

# Sweetpotato Research Front

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## Report on the 14th Meeting on Root Crop Research Held in Nagasaki Prefecture

**Osamu Yamakawa**

**Director of the Upland Farming Research of KONARC**

The 14th Meeting on Root Crop Research was held during December 7-8, 2000, in Nagasaki Prefecture. Over 80 researchers engaged in study of the sweetpotato and the potato attended the meeting to exchange information on results and plans for future studies. The discussions on sweetpotato are summarized as follows.

1. Performance trials conducted by the Prefectural Agricultural Experiment Station for newly distributed breeding lines were described. Kyushu-138 showed good taste and good shape for table use. Kyushu-139 with an anthocyanin flesh content was selected for table use due to its good taste, in spite of its lengthy root. Kyushu-140 was selected for extraction of beta-amylase, useful in maltose production and as a food additive.

2. A presentation on the physiological benefits of sweetpotato was given. Sweetpotato is rich in vitamins, minerals and dietary fiber, and anthocyanin contained in the flesh possesses antioxidative and antimutagenic functions. Dr.Suda showed that impaired hepatic function in humans was improved by drinking high anthocyanin sweetpotato juice.

3. Eight short research topics were presented.

1) Search for promotor genes specified in the skin of sweetpotato root. 2) Estimation of the environmental impact of sweetpotato cultivation using the Life Cycle Assessment (LCA) method. 3) Change of vitamin and mineral content in sweetpotato leaves with harvesting date. 4) Characteristics of sweetpotato starch in new breeding lines. 5) Effect of variety and cultivation conditions on the characteristics of sweetpotato starch. 6) Report of the "International Workshop on Cultivar Decline" in Miyakonojo. 7) Report of the "International Symposium on Tropical Root Crop" in Tsukuba. 8) Report on sweetpotato research at the Jiangsu Academy of Agricultural Sciences.



# Research Paper

## Nurturing of Plantlets from Cut Pieces of Sweetpotato Storage Root, and Productivity in the Field

**Masataka Yamashita**

**Research Team for Subtropical Farming**

In sweetpotato production in Japan, the manual tasks from nurturing to transplanting are major factors preventing low cost and labor reductions in production. To resolve the problem, a new nurturing method using pieces cut from storage roots has been developed. The shooting potential of sweetpotatoes derived from roots is maintained in the pericycle and xylem tissue, and the tissues can differentiate adventitious shoots when stimulated (Fig.1). Cut pieces (cultivar: Koganesengan) of 10g fresh weight, treated with ABA (100, 200mg $l^{-1}$ ) or distilled water, formed adventitious shoots most often. Shooting was induced within one to two weeks of treatment by incubating the pieces under 30°C in a wet condition. After shooting, the pieces could be grown to plantlets by nurturing under 30°C in wet conditions.

To estimate the productivity of the new method, plantlets nurtured for 10, 30 or 50 days after shooting and conventional cut sprouts (control) were transplanted to a test field in early May 1998 and were harvested in late October (Fig. 2). The 50-day plantlet achieved the highest yield and best quality (Fig. 3).

In conclusion, the new nurturing method is superior to the conventional method in both productivity and quality. The method is also considered to be applicable to mechanized transplanting. For this method to be put to practical use, however, there are still several problems to be solved, such as how to improve the shooting rate (M. Yamashita 2000, Plant Production Science. 3:259-267).

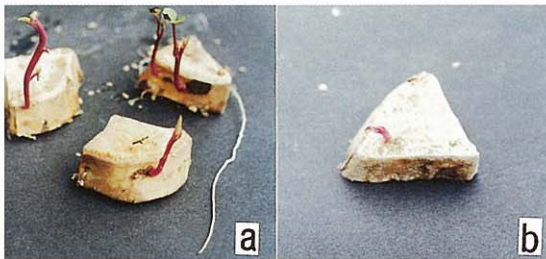


Fig. 1. Shooting from cut pieces treated with ABA.  
(a) Differentiation in pericycle  
(b) Differentiation in xylem tissue.

