

Yellow Cassava Attributes Influencing its Utilization among Cassava Processors in Oyo State, Nigeria.

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Abstract— The research focused on attributes determining utilization of Yellow cassava (YC) varieties. Two of the four agricultural zones in the state namely; Ogbomosho and Oyo zones were covered in the study. Structured interview schedules were used to elicit information from 302 cassava processors who were selected through multi-stage sampling procedure. Data was presented using descriptive statistics and analysed with inferential statistical tools. Findings showed age of respondents was 46 years, about 92% were females with more than two-thirds (75.5%) having formal education. Awareness of YC was substantial among sampled processors. Virtually all the respondents (99.3%) claimed to be aware of TMS 01/1368 variety of YC and majority were using this particular variety. Extension agents from Oyo State Agricultural Development Programme (OYSADEP), Harvest plus and International Institute of Tropical Agriculture (IITA) formed leading sources of information on YC varieties among the respondents. Gari and Fufu were the common products people in the study area made from YC. The processors are favourably disposed to utilization of YC. Critical constraints faced in the utilization of YC were non availability of market for YC products and inadequate information on the potentials of yellow root cassava. Pearson Product Moment Correlation revealed that taste of YC products ($r=0.813$), consumer's acceptability of the products ($r=0.758$) and multiple usage of the YC ($r=0.818$) are important attributes that influences the utilization of YC. More awareness campaign on potential of YC should be made so as to create market for its products thereby increasing the income of the processors.

Keywords— Yellow cassava, Processors, Utilization, Vitamin A, Attributes.

I. INTRODUCTION

Globally, Vitamin A deficiency (VAD) is the world's commonest cause of blindness among children. Approximately 228 million children are affected sub-

clinically and 500,000 children become partially or totally blind every year due to VAD {World Health Organization(WHO)/Food and Agricultural Organization(FAO), 2003}. Therefore, VAD has been a major public health problem in many developing countries. In Nigeria, about 30 percent of children under age five and almost 20% of pregnant women are deficient in micronutrients like Vitamin A. Vitamin A deficiency in children leads to stunted growth, diarrhoea, measles and premature death. According to Maziya-Dixon et al., (2007) and World Health Organizations (2017), Vitamin A deficiency can cause severe night blindness and high mortality rate in pregnant women.

Many Nigerians irrespective of age, gender and geographical location get less Vitamin A than the required amount. The major determinants of Vitamin A deficiency are low availability and inadequate consumption of Vitamin A diets. Animal foods that are good sources of Vitamin A are not affordable by the poor communities and thus leaving foods of plant origin as an important source of pro-Vitamin A in developing countries (Tumuhimbise *et al*,2013). Recognizing the severity of the problem, Nigerian government had embarked on supplementation programs with Vitamin A for children within the age range of 6 months to 5 years during immunization days and has mandated the fortification of certain food items like sugar, wheat flour and vegetable oil with Vitamin A since the year 2000. In order to combat the prevalence of VAD, various strategies including fortification and bio-fortification methods have been developed by scientists across the world (www.harvestplus.org). Cassava (*Manihot esculenta* Crantz.), is the chief source of dietary food energy for the majority of the people living in the low land tropics and much of the sub-humid tropics of west and central Africa (Echebiri and Edaba, 2008). Cassava is a hardy crop that is extremely adaptable to severe weather conditions and drought tolerant. It can grow well on soils of limited fertility. Cassava is an important food and subsistence

crop in Nigeria and one of the staple foods generally consumed by the majority of the populace that is vulnerable to VAD. It has been estimated that 600–700 million people obtain more than 500 calories/day from cassava (Maziya-Dixon et al., 2007; Nuwamanya et al., 2010) but the commonly available white cassava lacks micro nutrients like Vitamin A ([www.harvestplus](http://www.harvestplus.org), 2014). Economic problems, political unrest, reduced soil fertility, drought, and the population explosion all have increased the need for cassava as a cheap, common, versatile crop that is resistant to adverse environmental factors, such as poor soil fertility, drought (Osiru et al., 1992) and disease (Asonye, 2001). Considering the important role of cassava in the diets of Nigerians, National Root Crops Research Institute (NCRI) Umudike and International Institute of Tropical Agriculture (IITA), Ibadan jointly developed cassava varieties bio-fortified with Vitamin A in order to complement government efforts to check Vitamin A deficiency and malnutrition in the country. These varieties are yellow in colour owing to their high beta-carotene (pro-Vitamin A) content; hence they are called Yellow Cassava. The new yellow varieties are also high yielding and resistant to major diseases and pests. It is strongly believed that the YC varieties being introduced to farmers would be an effective tool in reducing VAD among poor people.

