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Full Length Research Paper

Adoption of improved cassava varieties in six rural communities in Anambra State, Nigeria

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A survey of 118 randomly selected cassava farmers was conducted in Ukpor, Amichi, Osumenyi, Ezinifite, Ekwulummili and Ebenator, communities in Nnewi South Local Government Area of Anambra State using structured interview schedule, to determine the use of improved cassava and local cassava cultivars in the area. Majority (64%) of the respondents cultivated both local and improved cassava cultivars. The improved cassava cultivars grown by the farmers were TMS 30572, TMS 30555 and TMS 4(2) 1425 while 'akpuocha', 'udukanani' and 'achirinaka' were the most popular local cultivars grown in the area. However, TMS 30572 and 'udukanani' were the most widely grown cassava cultivars with 78.8 and 77.1% of the respondents cultivating them, respectively. Specifically, many of the farmers cultivated TMS 30572 for its high yield, perceived low level of HCN in products, high product quality, pests/disease resistance, ability to shade off weeds and early maturity. Similarly, greater proportion of the farmers cultivated 'udukanani' for its late maturity, ease of harvest and colour of tubers while others cultivated it for its ability to store longer after processing and the palatability of its products. The major factors that limit the effective use of improved cassava cultivars in the area were non-availability of important agrochemicals, high cost of labour and lack of finance. The study recommended investigation of the 'udukanani' cultivar to determine its suitability for future cultivar development.

Key words: Improved cassava cultivars, desired attributes.

INTRODUCTION

Cassava (*Manihot esculenta Crantz)* is an important staple food and cash crop in several tropical African countries especially Nigeria where it plays a principal role in the food economy. Nigeria is the largest cassava producing country in the world with an annual estimate of 39 million tones (Central Bank of Nigeria, 2003). Nigeria's production accounts for 19% of the world output and 34% of Africa's output (Okoro et al., 2005). Among the starchy staples, cassava gives a carbohydrate production which is about 40% higher than rice and 25% more than maize, with the result that cassava is the cheapest source of calories for both human nutrition and animal feeding (Tonukari, 2004). According to Nweke et al. (2002) eighty percent of Nigerians in the rural areas eat a cassava meal at least once a week and majority eats cassava at least once a day; hence it plays a major role in the country's food security. Cassava is widely consumed in a wide range of forms by inhabitants in Nigeria. The most common forms being 'garri', 'fufu', tapioca, composite flour, vegetable alcohol, starch and its pellets for livestock feed (11TA 1993, 1994). These common forms of consumption equally involve the manipulation of a whole range of biotechnological methods on cassava tubers to meet the human needs.

The high consumption of cassava in the country led to an increase in the demand for this crop both for food and for industrial uses, which exceeded the supply (Odigboh, 1985). To reverse this trend, the International Institute of Tropical Agriculture (IITA) and National Roots Crop Research Institute (NRCRI) in Nigeria led the development of improved cassava cultivars through their breeding programmes to obtain higher quality cassava roots at relatively shorter time and pest/disease resistant cassava cultivars capable of adapting to a wide range of ecological conditions and farming systems. These culti-

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Table 1. Attributes of the 17 cassava cultivars released for cultivation in Nigeria.

Cassava Variety	Branching habit	Canopy development	Ecological adaptation	Pests and disease resistance	Fresh root yield (t/ha)	Dry matter yield (80(c24h)	Garri yield (%)	Starch yield (%)	HCN in products (mg/100g)
TMS 90257	Profuse	Moderate	Wide	High	43	25	23	23	15.5
TMS 84537	Moderate	Sparse	Wide	High	35	28	18	27	6.3
TMS 82/00056	Profuse	Moderate	Wide	High	35	28	21	26	6.4
TMS 82/00661	Profuse	Moderate	Wide	High	39	30	22	26	4.1
NR 8212	Profuse	Moderate	Wide	High	27	37	25	21	High
NR 8082	Profuse	Profuse	Wide	High	32	32	22	19	High
TMS 50395	Moderate	Moderate	Wide	Moderate	36	29	24	12	High
TMS 30001	Moderate	Moderate	Wide	Moderate	16	28	23	22	Low
NR 8208	Profuse	Moderate	Wide	Moderate	26	32	25	23	High
NR 8083	Profuse	Moderate	Wide	High	31	43	36	25	High
TMS 81/00110	Profuse	Moderate	Wide	High	28	31	24	25	4.5
TMS 91934	Moderate	Sparse	Wide	Moderate	32	34	26	21	High
TMS 30572	Profuse	Profuse	Wide	Moderate	27	34	25	24	750
TMS 4(2) 1425	Moderate	Profuse	Savanna	Moderate	26	36	25	22	31
TMS 30555	Moderate	Profuse	Wide	Moderate	17	32	24	20	High
NR 83107	Profuse	Moderate	Wide	High	22	31	22	19	High
NR 41044	Moderate	Profuse	Forest	Moderate	37	34	25	23	High