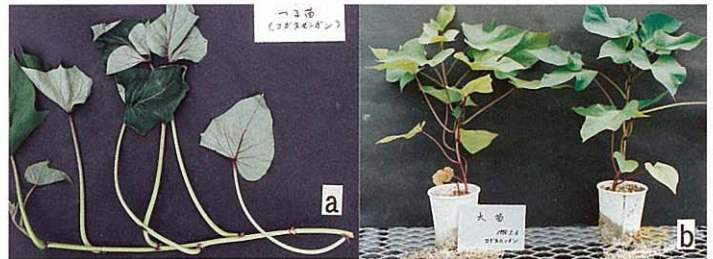


Fig. 2. Shoot growth at the time of transplanting  
(a) Conventional cut sprout  
(b) 50-day plantlets

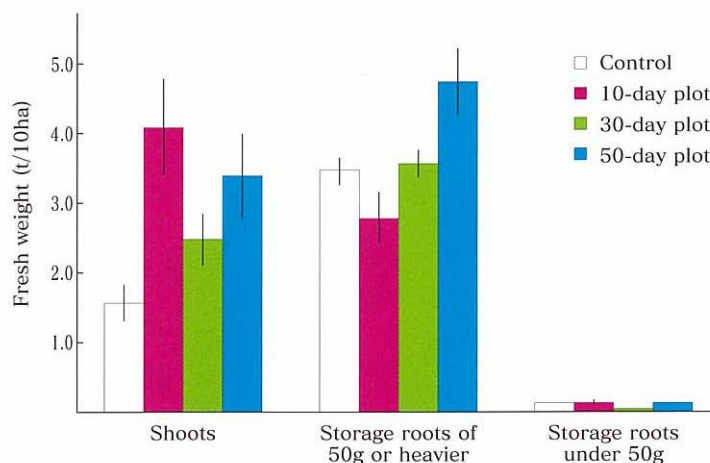


Fig. 3. Shoot growth at harvest time and yield.

# Research Paper

## The Effect of Covering Materials on the Yield and Anthocyanin Content of Ayamurasaki

*Tooru Kobayashi and Hideyuki Mochida*

**Laboratory of Crop Production Management**

“Ayamurasaki” is a newly released sweetpotato cultivar with a high anthocyanin content. It has been found that the anthocyanin content of the tuberous root increases in lower soil temperatures. New covering materials are being developed to save labor at harvest time. This report is concerned with the effects of covering materials on the yield and anthocyanin content of Ayamurasaki.

From 1998 to 2000, field experiments were carried out at the National Agricultural Research Center for the Kyushu Okinawa Region in Miyakonojo. Cut sprouts were transplanted in May and the tubers were harvested from September to November each year. The covering materials used were made from paper, non-woven fabric and polyethylene film. The soil temperature was taken at 10cm below ground.

The effect of the covering materials on the yield

and anthocyanin content of Ayamurasaki is shown in Fig. 1. Differences in yield were observed among the covering materials. The highest yield was obtained using polyethylene film. The highest content of anthocyanin was obtained using covering material made from paper or non-woven fabric. Using these materials, the soil temperature remained low compared to when polyethylene film was used. Variations in soil temperature are shown in Fig. 2. These results suggest that the anthocyanin content of the tubers was increased by the use of covering materials made from paper or non-woven fabric because of low soil temperature during tuberous root growth.

The paper and the non-woven fabric covering materials controlled the soil temperature, and the anthocyanin content increased in consequence.