This study;

1. described the socio-economic and enterprise characteristics of the processors
2. determined extent of awareness and utilization of YC varieties
3. investigated the processors' perception of yellow cassava,
4. determined level of yellow cassava utilisation
5. identified YC attributes that determines its use by the processors
6. know constraints to the utilization of YC
7. identified factors influencing the utilization of YC

II. METHODOLOGY

Four (4) Local Government Areas (LGAs) were purposively selected for the survey because they were noted for production and consumption of cassava in large quantity and formed part of the targeted areas by the Oyo State Agricultural Development Programme (OYSADEP) for YC introduction and delivery. The LGAs included in the survey were; Afijio and Ojongbodu in Oyo Agricultural zone while Orire and Surulere LGAs were selected in Ogbomoso Agricultural zones of the state. All the villages with a high concentration of cassava processors in the selected LGAs were listed through the assistance of OYSADEP Women In Agriculture (WIA) extension agents and two villages were randomly selected from each LGA; thus a total of eight (8) villages for the

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four (4) LGAs selected for the survey. The WIA agents were tasked to make the list of all the processors within the selected villages which resulted in sampling frame of 604 from which fifty (50) percent (302) of the processors were randomly selected to form the sample for the study. Interview schedule was developed and used to collect data for the study. The processors were asked to give their ratings of cassava attributes that will encourage the utilisation of cassava using a Likert type scale ranging from 3 (very important) to 1 (somewhat important). Processors' perception of YC and its products were operationalized as follows: Strongly Agreed (SA) = 5, Agree (A) =4, Undecided (U) =3, Disagree (D) =2 and Strongly Disagreed (SD) = 1 for positive statements and these values were reversed for the negative statements. Data collected was subjected to descriptive (frequency counts, percentage distribution, mean standard deviation) and inferential statistics (Chi-square and Pearson Product Moment Correlation) at p 0.05

III. RESULTS AND DISCUSSION

3.1 Socio-economic characteristics of the respondents

Results in Table 1 revealed that few (4.3%) of the processors were within the age group of 20 to 29 years, majority were between 30 and 49 years while 33.8% were within the age group of 50 to 69 years. The mean age of the processors was 46 years and as such, an average processor in the study area is still economically active and could result in a positive effect on adoption as he or she would be willing to take risks in expectation of more profit.

Majority (92.4%) of the respondents were females. The implication of this is that females are most active and involved when it comes to garri processing in the study area. This corroborates the findings of Nweke et al.,(2002) and Ogunleye, Olaniyi and Adedeji (2012) that women specializes in cassava processing. Also, 94.4% of the respondents were married while others were either single or divorced. This could help in the dissemination of information, because according to Ojo and Jibowu (2008), married people being responsible, their views are likely to be respected within rural communities as they take decisions on the use of agricultural inputs.

Education is very important for farmers to understand and interpret any agricultural information coming to them from any direction. It enables one to access information needed to use and practice an innovation. About 76% of the respondents had formal education while others had no formal education. Given this level of literacy, the implication is that information could be disseminated with ease among the processors. Majority (66.6%) of the respondents spent between 1 and 9 years in obtaining basic education, while only a few (0.7%) spent between

20 and 29 years in obtaining basic education. The average number of years spent in obtaining basic education by respondents was approximately 7 years. This implies that the level of education of the processors was low although they had one form of education or the other.

Household size is considered to be the number of individuals who reside in a family. Large household size is assumed as an indicator of labour availability in the family. Table 1 further shows majority (94.0%) of the respondents interviewed had between 1 – 10 household members, while only 0.7% had between 21 – 30 members within their household. The average number of members

within a household is 6. Very few (9.6%) of the respondents used family labour, 44.7% used hired labour for processing activities while 45.7% used both family and hired labour. This might be due to the small household size. Findings also showed that majority (74.5%) received information about YC through Oyo State Agricultural Development Programme (OYSADEP), 43.0% obtained information through relations while 4.0% and 6.0% of the respondents obtained information through Harvest Plus and International Institute for Tropical Agriculture respectively.