Sources: FMANR 1997.

vars include TMS 30572, TMS 30555, TMS 4(2)1425, NR 8082, and NR 8203. These have been tried and found to be high yielding as well as disease and pest resistant. Consequently they have been distributed through the public extension service (Agricultural Development Programme) and adopted in varying degrees in different ecological zones of Nigeria.

However, the first step in assessing the usefulness of the technology to cassava farmers is to determine the attributes responsible for choice of cultivars among the farmers as well as the major constraints militating against the effective use of these cultivars. Earlier studies by Dorp and Rulkens (1993), Agwu (2002), Springer et al. (2002) and Kimenju et al. (2005) show that farmers decision to use particular crop cultivars were influenced by a number of reasons, some of which are market-driven or socio-culturally based. This work, therefore, sought to determine the level of use of improved and local cassava cultivars among farmers in Nnewi South Local Government Area of Anambra State, Nigeria.

MATERIALS AND METHODS

The study uses data collected from 118 cassava farmers randomly selected from six rural communities (Ukpor, Osumenyi, Amichi, Ebenator, Ekwulummili and Ezinifite) in Nnewi South Local Government Area of Anambra State, where cassava production is the dominant agricultural activity. From each community, 20 cassava farmers were selected using a simple random sampling technique. In all, 120 farmers were sampled using structured interview schedule. However, only 118 completed interview schedules were used for analysis.

The interview schedule sought to obtain information from farmers on the existing cassava cropping patterns and the different improved and local cassava cultivars grown in the area. Identification of the improved cassava cultivars among the existing local cultivars in the field requires experience. According to 11TA (1990), there are many improved cassava cultivars under cultivation. They can be distinguished by morphological characteristics such as leaf size, colour and shape, branching habit, plant heights, colour of stem and petioles, tuber shape, time – to – maturity, yield and level of cyanogenic glucosides in the tuber and leaves (Table 1). There are about 17 cassava cultivars, with wide range of ecological adaptability, released for cultivation in Nigeria as shown in Table 1. However, to ascertain the major cassava cultivars grown in the area, each farmer was asked to give a maximum of four cassava cultivars grown and the major reasons for growing each of the cultivars. A preliminary visit of the study area had earlier shown that Igbo is the common language. Hence, during the field survey in the various communities efforts were made to identify each improved cultivar including the land races with the commonest Igbo name using their morphological and agronomic characteristics.

To ascertain the major constraints militating against the effective use of improved cassava cultivars, a five points Likert- type scale with options of 'Not at all (1)', 'To a very little extent (2)', 'To a little extent (3)', 'To a great extent (4)', 'To a very great extent (5)', were used.

Percentages and bar charts were used to describe farmers' cropping systems and desirable attributes responsible for choice of improved and local cassava cultivars. Mean scores were used to determine the major constraints militating against effective use of improved cassava materials.

Table 2. Percentage distribution of respondents by types of cassava cropping patterns practiced.

Patterns of cassava cropping practiced	Percentage*
Cassava only	24.6
Cassava + cocoyam + yam	17.8
Cassava + cocoyam + maize	19.5
Cassava + cocoyam + yam + maize	12.7
Cassava + yam + maize	6.7
Cassava + maize	11.9
Cassava + yam	6.8

*Multiple responses.

Table 3. Percentage distribution of respondents by cassava cultivars grown.

