Research Note

EFFECT OF GAMMA IRRADIATION ON SWEET POTATO STEM CUTTINGS

The sweet potato (*Ipomoea batatas* (L.) Lam) is a creeping plant with perennial vines and adventitious roots widely cultivated in the Tropics and warm temperate regions. Marked differences exist among the varieties as to the color of the leaf and its morphology, tuber form, color of the skin and flesh, maturity, yield potential, disease resistance, etc. The yellow-flesh type, usually called "mameya," has become an important food item in the Tropics for its outstanding vitamin A content.

In sweet potato varietal improvement, individual plant selection and hybridization have been commonly practiced. In recent years, improvement through mutation breeding also has been attempted but no substantial results have been reported.[1] As a preliminary step in the sweet potato mutation breeding program, varietal response to radiation has been investigated to determine the optimum dose for treatment of vegetative parts in three common varieties grown in Puerto Rico. The results are reported in this note.

Vine material of Gem, Blanquita, and Cobre varieties obtained from the Agricultural Experiment Station of the University of Puerto Rico, were selected and cut into pieces, with three buds each. Cuttings were irradiated with cobalt-60 gamma radiation at doses of 500, 1,000, 1,500, 2,000, 2,500, 3,000, and 3,500 rads, 60 cuttings per treatment. Each of the irradiated samples, together with the non-irradiated control, were planted in four replications, 15 cuttings per replication, in soil benches in the greenhouse. Records were taken 6 weeks later of the number of cuttings with buds that survived and sprouted into shoots, and of the growth of vines and roots.

Table 1 shows varietal differences in both the control and irradiated materials, with respect to the number of cuttings with buds that survived and sprouted. Among the controls, Gem variety had the highest percentage of surviving cuttings. The irradiated Blanquita variety, however, had a higher percentage of surviving cuttings than the other two varieties at the highest dose (3,500), although the same variety appeared to be inferior in this respect at the intermediate dose range. Also noted was the radiation stimulation effect at a low dose (500 rads) in both Blanquita and Gem varieties. It is apparent that if a 50-percent stem-cutting survival is desired in the mutation induction work, the optimum dose would be

[1] Gustafsson, A., and Gadd, I., Mutations and Crop Improvement. III *Ipomoea batatas* (L.) Poir. (Convolvulaceae), Hereditas 53: 77–89, 1965.

TABLE 1.—*Percent stem cuttings which survived (±S.E.) and growth measurement in inches (±S.E.) in three sweet potato varieties following gamma irradiation at various doses (the figure in parentheses represents measurement in percent of control)*

Variety	Radiation doses in rads							
	Control	500	1,000	1,500	2,000	2,500	3,000	3,500
	Percent stem cuttings survived							
Gem	85.00±5.00	91.67±1.67	75.00±1.67	70.00±4.30	56.67±1.93	20.00±6.09	5.00±1.67	0.00
	(100.0)	(107.8)	(88.2)	(82.4)	(66.7)	(23.5)	(5.9)	
Blanquita	60.00±10.90	63.33±4.30	56.78±7.93	43.33±5.78	20.00±9.82	11.70±5.00	11.70±9.57	6.67±3.85
	(100.0)	(105.6)	(94.6)	(72.2)	(33.3)	(19.5)	(19.5)	(11.1)
Cobre	70.00±7.94	58.34±9.58	65.00±12.58	51.67±8.34	36.67±6.99	21.67±6.28	6.67±2.72	0.00
	(100.0)	(83.3)	(92.9)	(73.8)	(52.4)	(31.0)	(9.5)	
	Vine growth measurements in inches							
Gem	10.24±0.92	9.85±0.64	8.45±0.28	4.95±0.43	3.50±0.31	3.08±0.64	0.75±0.25	0.00
	(100.0)	(96.2)	(88.2)	(48.3)	(34.2)	(30.1)	(7.3)	
Blanquita	18.14±2.75	15.63±3.16	14.66±2.61	12.65±2.28	10.09±3.95	6.41±2.23	4.12±2.39	1.79±0.90
	(100.0)	(86.2)	(80.8)	(69.7)	(55.6)	(35.3)	(22.7)	(9.9)
Cobre	11.06±2.33	11.56±1.14	10.64±0.74	9.58±0.25	6.71±0.59	5.14±0.65	6.06±1.22	0.00
	(100.0)	(104.5)	(96.2)	(86.6)	(66.7)	(46.5)	(54.8)	

approximately 2,000 rads, as the doses observed for the 50-percent stem-cutting survival for the three varieties ranged from approximately 1,750 to 2,250 rads. If a higher survival index is desired, say about 75 percent, then the appropriate dose would be about 1,500 rads. These suggested optimum doses (1,500–2,000 rads) might be considered the most appropriate for sweet potato mutation work in general, although the recommendation is based on stem-cutting survival only and not on mutation induction efficacy.

Table 2 shows the number of cuttings of Gem variety with a varying number of buds surviving and sprouting into shoots in each treatment. Most of the irradiated cuttings had one shoot only and none had more than two. This was also true with the control. These results seem to suggest

TABLE 2.—*Effect of gamma irradiation on stem cuttings having a varying number of buds sprouted and total number and percent of buds sprouted in Gem variety*

Radiation dose in rads	Number of cuttings with various buds sprouted				Buds sprouted	
	0 bud	1 bud	2 buds	3 buds	*Number*	*Percent*
0	9	42	9	0	60	33.3
500	5	46	9	0	64	35.6
1,000	13	41	4	0	49	27.2
1,500	18	35	7	0	49	27.2
2,000	26	32	2	0	36	20.0
2,500	48	12	0	0	12	6.7
3,000	57	3	0	0	3	1.7
3,500	60	0	0	0	0	0

that the development of the third bud, if viable, is not essential for the survival of the cuttings. In fact, a dormant third bud might be more desirable or even beneficial to the development of the other one or two buds in the cutting. At the very high doses (2,500–3,000 rads) only one shoot was observed. The total number or percentage of buds that survived and developed into shoots in Gem variety was indeed very low. The control had 33.3 percent of sprouted buds while the irradiated material had 35.6 percent, at 500 rads, dropping to 20 percent at 2,000 rads. The total number of sprouted buds in the other two varieties was even smaller and none of the cuttings had more than one sprouted bud.

Among the three varieties, the Blanquita control had the most vigorous growth based on the measurement of vine length 6 weeks after planting the cuttings (table 1). The radiation effect on growth also was evident, as the shoots grew less with increasing doses. Cobre variety was affected the least by radiation insofar as growth was concerned, whereas Gem variety was the most affected. Considering the results as to the proper dose range for a 25- to a 50-percent growth reduction in the three varieties, again it appears reasonable to suggest that approximately 1,500 to 2,000 rads be used as an adequate dose range for sweet potato mutation work.

It is interesting to point out that variety Gem responded somewhat differently to radiation in our study than the other two varieties, as it was able to develop a root system in the cuttings even after all the buds had been killed by irradiation (especially above 2,000 rads).

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