Table.1: Distribution of respondents' socio-economic characteristics

Socio-Economic Characteristics	Category	Frequency	Percentage
Age (Years)	20 – 29	13	4.3
	30 – 39	74	24.5
	40 – 49	113	37.4
	50 – 59	66	21.9
	60 – 69	36	11.9
Mean=45.78			
SD=(9.847)			
Sex	Male	23	7.6
	Female	279	92.4
Marital status	Single	4	1.3
	Married	285	94.4
	Divorced	13	4.3
Educational status	No Formal Education	74	24.5
	Primary Education	132	43.7
	Secondary Education	79	26.2
	Tertiary Education	17	5.6
Years spent in school	0	74	24.5
	1 – 9	127	42.0
	10 – 19	99	32.8
	Mean=6.85		
SD=(5.132)			
Household size (People)	1 – 10	284	94.0
	11 – 20	16	5.3
	21 – 30	2	0.7
Mean=6.39			
SD=(3.036)			
Religion	Islam	142	47.0
	Christianity	160	53.0
Source of labour	Family	29	9.6
	Hired	135	44.7
	Both	138	45.7
Source of information*	Extension Agents	225	74.5
	Family Relations	130	43.0
	Harvest Plus	12	4.0
	IITA	18	6.0

Note: * multiple responses

3.2 Enterprise characteristics of the processors

Table 2 shows majority (92.7%) of the processors used local method for processing while very few (7.3%) used

improved method. This might be because of sharp reduction in carotenoid content due to losses during processing (Aniedu and Omodamiro, 2012).

The result further revealed that 61.0% had spent between 10 and 29 years in cassava processing, with the average number of years being 21 years. It shows the processors are veterans in cassava processing. About 92.0% of the respondents are into farming and had farm size of less than 10 hectares, 7.3% had 10 to 29 hectares while very few (0.7%) had above 30 hectares. Nonetheless, their average farm size was approximately 3 hectares. However, 93.4% used 5 hectares or less to cultivate cassava while 4.6% used 6 to 10 hectares and 0.7% cultivated 16 to 20 hectares. The average land cultivated to cassava was 2 hectares meaning they are not large scale farmers.

The result further revealed that only about half (53.3%) of the respondents used 1 hectare to cultivate YC while very few (6.0%) used 2 ha but 40.7% did not cultivate YC. This implies that majority of the processors operate on a small scale production in the study area. This is because they had farm size of less or equal to 5 hectares which is considered as small scale based on classification of Federal Office of Statistics (1999). This supports Erhabor and Emokwo (2007) who stated that most cassava farmers' are small-holder farmers.

Furthermore, majority (74.5%) of the respondents obtained their planting materials from other farmers while

the remaining (25.5%) obtained their planting materials from either IITA or relatives. Extension visits afford farmers easy exposure to new technologies, how to go about them and the benefits. The greater the visits by extension agents, the better the farmers are informed about new technology (Manyong and Houndekon, 1997; Wejnert, 2002; Berisso, 2008). Furthermore, majority (72.5%) of the respondents had contact with extension agent, though the frequency of contacts was not the same. The reason for the respondents' access to extension agents may be due to membership of social organization. It could therefore be seen that extension visits is a determinant of investment decision in new technologies. Therefore, Oseni *et al.* (2015) posited that farmers, through extension visits become better informed about farm management planning and new technologies, hence improving their efficiency in production. Result also revealed that all the respondents were aware of YC as 33.8% had been aware for 1 to 2 years, 64.2% had been aware for 3 to 4 years while very few (2.0%) had been aware for 5 or more years. Majority (74.2%) of the respondents in the study area preferred the yellow variety of cassava to the white variety. The reason for their preference was adduced to the fact that products from YC sells faster, the YC gives more product after processing, and that there are more buyers for the products. This finding corroborates Oparinde *et al.* (2014) that yellow cassava products is most preferred in Oyo state.