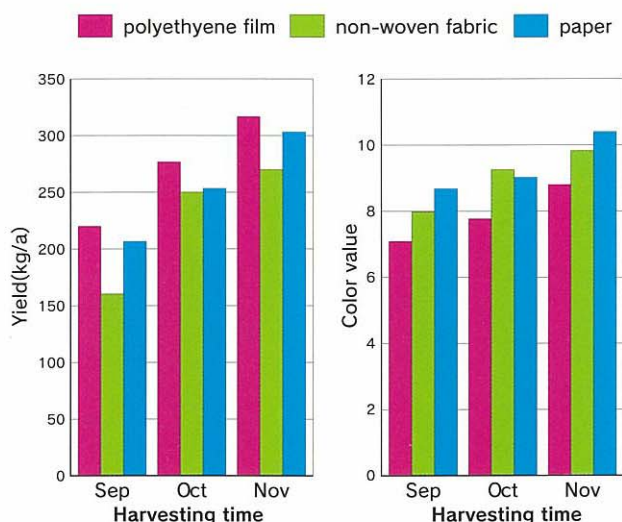


Fig. 1. Effect of covering materials on the yield and anthocyanin content

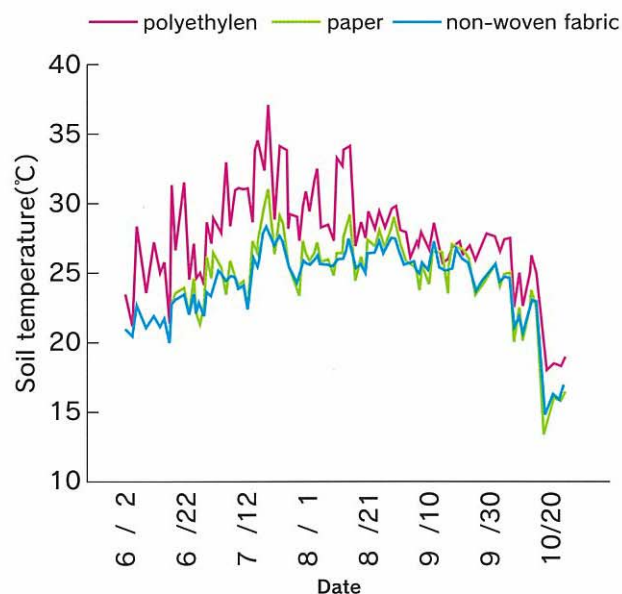


Fig. 2. The fluctuation of soil temperature

# Research Paper

## Extrusion Processing for Sweetpotato Powder to Improve Product Quality

Terumi Sugawara

### Laboratory of Farm Operation Mechanization Systems

A drying and milling system for storage of sweetpotato root has recently been developed. It enables usefully high anthocyanin levels to be maintained in the product. Sweetpotato powder produced by the process has appeared on the market. There was a germcontamination problem with the product, however, because of the low temperatures used during the process to preserve the nutrients and physiologically functional components. Therefore, the efficacy of extrusion as a sterilization treatment was examined under various conditions.

Sweetpotato powder (cultivar "Ayamurasaki", M.C.=7.8% b.w.) was used as the base material for the test. The type of extruder used was E-100 (S Corporation).

Its L/D proportion was 24.

Treatment conditions are shown in Table 1.

Results:

1. The general viable count in the product was decreased by extrusion treatment. Sterilization was more effective with the addition of water and increasing the rotational speed of the screw. Also, 0.5~1% acetic acid improved sterilization.

2. There was little loss of anthocyanin content when water was added and the rotational speed of the screw was increased. When acetic acid was added, there was an increase in the  $a^*$  value and the  $C^*$  value (chroma), and a decrease in the anthocyanin content of the product.

3. It was observed by SEM that starch was damaged or disintegrated in condition Nos. ④~⑥(Fig. 1).

In addition, we had some granular products in condition Nos. ④~⑥(Fig. 2). Changing the properties of the starch and the form of the product in this way, we had preliminary material with no similarity to sweetpotato powder. It facilitated mixing with water and reduced handling difficulties (such as contamination in the factory). The product can be used for paste, in processed food, and elsewhere.

condition	①	②	③	④	⑤	⑥	⑦ no treatment
material feeding (kg/hr)	50	100	100	100	100	100	—
water addition (L/hr)	0	0	0	4.5	6	6.5	—
conditions in process	end barrel $T_e$	82	88	56	84	83	85
	middle barrel $T_s$	120	140	120	122	120	121
	middle barrel $T_4$	190	190	190	190	190	190
	middle barrel $T_3$	190	190	190	190	190	190
	middle barrel $T_2$	140	130	140	134	140	140
	feeding barrel $T_1$	44	64	62	60	58	58
screw revolution (r.p.m.)	120	120	120	180	180	180	—
acetic acid addition	—	—	1% <sup>(1)</sup>	1% <sup>(1)</sup>	0.5% <sup>(2)</sup>	—	—
results of measurement	$L^*$	50.99	52.65	51.66	56.15	58.25	56.74
	$a^*$	15.83	15.38	18.19	17.16	15.02	15.56
	$b^*$	-2.63	-2.68	-1.72	-2.12	-1.67	-2.50
	$C^*$	16.05	15.62	18.27	17.29	15.12	15.77
absorption at 530nm (anthocyanin content)	0.20	0.20	0.16	0.19	0.16	0.20	0.21
genral viable count(/1g powder)	$1.3 \times 10^3$	$9.7 \times 10^2$	$5.3 \times 10^2$	$5.0 \times 10^1$	$1.9 \times 10^2$	$1.0 \times 10^2$	$1.4 \times 10^3$
products form	powder	powder	powder	powder	powder	powder	powder