Cassava cultivars	Percentage*
Local cassava cultivars	14
Improved cassava cultivars	22
Improved/local cassava cultivars	64

* Multiple responses

RESULTS AND DISCUSSION

Cropping systems practiced by farmers

Cassava is a common crop mostly grown by farmers in cassava growing areas. It is grown mainly as an intercrop and sometimes as a sole crop. Data in Table 2 shows that 24.6% of the farmers practice monocropping while 75.4% practice mixed cropping. Specifically, 19.5% of the respondents intercropped cassava with cocoyam and maize, 17.8% of the respondents intercropped cassava with cocoyam and yam while 12.7% of the respondents intercropped cassava with cocoyam, yam and maize. Also 11.9% of the respondents intercropped cassava with maize, 6.8% of the respondents intercropped cassava with yam while 6.7% of the respondents intercropped cassava with yam and maize. Sixty percent of the farmlands are planted with cassava; hence the farming system in the area is cassava – based. Mutsears et al. (1986) indicated that mixed cropping is normally the predominant cropping pattern in Africa.

Cassava cultivars grown in the locality

A Large number of cassava cultivars were grown by farmers in the area and farmers distinguish them by names which are often descriptive of the physical characteristics of the plant. Data in Table 3 show that 14% of the respondents grew local cassava cultivars alone, 22% of the respondents grew only improved cassava cultivars while a majority (64%) of the respon-dents grew both local and improved cassava cultivars either in mixtures or solely in their farms.

Table 4. Percentage distribution of respondents by major cassava cultivars grown.

Cassava cultivars	Percentage*
TMS30572	78.8
TMS 30555	56.8
TMS 4(2) 1425	10.2
'akpuocha'	11.9
'udukanani'	77.1
'achirinaka'	5.9
Less common local cultivars	3.6

*Multiple responses

Major cassava cultivars grown in the area

Many cassava cultivars were grown by farmers in the area. However, six cassava cultivars made up of three improved and three local cassava cultivars were popularly grown by farmers in the area (Table 4). The improved cultivars include TMS 30572, TMS 30555 and TMS 4(2)1425 while the local cultivars include 'akpuocha', 'achirinaka' and 'udukanani'. A number of less common local cultivars of cassava, which includes 'akwaakwuru', 'aburuasua' and 'nwanyibioka', were equally grown by only a small proportion of farmers.

Of all the cultivars observed in the fields, the improved cultivar TMS 30572 (78.8%) was the most widely cultivated. This was followed by the local cultivar 'udukanani' which was grown by 77.1% of the respondents while TMS 30555 was widely grown by 56.8% of the respondents. Other cassava cultivars grown in the area were 'akpuocha' (11.9%), TMS 4(2) 1425 (10.2%) and 'achirinaka' (5.9%).

Major cassava attributes responsible for choice by farmers

The desired attributes preferred by farmers (Table 5) include low HCN in products, pests and disease resistance, early maturity, late maturity, ability to suppress weeds, high yield, resistant to drought, ease of harvest, storage capabilities, palatability of tubers, colour of tubers and high product qualities.

Enhanced shelf life

This refers to the ability of cassava cultivars to store longer after processing. Fresh cassava roots cannot be

Table 5. Number of responses recorded for each desired cassava attributes.

Number of Responses							
Desired attributes	**TMS 30572**	**TMS 30555**	**TMS 4(2) 1425**	**'akpuocha'**	**'achirinaka'**	**'udukanani'**	**Total number of responses**
Enhanced shelf life	87	65	14	14	6	93	279
High yield	91	68	15	10	6	84	274
Perceived low level of HCN in products	91	68	17	9	6	81	272
Palatability of products	84	66	15	12	6	87	270
High product quality	86	61	14	13	6	84	264
Ease of harvest	55	44	9	9	4	81	205
Pests and disease resistance	72	54	13	10	5	49	203
Ability to suppress weeds	56	41	12	6	2	46	163
Early maturity	93	51	14	-	-	-	158
Colour of peeled tubers	4	4	7	6	2	92	115
Late maturity	-	-	-	11	5	91	107
Resistant to drought	30	23	3	4	0	29	89

stored because they begin to rot within 2 - 4 days after harvest. This makes it necessary to process cassava into various products that have longer shelf life, less cyanide content and improved palatability (through fermentation). Ability to last and store longer was the most frequently cited reason for choosing cassava cultivars found in the area. Data in Figure 1 show that 33.3% of the respondents indicated that they cultivated 'udukanani' based on this attribute. TMS 30572 and TMS 30555 followed with 31.2% and 23.3% of respondents cultivating them for the same attribute. Also other cassava cultivars grown by farmers based on this attribute include 'akpuocha' (5.0%), TMS 4(2)1425 (5.0%) and 'achirinaka' (2.2%). This finding shows that the ability of cassava cultivars to store longer after harvest constituted a major objective of the farmers and could have been mainly responsible for the observed popularity of 'udukanani' in the area and also partly explains the existence of some of the local cultivars found in the area.

