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Improving Market Demand and Productivity Level in an Underutilised Yam (Dioscorea esculenta) in Ghana: Implications for Crop Breeding and Production Choices

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Introduction

In spite of its huge economic potential and as a source of food security, *Dioscorea esculenta* or Chinese yam locally called "oboaduonum" or 'broni bayere'still remains an underutilized and under seriously genetic extinction threat in Ghana. Lack of planting materials, neglect by both farmers and researchers– and, more importantly, their displacement by improved varieties, mining activities, bush fires, infrastructure development and over-grazing coupled with small tuber size has resulted in the almost complete extinction of this yam species in Ghana. Consequently, the full potential of this crop for income generation through the domestic and international export trade has not been realized due to neglect in production, handling and trading systems as a result of it poor sizes that inhibit its use for food and agriculture in Ghana *(L. Longwe, 1995,* G. Hawtin, 2007*)*. Varieties cultivated for the Ghanaian markets includes; 'Pona' and 'Dabriko' 'Dente', 'Nkani', 'Afasie', 'kokoase bayere', 'Nkanfuo' 'Ahabayere', 'Muchumudu' 'Afuun', 'Apoka', 'Asobayere'and 'Ediamawoba' with 'Pona' being the most popular landrace cultivar of yams on the Ghanaian market (E. Otoo et. Al, 2009).

The purpose of this study was to improve the tuber size and market value of *D. Esculenta* using different doses of gamma radiation to promote the effective use of these species and enhance effective conservation and sustainable use for food, agriculture and industry.

Some characteristics of yam are valued more than others, and prices vary across species, time, and market sites. Some residual symptoms of pest and disease damages on yam tubers reduce their market values. Tuber weight exhibits an increasing marginal value and price per kilogram increases above an optimum size; therefore, producers derive additional reward from extra-large tubers.

Methodology

The surveys on market demand and productivity assessment focus on "ex-ante" or "ex-post" evaluations of the underutilized yam *Dioscorea esculenta*. Both primary and secondary methods were used for data collection from forty yam producers mainly from the Northern and Eastern Region of Ghana were interviewed. 115 people were interviewed in a market

survey in the Greater Accra Region, the centre of yam marketing. The field survey (ex-ante and ex-post) took place from October 2009 to January 2011 using standardized questionnaires. To improve the size of the tubers of *Dioscorea esculenta*, repeated experiments with different doses of radiation at 10, 20, 30, and 40 Gy.

Results and Discussion

47% of the farmers interviewed were 30 years and above. The minimum household number was 1 and the maximum was 9 with 23% of interviewed farmers having an average household size of 4. 46% of interviewee had high school education while 20% of farmers had basic school education (Table 1). Most of the farmers (64%) interviewed had been farming for more than 15 years. 53% of the farmers (below 30 years) who had been farming for less than 15 years were aware of "oboaduonum" but had never seen it. All farmers cultivated at least more than three species of yam and the important amongst them are 'Laribako', 'Muchumudu', 'Kulunku' 'Fuseini' and 'Nyumbo' with 'Puna' being the most popular landrace cultivar for both local and the international market. The average farm size is 3.7 acres, minimum is 1 and maximum is 5.

92% of the farmers interviewed were aware of *D. esculenta* but 43% of them are cultivating it on less than 2% of the total land area. Tuber weight exhibits a diminishing marginal value and price per kilogram decreases below an optimum size; therefore, producers do not derive additional reward from cultivating "oboaduonum" small tubers.