Table.2: Enterprise characteristics of the respondents

Enterprise characteristics	Category	Frequency	Percentage
Methods of processing	Local method	280	92.7
	Improved method	22	7.3
Years spent in Cassava processing	1 – 9	36	11.9
	10 – 19	89	29.5
	20 – 29	95	31.5
	30 – 39	66	21.9
	40 – 49	16	5.3
Mean=21.04			
SD=(9.823)			
Farm size (Ha)	< 10	278	92.1
	10 – 19	14	4.6
	20 – 29	8	2.7
	> 30	2	0.7
Farm size planted to cassava (ha)'	≤ 5	282	93.4
	6 – 10	14	4.6
	>10	6	2.0
Farm size planted to YC (ha)	0	123	40.73
	1	161	53.31
	2	18	5.96
Source of planting materials	IITA	60	19.9
	Self/Relative	17	5.6
	Other farmers	117	38.7
Contact with extension agent	Contact	219	72.5
	Non-contact	83	27.5

Enterprise characteristics	Category	Frequency	Percentage
Years of awareness of YC varieties (years)	1-2	102	33.8
	3-4	194	64.2
	≥5	6	2.0
Preferred Cassava variety	Yellow	224	74.2
	White	78	25.8

* Multiple responses recorded

3.3 Awareness of white and yellow varieties of cassava

According to Agricultural Development Office in Ogbomoso agricultural zone, three varieties were introduced namely; TMS 01/1368, TMS01/1412 and TMS01/1371. From the findings of the study 99.3% of the processors were aware of TMS 01/1368 while 95.7% used the variety by processing into products. This implies TMS

01/1368 is the most adopted YC variety and the least adopted was TMS01/1412. Lack of awareness and poor use of other varieties might be because the varieties did not thrive well in the area. This is similar to the findings of Umunakwe *et al* (2015) that low planting of some cassava varieties by farmers could be due to farmers unfamiliarity of the varieties and lack of desirable characteristics that may encourage their cultivation.

Table.3: Extent of awareness and utilization of YC varieties

Varieties	Aware	Unaware	Using	Not using
TMS 01/1368	300 (99.3)	2 (0.7)	287 (95.67)	15 (5.0)
TMS01/1412	25 (8.3)	277 (91.7)	14 (4.6)	288(95.4)
TMS01/S371	62 (20.5)	240(79.5)	60 (19.9)	242 (80.1)

3.4 Frequency of YC processing, quality and attractiveness of product

Majority (85.1%) of the respondents always make Garri from YC while 13.6% occasionally make Garri from YC. About 42% occasionally make Lafun from YC. This might be due to the colour that the YC will bring out in the making of Lafun which will nonetheless affect its sale. Findings also showed that most (35.4% and 35.1%) of the respondents either rarely or always make fufu from YC respectively while only 27.5% occasionally make fufu from YC. Results also revealed that majority (68.5%) of the respondents never make starch from YC while only 22.2% of the respondents rarely make starch from this variety of cassava. Also, majority (69.5% and 93.4%) of

the respondents never make chips and cassava cake from YC. This could be due to their acceptability in the market. Almost all (98.7%) the respondents claimed that Garri made from YC had an excellent taste; 43.7% and 46.0% claimed that Lafun and Fufu made from this variety of cassava tasted good respectively. Majority (93.7%) of the respondents believed that Garri made from YC had a very attractive colour, while about half (50.7%) of the respondents believed that Lafun made from YC was attractive. Also, 62.9% of the respondents were convinced that the colour of the Fufu made from YC was attractive while 45.4% claimed that the colour of cassava chips made from YC was attractive (Table 4).

Table.4: Respondents' frequency of YC processing, quality and attractiveness of product

Frequency of YC processing	Gari	Lafun	Fufu	Cassava Chips
Always	257 (85.1)	14 (4.6)	106 (35.1)	2 (0.7)
Occasionally	41 (13.6)	126 (41.7)	83 (27.5)	0 (0)
Rarely	4 (1.3)	28 (9.3)	107 (35.4)	18 (6.0)
Never	0 (0)	134 (44.4)	6 (2.0)	282 (93.4)
Quality of product				
Excellent	298 (98.7)	6 (2.0)	74 (24.5)	33 (10.9)
Good	2 (0.7)	132 (43.7)	139 (46.0)	37 (12.3)
Fair	2 (0.7)	79 (26.2)	85 (28.1)	120 (39.7)
Poor	0 (0)	85 (28.1)	4 (1.3)	112 (37.1)
Attractiveness of product				
Very attractive	283 (93.7)	28 (9.3)	103 (34.1)	39 (12.9)
Attractive	5 (1.7)	153 (50.7)	190 (62.9)	137 (45.4)
Not Attractive	14 (4.6)	121 (40.1)	9 (2.98)	126 (41.7)