High yield

The yield of cassava tubers forms the basis for which farmers cultivate the various cassava cultivars found in the area. In this regard the improved cassava cultivars – TMS 30572 was rated highest (33.2%). This was followed by 'udukanani' (30.7%). The TMS 30555 was next with 24.8% of farmers cultivating it for this reason. TMS 4(2)1425, 'akpuocha' and 'achirinaka' had 5.5, 3.6 and 2.2% of farmers, respectively, cultivating them for this purpose (Figure 1). This finding tends to support the fact that high yield is one of the primary objectives in farmers' varietals selection. Field observations and further interaction with farmers show that the yields of the TMS 30572 and that of the 'udukanani' are about the same. It was found that the main yield advantage of the improved cultivar over local cultivar is more in earliness of bulking than in the level of yield per se. This is because given longer time the local cultivars close the yield gap with the improved cultivars. Making a similar comparison Nweke et al. (1988) showed that the older the cassava before being harvested, the less difference in yield bet-ween the improved and local cultivars. This partly exp-lains the reason why there is still an observed dominance of the 'udukanani' variety in the study.

Perceived level of HCN in products

"Perceived level of HCN in products" is also one of the frequently cited reasons for choosing a particular cultivar. Figure 1 shows the percentage of farmers that perceived the various cassava cultivars as being low in HCN. TMS 30572 has the highest percentage (33.5%) of farmers cultivating it because of its perceived HCN content. Toxicity levels of cassava are markedly influenced by the local soil and climatic conditions whereas changes in toxicity can occur when moving cultivars from one country to another (Rogers, 1987). A local cultivar 'udukanani' followed with 29.8% of farmers cultivating it for the same attribute. Other major varieties grown in the area based on this attribute include TMS 4(2)1425 (6.2%) and 'akpuocha' (3.3%). Also 2.2% of the respondents cultivated 'achirinaka' based on this attribute. High HCN is detrimental to human health. According to Rogers (1987) cassava cultivars with low HCN content are preferred by

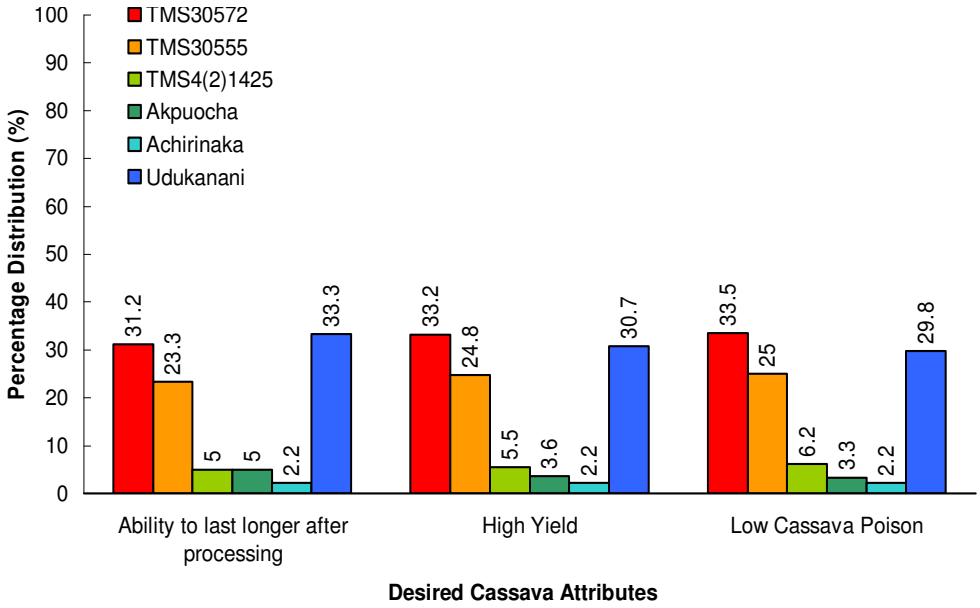

Figure 1. Percentage distribution of cassava cultivars cultivated on the basis shelf-life, high yield and low cassava poison.

