



## **IMPROVEMENT OF CASSAVA QUALITY THROUGH MUTATION BREEDING**

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### **1. INTRODUCTION**

Ghana has not been able to take advantage of the high-yielding cassava varieties developed by the International Institute of Tropical Agriculture (IITA) because these varieties generally do not have the desired cooking quality. The major emphasis of this project therefore is to use mutations to produce varieties with the desired starch characteristics while maintaining the disease-resistance and high-yielding characteristics of the IITA varieties.

### **2. MATERIALS AND METHODS**

The following two approaches reported during the last RCM have been followed during the past two years: 1. selection within irradiated populations for disease and pest resistance, high yield and good cooking quality. 2. research to understand the physico-chemical properties of cassava starch.

In 1991, we reported the screening of the  $M_1V_2$  generation of varieties 'ISU-W', '1425-LB', '1425-W' and '518-DB'. A number of promising mutants were identified especially in ISU-W. Much effort has been subsequently concentrated on the  $M_1V_3$  and  $M_1V_4$  of this variety.

### **3. RESULTS AND DISCUSSION**

During 1991, in 'ISU-W'  $M_1V_3$ , 197 plants were individually examined for tuber yield and cooking quality. Only those plants with yield above 2 kg, and which showed mealiness, smoothness and elasticity of pounded paste score of 3 or above were selected. Thus, 32 plants were selected and five cuttings were planted of each selected plant. The yield and cooking quality and the characteristics of the plants selected are shown in Tables I and II.

During 1992, the  $M_1V_4$  generation was examined as in the previous year; in addition, dry matter content was also determined. The yield, dry matter and cooking quality characteristics of the lines selected are shown in Table III. The selected lines were planted in 0.5 acres. The 1993 harvest, which is not completed yet shows that all the plants have very good cooking quality and high tuber yield. The characteristics of those harvested are shown in Table IV. The high yielding ability combined with good cooking ability of this new variety has brought tremendous benefit to the workers of the Arable Crops Section who have known the poor cooking quality of the initial introduction, and are now witnessing the improved cooking quality. The Director, Regional Crop Services was invited to witness the high yield and improved cooking quality.

**TABLE I. FREQUENCY DISTRIBUTION OF YIELD AND COOKING QUALITY SCORES OF M<sub>1</sub>V<sub>3</sub> ISU-W POPULATION**

Tuber Yiled/Plant (Kg)	Frequency	Cooking Quality Score*	Mealiness	F r e q u e n c y	
				Smoothness	Elasticity
0.5	26	0 - 1	6	6	3
0.6 - 1.0	47	1 - 1.9	5	1	2
1.1 - 1.5	40				
1.6 - 2.0	36	2 - 2.9	28	22	13
2.1 - 2.5	15	3 - 3.9	89	71	72
2.6 - 3.0	10	4	70	101	112
3.1 - 3.5	8				
3.6 - 4.0	4				
4	1				

\*Score

0 - 4 None mealy texture to very mealy texture

0 - 4 Lumpy pounded paste to increasing degree of smooth and elastic paste

Cuttings from this variety have been given to the Crop Services Department and have been included in this year's regional multi-location trial in farmer's fields. We are following these trials to monitor the results. A multi-location trial would be carried out next year. If the variety maintains its performance in these trials, it could be released for cultivation by 1995. Other irradiated varieties which are being examined include 60142, 30474, 30001 and 1425-LB.

#### *Studies on the cassava starch*

The studies on cassava starch and cooking quality reported at the 1991 RCM have been published [1]. Under a six-month IAEA fellowship at the National Institute of Nutrition, Rome studies on the physico-chemical properties of cassava starch in relation to cooking quality were carried out. The proximate composition, starch content, amylose content, changes in viscosity on heating using the Brabender amylograph, the swelling-power and solubility and the water-binding capacities of the IITA and local varieties in relation to their cooking qualities were studied. A lot of data was generated which showed that the characteristics of the starch rather than the total amount has a great effect on the cooking quality.

A related study on the effect of age at harvest on the cooking quality, dry-matter and starch characteristics of four cassava varieties was completed last June. The starch characteristics studied were swelling-power, solubility and water-binding capacity. The results showed how these starch characteristics affect the cooking quality which falls with the onset of the rainy season.

