloth pots, and the stems were trained onto a 1.2m prop.

Results and Discussion

Experiment 1. Searching for an early-maturing strain

Fig. 1 shows how tuber enlargement of the preserved strains of Kagoshima University changed with time. The Oosato No.1 dried tuber weighed 3.1g on the 70th day after planting, while tubers of the other strains weighed less than 2g. This demonstrated that Oosato No.1 started tuber enlargement earlier than the other strains. Furthermore, Oosato No. 1 started rapid tuber enlargement around the 100th day after planting, whereas No. 36, Arata, and No. 59 started on the 100th to 130th day and Solo Yam on the 130th to 160th day. This proved that the strain of Oosato No. 1 started tuber enlargement about two months earlier than Solo Yam.

Based on the above result, we decided to use Oosato No.1, which started the tuber enlargement the earliest among the preserved strains, as a standard and compared it with the enlargement pattern of the strains introduced from Nepal (Fig. 2). Among the five strains that we had brought in from Nepal, N-1, N-3, N-5 and N-6 started tuber enlargement on the 70th to 100th day, which was about 15 to 30 days earlier than Oosato No.1.

N-1 in particular continued excellent tuber enlargement from the 100th day to the 160th day after planting, and the weight of the dried tuber on the 160th day at harvest time was 1.5 times that of Oosato No.1. This result clarified that four out of the five strains that we had brought in from Nepal started tuber enlargement even earlier than Oosato No. 1 that was native to Kagoshima.

N-1 and N-6 had been collected from villages that were more than 1,700m above sea level. The average temperature of August (January) at 1,740m above sea level is 20.4℃ (9.0

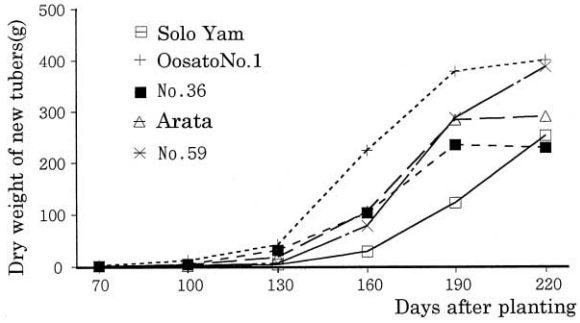

Fig.1. Changing in dry weight of new tubers in water yam collected from South-East Asia and Kagoshima, Japan.

℃). Hence the latter half of the growing period of yam cultivated in these areas could be under quite low temperatures. Therefore, we can consider that earlier maturing strains would be found in regions high above sea level where the temperature falls quicker.

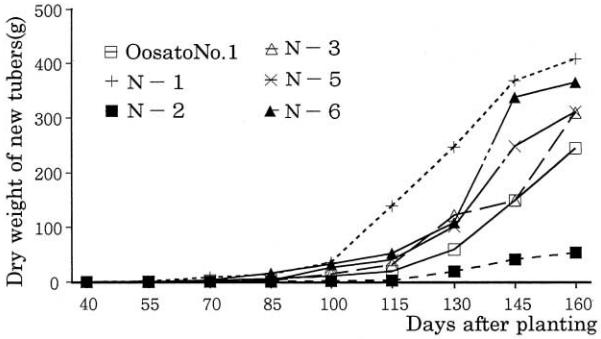

Fig.2. Changing in dry weight of new tubers in water yam introduced from Nepal.

Experiment 2. Promoting tuber enlargement with plant growth regulator

Table 1 shows the effect of GAs on tuber enlargement. We applied GAs at the beginning of July when tuber enlargement was stagnant. The fresh weight of the new tubers increased in both Arata and Solo Yam strains, which showed that GAs promoted tuber enlargement. The effect was particularly remarkable in 100ppm and 1,000ppm application divisions, the fresh weight of new tubers in the 1,000ppm division was 15 times that in the 0ppm division for Solo Yam and about twice for Arata. Whether this large diversion of promotion effect between the strains is due to their difference of sensibility to GAs or due to the variation of the growth stage at the time of application will be discussed in the future.

GAs is generally known as a plant hormone controlling the growth of a plant. It is widely used in agriculture, with seedless vines for example. It is safe and can be obtained cheaply anywhere. The fact that GAs promotes tuber enlargement will open up a way to use chemical control for early cultivation of water yams.

Table 1. Promotion effects of tuber enlargement by gibberellins treatment in water yam (*Dioscorea alata* L.).

Gibberellins concentrations (ppm)	Fresh weight of new tubers (g)	
	Solo Yam	Arata
0	1.2a*	6.0a
1	1.2a	4.8a
10	2.3a	8.8ab
100	4.0a	11.7b
1,000	18.7b	12.5b

*:Different figures show the significant differences at 5% level.

It will then be necessary to examine the amount of harvest, viscosity and tastes of the strains introduced from Nepal. Furthermore, the possibility of combining existing strains and Nepal strains in actual cultivation and of chemical control of those strains using GAs needs to be discussed in the future.

References

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