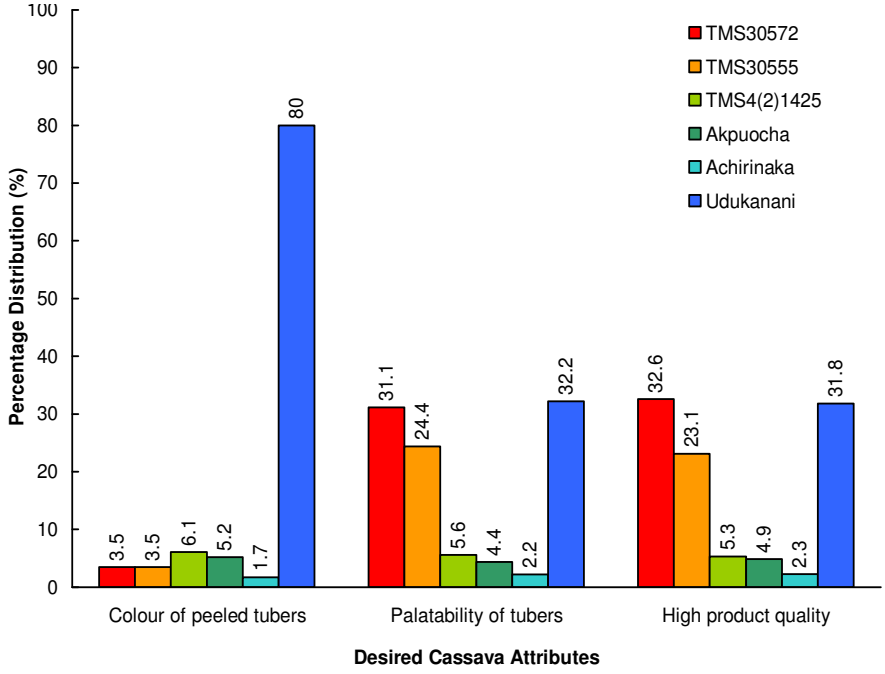

Figure 2. Percentage distribution of cassava cultivars cultivated on the basis of colour, palatability and high product quality.

majority of growers.

Colour of tubers and palatability of products

Issues relating to the physical nature of processed products from the different cultivars were the fourth most frequently cited reasons for growing cassava cultivars found in the area. This generally refers to the ability of the processed cassava to taste well to the consumers and give a colour which is appealing to them. Data in Figure 2 shows that with regards to taste, 32.2% of the respondents cultivated the 'udukanani' cultivar. Also, cultivars like TMS 30572, TMS 30555, TMS 4(2) 1425 and 'akpuo-