**TABLE II. YIELD AND COOKING QUALITY CHARACTERISTICS OF PLANTS SELECTED IN M<sub>1</sub>V<sub>3</sub> 1991**

Plant No.	Top growth (Kg)	Tuber yield (Kg)	Harvest Index	No. of Tubers	Cooking Quality		Elasticity
					Mealiness	Smoothness	
1.	2.0	3.0	1.50	4	4	4	4
2.	2.4	3.0	1.25	5	3	4	4
3.	1.2	2.0	1.67	4	3	3.5	3.5
4.	1.5	2.2	1.47	6	3	4	4
5.	1.4	2.2	1.57	5	4	3	3
6.	2.7	2.7	1.00	4	4	4	4
7.	1.9	2.7	1.42	7	4	3	3
8.	1.9	2.5	1.32	4	3.5	4	4
9.	2.1	2.2	1.05	6	4	4	4
10.	2.6	2.7	1.04	7	3.5	4	4
11.	2.7	3.8	1.41	12	3	3.5	4
12.	1.1	2.0	1.82	6	3	4	4
13.	5.8	6.5	1.12	4	4	4	4
14.	3.2	3.2	1.00	8	3.5	4	4
15.	1.5	2.3	1.53	3	4	3	3
16.	1.5	2.3	1.53	3	4	3	3
17.	1.8	3.2	1.78	9	4	4	4
18.	1.7	2.1	1.24	6	4	3	3
19.	2.3	3.4	1.48	8	4	4	4
20.	1.6	2.5	1.56	8	3	3	4
21.	2.3	3.1	1.35	5	3.5	4	4
22.	1.5	2.9	1.93	5	4	4	4
23.	3.0	3.7	1.23	5	4	4	3.5
24.	1.3	2.1	1.62	6	3.5	4	4
25.	2.9	3.8	1.31	7	3.5	4	4
26.	1.9	2.9	1.52	5	3	4	4
27.	1.2	2.0	1.67	5	3.5	3	4
28.	2.1	3.0	1.43	3	3	4	4
29.	1.9	2.9	1.53	5	4	4	4
30.	2.6	3.7	1.42	5	4	4	4
31.	1.9	3.5	1.35	9	3	4	4
32.	1.8	3.5	1.94	9	3.5	3	4

#### Studies on *Solanum torvum*

*Solanum torvum* is a wild species from which berries are used in stews and soups, and are reported to have lactogenic properties. Therefore, lactating mothers and anaemic patients are encouraged by doctors and nurses to include it in their diets. It also has many other medicinal uses. However, its sharp, hard spines or thorns on the stems and leaves make its cultivation difficult. It also has a large number of tiny indigestible seeds, and is a perennial. It is our objective to obtain a thornless mutant with reduced number of seeds and annual growth habit. Radio-sensitivity study showed 60 Gy as the appropriate dose. In M<sub>2</sub>, a chlorophyll-deficient plant was observed but no useful mutations were obtained. M<sub>3</sub> seeds were re-irradiated and gave an M<sub>1</sub> thornless chimera. The M<sub>2</sub> will be studied to obtain solid mutant. This work was presented as a poster at the International Genetics Congress, Birmingham, U.K.

**TABLE III. YIELD AND COOKING QUALITY CHARACTERISTICS OF PLANTS  
SELECTED IN M<sub>1</sub>V<sub>4</sub> - 1992**

Plant No.	Tuber Yield (Kg)	% Dry Matter	Cooking Quality		
			Mealiness	Elasticity	Smoothnes
1.	3.24	40.64	2.3	2.5	2.3
2.	1.55	39.90	2.3	2.8	2.8
3.	7.38	41.07	2.5	2.8	2.7
4.	1.89	42.49	2.3	2.7	2.3
5.	1.23	36.96	2.2	3.0	2.7
6.	1.54	43.20	2.3	2.8	2.7
7.	2.00	39.12	2.5	3.0	2.8
8.	0.64	39.17	2.4	2.8	2.8
9.	2.46	37.29	1.8	2.5	3.0
10.	0.28	34.20	1.3	2.0	1.8
11.	1.10	39.41	2.1	2.9	2.8
12.	0.55	41.18	1.7	2.3	2.2
13.	1.89	40.23	1.3	2.7	2.1
14.	1.06	39.06	1.6	2.1	1.9
15.	0.73	39.52	2.4	2.8	2.3
16.	0.70	42.64	1.3	2.2	1.8
17.	0.56	43.05	1.6	2.8	2.0
18.	0.78	39.77	2.2	2.8	2.4
19.	0.99	44.95	2.5	2.3	2.5
20.	0.83	42.03	2.5	2.7	2.6
21.	1.17	40.87	1.8	2.8	2.7
22.	1.08	36.20	1.7	2.4	2.4
23.	0.68	44.03	2.2	3.0	3.0
24.	0.77	41.73	2.2	2.8	2.7

**TABLE IV. YIELD CHARACTERISTICS OF M<sub>1</sub>V<sub>5</sub> PLANTS HARVESTED - 1993**

Row No.	SET A		SET B		SET C	
	Av. No. of Tubers/Plant	Av. Tuber Yld./Plant KG	Av. No. of Tubers/Plant	Av. Tuber Yld./Plant KG	Av. No. of Tubers/Plant	Av. Tuber Yld./Plant KG
1.	4.4	1.87	8.6	4.46	7.0	5.61
2.	8.9	7.08	11.5	6.13	7.7	5.05
3.	7.8	3.83	12.8	6.28	7.5	5.51
4.	8.4	7.72	7.1	4.13	7.1	8.03
5.	8.8	5.87	11.0	6.81	6.2	3.90
6.	7.8	4.89	9.1	5.59	6.9	4.49
7.	7.4	7.25	9.1	6.91	7.9	6.74
8.			7.6	4.80	7.1	4.65
9.			6.8	4.62	8.0	9.52
10.			7.0	4.26	5.9	2.64
11.			7.4	5.20	7.9	5.85
12.			10.8	7.93	8.8	5.98
13.			6.8	4.75	7.5	3.81
14.			7.0	4.78		
15.			8.0	6.89		
16.			6.6	4.88		
17.			6.8	6.41		

#### REFERENCES

- [1] SAFO-KANTANKA, O., OWUSU, J. (1992). Cassava varietal screening for cooking quality: relationship between dry matter, starch content, mealiness and certain microscopic observations of the raw and cooked tuber. *J. Sci Food Agric.* 60: 99-104.