3.5 Perception of processors on Yellow cassava utilization

As shown on Table 5, majority (95.0%) of the processors strongly agreed that yellow root cassava is very rich in Vitamin A, 99.3% agreed that consumption of yellow root cassava products can help prevent blindness in children and disease infection in reproductive women and 98.1% agreed that improvement in children growth and development can be achieved by feeding them with yellow root cassava products. The findings also revealed

that most of the respondents did not agree with the statements that were not in favour of the YC and its products which was indicative of their favourable disposition to such statements. These perceptions of the respondents with respect to YC and its products could have been mostly shaped by the information they received from OYSADEP extension agents during the introduction of YC varieties to them. This implies that the processors have a good perception of YC and its products for consumption.

Table.5: Respondents' perception of Yellow cassava utilization

S/N	Perception Statements	SA	A	U	D	SD	Mean
1	Utilizing yellow root cassava is very rich in Pro-Vitamin A	287 (95.0)	15 (5.0)	0 (0)	0 (0)	0 (0)	4.95
2	The yellow root cassava does not produce good quality cassava products	6 (2.0)	4 (1.3)	8 (2.6)	92 (30.5)	192 (63.6)	1.48
3	Consumption of products from yellow root cassava can help improve health conditions of my family	141 (46.7)	157 (52.0)	0 (0)	2 (0.7)	2 (0.7)	4.43
4	Consumption of yellow root cassava products can help prevent blindness in children and disease infection in reproductive women	165 (54.6)	135 (44.7)	2 (0.7)	0 (0)	0 (0)	4.54
5	Improvement in children growth and development can be achieved through feeding them with yellow root cassava products	143 (47.4)	153 (50.7)	4 (1.3)	0 (0)	2 (0.7)	4.44
6	The appearance and colour of products made from yellow root cassava are not attractive to encourage its consumption	8 (2.6)	4 (1.3)	6 (2.0)	156 (51.7)	128 (42.4)	1.70
7	Many products cannot be made from yellow root cassava compared to other varieties	31 (10.3)	24 (7.9)	6 (2.0)	172 (57.0)	69 (22.8)	2.26
8	Consumers do not patronize products made from yellow root cassava	7 (2.3)	58 (19.2)	29 (9.6)	167 (55.3)	41 (13.6)	2.41
9	Taste of yellow root cassava products is not as palatable as products from other cassava varieties	22 (7.3)	8 (2.6)	10 (3.3)	177 (58.6)	85 (28.1)	2.02
10	Consumption of yellow root cassava products will help reduce the money that I usually spend on my family members as hospital	182 (60.3)	106 (35.1)	8 (2.6)	4 (1.3)	2 (0.7)	4.52
11	Quick discoloration of yellow root cassava during processing makes it unattractive to buyers and consumers	14 (4.6)	20 (6.6)	88 (29.1)	91 (30.1)	89 (29.5)	2.27

Figures in brackets are percentages

3.6 Yellow Cassava attributes that determines its use by the processors

Table 6 shows the importance of Yellow cassava attributes in its use by the processors. Majority (71.2%) of the processors considered consumer acceptability of

products from yellow cassava as important. However, other attributes such as ease of processing (67.5%), taste of the products (67.2%) and multiple usage of the tuber (65.9%) were also considered important for its processing by the processors. This is similar to the findings of Agwu

and Anyaeche (2007) who opined that high product quality, ease of processing and ability of the processed

cassava to taste well to the consumer are reasons for continued use of some cassava cultivar.