<sup>(1)</sup> 0.1kg acetic acid premixed into 10kg material

<sup>(2)</sup> 0.05kg acetic acid premixed into 10kg material

Table 1. The condition of extrusion processing and quality of the products

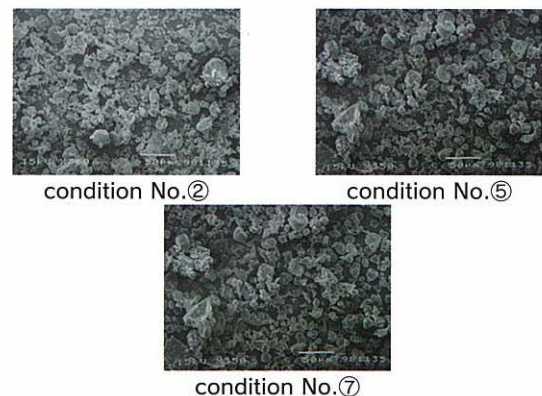


Fig. 1. The photos of the starch in the products by SEM



Fig. 2. The products produced by extruder

# Research News

## Dr. Noda, Incentive Award from the Japanese Society of Applied Glycoscience

Dr. Noda, Researcher at the Laboratory of Crop Quality, Storage and Processing, received an incentive award from the Japanese Society of Applied Glycoscience. He gave an award presentation entitled “The Effect of Cultivar and Growth Conditions on the Starch Properties of Sweetpotatoes” at the award ceremony, held at Nagano City on 28 September 2000. Since 1990, he has conducted intensive research into the starch properties of sweetpotato roots. Research subjects discussed in the presentation were: 1) Physicochemical properties of sweetpotato starch for commercial use, 2) Effects of cultivation conditions on the properties of starch from purple- and orange-fleshed sweetpotatoes, and 3) Relationships between gelatinization properties and amylopectin structure for sweetpotatoes with the same botanical origin.



Dr. Takahiro Noda

# Reader's Talk

## Announcements

SPORF is a public information forum where information relating to sweetpotato research can be exchanged. “Letters to the Editor” are welcomed. Please address contributions to Osamu Yamakawa, SPORF editor.

## Editor's note

On April 1, 2001, KNAES was renamed the National Agricultural Research Center for Kyushu Okinawa Region (KONARC), an independent administrative organization under the auspices of the Ministry of Agriculture, Forestry and Fisheries. The publication of SPORF will continue, providing information on current sweetpotato research. (K.N.)

# Reader's Talk

## Letter to the editor



Kyushu National Agricultural Experiment Station (KNAES) at Miyakonojo:  
An Excellent Place for Sweetpotato Research and Development

*Md. Shahidul Islam*

STA Fellow

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It gives me an immense pleasure to avail the opportunity of expressing my deep sense of gratitude to Dr. Osamu Yamakawa, my host researcher and Director, Upland Farming Division of KNAES for his initiative and interest to the Science and Technology Agency (STA) Fellowship program. Heartfelt gratitude is due to Dr. Makoto Yoshimoto, Head, Laboratory of Upland Crop Utilization for gladly accepting me as one of his lab. members. Gratitude is also extended to the JST and JISTEC for granting me the Fellowship. The branch office of KNAES at Miyazaki is a very beautiful campus, well-equipped and excellent research environment.

I am a Scientific Officer of the Horticulture Research Center, Bangladesh National Agricultural Research Institute. While working there I could gather experience on various aspects of horticultural crops. Currently, I am investigating the normal and rare polyphenols in sweetpotato leaves that are associated to the medicinal value. Now-a-days polyphenol and phenolic compounds have attracted special attention because they can protect human body from oxidative stress, which may cause many diseases including cancer and aging. It is now well known that certain sweetpotato cultivar contains much higher amount of total phenol as compared to any other vegetable species. My aim of the present study is to find out variety(s) with high content of polyphenol, to clarify the chemical characteristics of the above polyphenol, and to clarify the relationship between the polyphenolic quality and quantity in relation to environmental factors. Therefore working on this area has been considered very important, because some polyphenols are medi-

cinally important for human health and diseases. I firmly believe that the knowledge and intuition acquired from present laboratory will enhance my capabilities on postharvest and food science research.

My living in Japan is a unique experience and valuable asset of my life. I have indelible impression of Japanese for their high level of public discipline, respect for authority, integrity and sincerity. Along with my research activity I have been enjoying life in Miyakonojo City with my wife, son and daughter. The frequent interactions with Japanese friends have helped my wife understand, to some extent, Japanese customs and food habits and I enjoyed the delicious Japanese food that she prepares in a Japan-Bangladesh style. We also acclaimed the taste of Tofu (soybean curd), Sashimi (sliced raw fish), Udon (wheat noodle), Oden (Japanese pot-au-feu), Nabe (sukiyaki), etc. and now have been included in the table menu. My son is going to the elementary school and he has his own friends to enjoy with. My daily life in Japan is simple life but I believe that during the nice time here I have received not only valuable knowledge but also very enjoyable experiences like sight seeing, festivals, etc. Moreover, wellness Miyakonojo is calm and quiet and its natural beauty attracts me greatly and the peoples are very kind.

Finally, I would like thanks other members of my laboratory, researchers, officers and staffs of the Division of Upland Farming of KNAES for their kind cooperation. I will make every effort towards the completion of my fellowship tenure nicely.

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