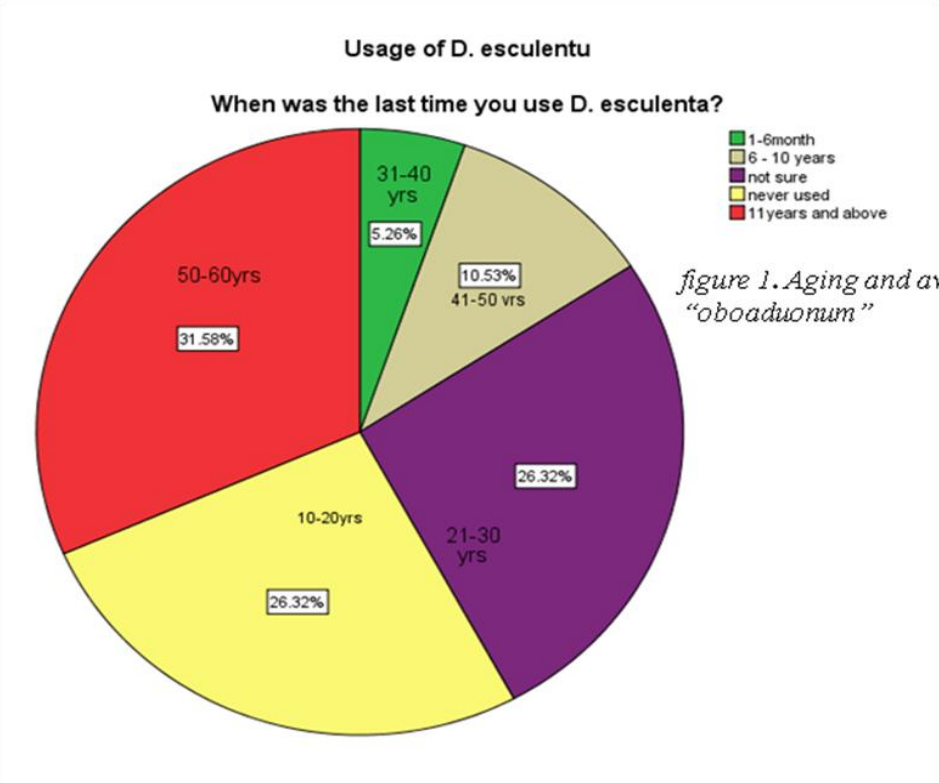

figure 1. Aging and awareness of "oboaduonum"

Table 2 indicate that as household size increases, farmers turn to cultivate or adopt cultivation of "oboaduonum" variety and other varieties to feed family. It also shows that as farmers aged, they shun away from the cultivation or adoption of *D. esculenta*, although it is the aged group that knows the crop. Our survey indicated that young yam farmers below the age of 30 do not known the crop while those above have cultivated the variety before. The result indicated that awareness of "oboaduonum" existence among farmers is directly correlated

with experience of farmers and farming years (figure 1). This observation poses serious genetic erosion threat to the crop.

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. summarize age hhsize edu frmyrs oboedu aware farmsize seedavai
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Variable	Obs	Mean	Std. Dev.	Min	Max
age	40	2.75	.438529	2	3
hhsize	39	4.692308	2.214234	1	9
edu	40	2.725	1.679247	1	6
frmyrs	40	3	1.281025	1	8
oboedu	40	.45	.5038315	0	1
aware	40	.975	.2761921	0	2
farmsize	40	3.7	1.697661	1	5
seedavai	40	.5	.5063697	0	1

Table 1. *Demographics and farming statistics*

Table 2. *Stata outputs analysis of variance (ANOVA) results along with the regression results. Top left is ANOVA table, and bottom is regression results.*

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. reg oboedu $x
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Source	SS	df	MS
Model	7.86605192	3	2.62201731
Residual	1.72369167	35	.049248334
Total	9.58974359	38	.252361673

Number of obs	= 39
F(3, 35)	= 53.24
Prob > F	= 0.0000
R-squared	= 0.8203
Adj R-squared	= 0.8049
Root MSE	= .22192

oboedu	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
age	-.0661358	.0919154	-0.72	0.477	-.252734	.1204623
hhsize	.0197063	.0179957	1.10	0.281	-.0168269	.0562395
seedavai	.8902708	.0765794	11.63	0.000	.7348064	1.045735
_cons	.0911574	.2303037	0.40	0.695	-.3763841	.5586988

An R Square of 0.82 means that differences in age, household size and seed availability can explain 82% of the variation in adoption rates of "oboaduonum" *(Table 2).*

Thus, to effectively enhance adoption of "oboaduonum" variety, research should focus on improving the tuber size as well as its nutritional content. The numerous tubers produced by the plant already make it an ideal candidate for adoption as shown in the figure 1.

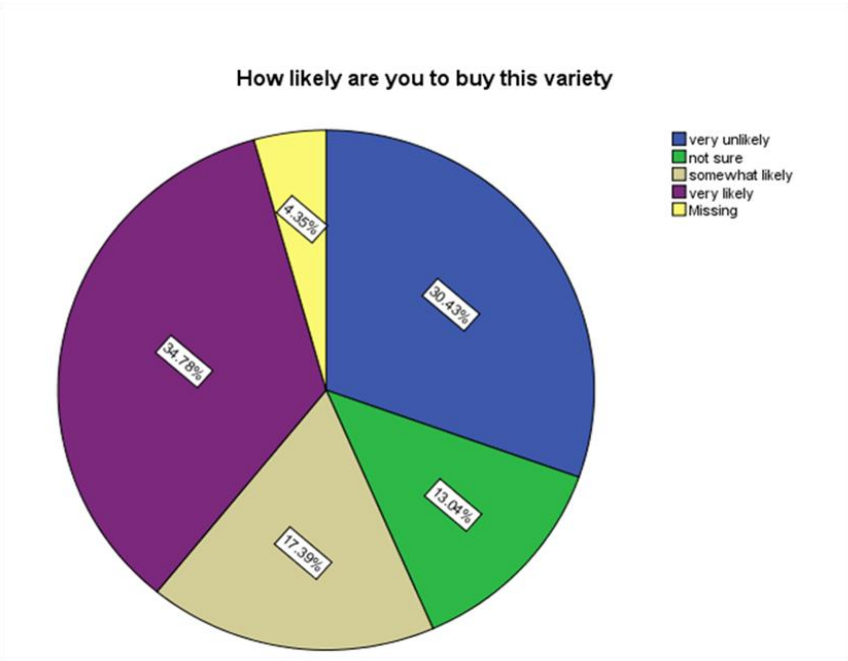

Figure 2. showing chances of adoption of oboaduonum bariety by market women

Observation through repeated experiments indicated that irradiation of tubers at 40 Gy decreased the number of tubers per vine and marginally increased the tuber size at M1 generation suggesting a correlation between tuber size and number of tubers per vine.