Table.6: Attributes of Yellow Cassava that determines its use by the processors

Attributes of Yellow Cassava	Very important	Important	Somewhat important
Taste of the products	40(13.2)	203(67.2)	59(19.5)
Ease of Processing	44(14.6)	204(67.5)	54(17.9)
Consumer acceptability of the product	33(10.9)	215(71.2)	54(17.9)
Multiple usage of the tuber	42(13.9)	199(65.9)	61(20.2)

3.7 Constraints faced by processors in the utilization of Yellow cassava

As shown in Table 7, majority non-availability of market for yellow root cassava products (93.0%) of the respondents claimed that the constraints to the utilization of yellow root cassava were non-availability of market for yellow root cassava products, inadequate information on the potentials of yellow root cassava (90.4%), non-

acceptance of yellow root cassava products by the consumers (54.6%) and inadequate knowledge about other products that can be made from YC (51.3%). However, 42.1% and 23.2% of the respondents indicated that low or poor quality products as well as the appearance and colour of yellow root cassava products makes it unattractive to some consumers respectively.

Table.7: Constraints to the utilization of Yellow cassava

Constraints	Yes	No
Low or poor quality products	127 (42.1)	175 (57.9)
Inadequate information on the potentials of yellow root cassava	273 (90.4)	29 (9.6)
Non acceptance of yellow root cassava products by the consumers	165 (54.6)	137 (45.4)
Appearance and colour of yellow root cassava products that makes it unattractive to the consumers	70 (23.2)	232 (76.8)
Non availability of market for yellow root cassava products	281 (93.0)	21 (7.0)
Inadequate knowledge about other products that can be made from yellow root cassava	155 (51.3)	147 (48.7)

3.8 Result of correlation analysis between attributes of yellow cassava and it's utilization by the processors.

The result of correlation analysis in Table 8 revealed there were positive and significant relationship between utilization of yellow cassava and the taste of its products ($r=0.813$), consumer's acceptability of the product

($r=0.758$) and multiple usage of the tuber ($r=0.818$). These results implied that the processors are likely to use Yellow cassava more as these attributes; taste of the products improves and the processing becomes easier. Also, acceptability of the products and its multiple use might increase the utilization of yellow cassava.

Table.8: Correlation analysis between attributes of yellow cassava and it's utilization by the processors

Variables	r-value	p-value	Decision
Taste of the product	0.813	0.000	Significant
Ease of Processing	0.109	0.059	Not Significant
Consumer acceptability of the product	0.758	0.000	Significant
Multiple usage of YC	0.818	0.000	Significant

$p \leq 0.005$

3.9 Chi-square result of relationship between selected socio-economic characteristics and utilization of Yellow cassava

The result of the chi-square test on table 9 shows sex ($\chi^2=30.141$), marital status ($\chi^2=84.919$), educational level has significant relationship with utilization of YC at $p \leq 0.05$. The significant relationship between sex and

utilization implies that gender affects the utilization of YC. This still emphasises the age long practice that women are more into the processing of cassava (Nweke *et. al.*, (2002) and Ogunleye, *et.al.* (2012). That of marital status implies that the married use YC as a major part of their meal. Also, the higher their education the more they utilize YC. This is because education influences ability to

adopt innovation like various ways to process the variety. As the extension visits to the respondent increases their utilization of YC increases. This might be because respondents were enlighten more on the benefits of the

consumption of the varieties and also because of the trainings received in the processing of the varieties to products which are good sources of additional income as well as increase the shelf life.

Table.9: Chi-square result showing the relationship between selected socio-economic characteristics and utilization of Yellow cassava

Socio economic Characteristics	χ^2 value	df	p-value	Remark
Sex	30.141	10	0.001	Significant
Marital Status	84.919	30	0.002	Significant
Educational level	112.925	40	0.001	Significant
Extension visit	48.656	10	0.001	Significant
Religion	17.707	10	0.060	Not Significant

IV. CONCLUSION AND RECOMMENDATIONS

The study concludes that the processors who were mostly women were in there active age and majority had formal education. Awareness of YC (pro-Vitamin A cassava varieties) was substantial among the processors. Virtually all the respondents were aware of TMS 01/1368 variety of YC and majority of them were using this particular variety to produce *Gari*, and *Fufu*. Extension agents from the Oyo State Agricultural Development Programme (OYSADEP), Harvest plus and International Institute of Tropical Agriculture (IITA) formed the leading sources of information on YC varieties among the respondents. Most severe constraint experienced by the processors was non availability of market for yellow root cassava products. It is recommended that effort should be intensified on awareness campaigns about the benefit of the varieties to increase their use and invariably provide market for the products. Also, training should be organised for the processors from time to time to upgrade their knowledge to process more products that will have better taste that is acceptable to consumers.

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