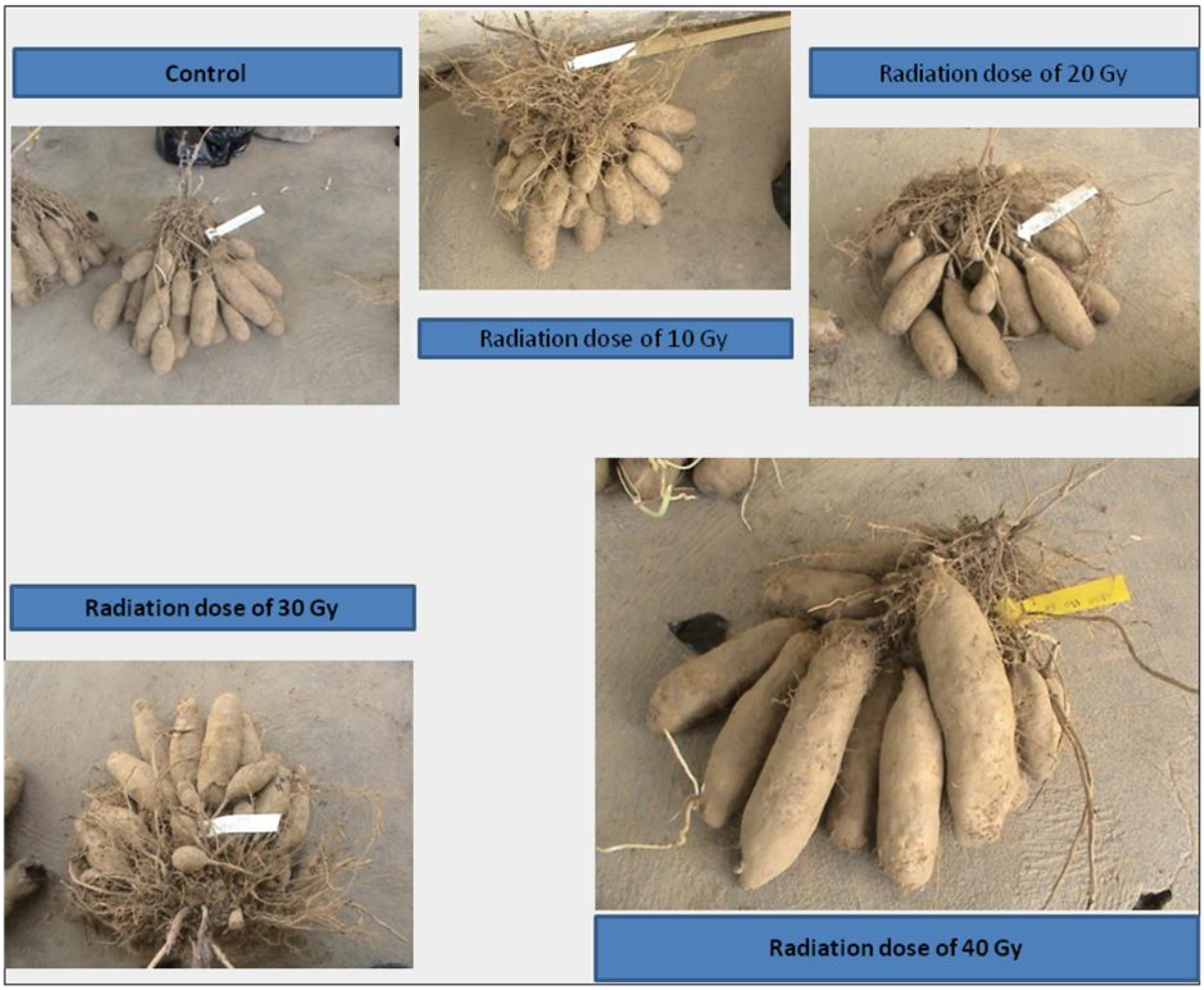

Figure 3. Results of repeated experiments with different doses of radiation at 10, 20, 30, and 40 Gy, yielding different tuber sizes of the underutilized yam "Dioscorea esculenta" **40 Gy gave the best results producing a M1 generation with a decreased number of tubers but with an increased tuber size per vine..**

Conclusions

The results of market survey indicated that "oboaduonum" is nearing extinction and farmers are willing to cultivate it if the size is improved and planting materials made available. The size and weight of the tubers increased to an average of 1 kg against 0.3 kg/tubers of the control (unirradiated planting material). Tuber weight exhibited an increasing marginal value and price per kilogram increased above an optimum size; therefore, producers derive additional reward from extra-large tubers. We conclude that, to effectively access and benefit from urban markets, producers should focus on the improved size and conical shaped-tubers, which are easy to process and meet the aesthetic qualities preferred by urban consumers.

References

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