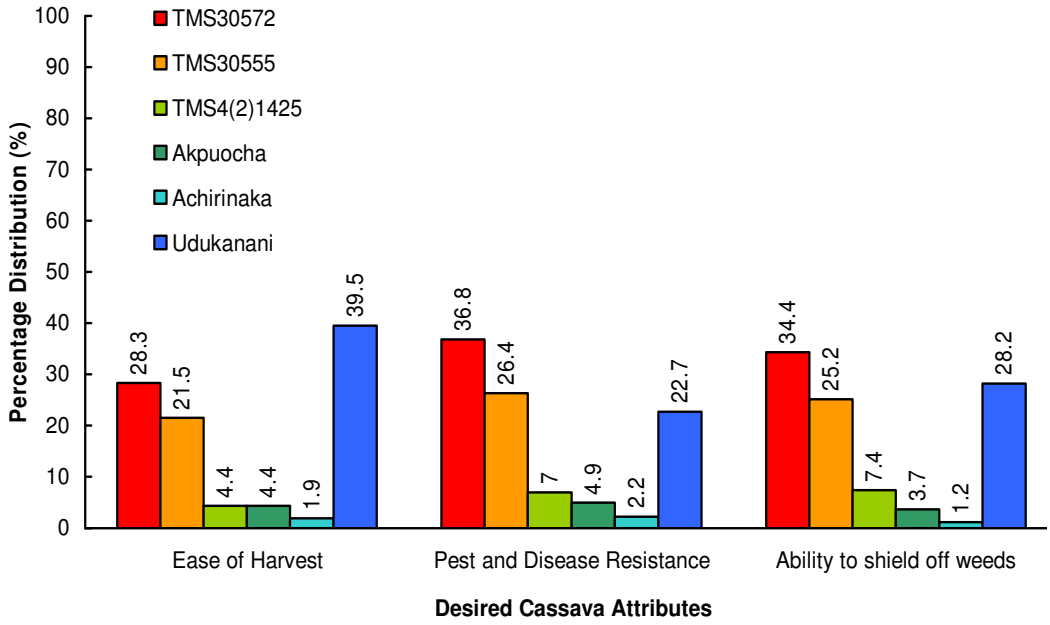

Figure 3. Percentage distribution of cassava cultivars cultivated on the basis of ease of harvest, pest and diseaese resistance and ability to shield off weeds.

cha' were cultivated by 31.1, 24.4, 5.6 and 4.4%, respectively, for the same reasons. While 2.2% of respondents cultivated 'achirinaka' on the basis of this attribute. The importance of this attribute was revealed by Westby (1991) whose survey on the modes of utilization of cassava in Africa revealed that nearly three out of the four cassava based food encountered were processed products. Hence, the colour, taste and texture of the product will determine the acceptability of that product to its consumers.

In terms of colour, farmers prefer white cassava tubers to milk coloured ones. Data in Figure 2 also reveal that 'udukanani' had the highest (80%) percentage of respondents cultivating it for this reason. 'Akpuocha' was next with 5.2% of respondents cultivating it for its colour appearance. This was followed by TMS 30572 (3.5%), TMS 30555 (3.5%), TMS 4 (2) 1425 (6.1%) and 'achirinaka' (1.7%). It could be deduced from this finding that the local cultivars were generally more acceptable to the farmers in the area in terms of taste, texture and colour. Osinaeme et al. (1988) also indicated in his work that colour and appearance is the most important consideration of farmers because of commercial production whereas texture or consistency and taste follows with equal importance. This is equally among the major reasons why the farmers in the area still cultivated the local cultivars.

High product quality

High product quality was perceived by respondents as a desired attribute for choosing the different cultivars. High product quality refer to such attributes as short cooking time, ability to remove HCN entirely after processing, the duration of fermentation period and the ease of processing associated with peeling, milling, grating and toasting. In this regard, 32.6% of respondents cultivated TMS 30572 cultivar, 31.8% and 23.1% of respondents cultivated 'udukanani' and TMS 30555 based on their high product qualities (Figure 2). Other cultivars grown in the area based on this attribute include TMS 4(2)1425 (5.3%), 'akpuocha' (4.9%) and 'achirinaka' (2.3%). It could be deduced from the response of the farmers that both TMS 30572 and 'udukanani' have high product qualities. This implies that the acceptability and persistence of the local cultivar 'udukanani' in the area was derived from this attribute among others.

Ease of harvest

Issues relating to harvesting properties were cited as one of the reasons for choosing a particular cultivar. Ease of harvest is largely determined by the number of roots. Fresco (1986) noted that a cassava plant produces a number of roots which vary in size and shape depending on the genotype and environment and this influences harvest. He further revealed that the average number of roots per plant is lower with a large size of roots in improved varieties than local ones. Hence it is much easier to harvest a larger number of roots but smaller in size. Data in Figure 3 show that about 39.5% of respondents indicated ease of harvest as a major reason for cultivating the 'udukanani' cultivar while 28.3% of the respondents indicated that they cultivated TMS 30572 for

the same attribute. This was followed by 'akpuocha' (4.4%), TMS 4(2)1425 (4.4%) and 'achirinaka' (1.9%). It could be deduced that because of the smaller size of the roots, they are easier to harvest than the improved cultivars which have larger root sizes.

Pest and disease resistance

The cultivars were perceived by the farmers to differ in their resistance to pests/disease attack. The TMS 30572 was the most favoured cultivar with 36.8% of the farmers cultivating it for this attribute (Figure 3). This was followed by TMS 30555 (26.4%), 'udukanani' (22.7%) and TMS 4(2)1425 (7.0%). Also 4.9 and 2.2% of the respondents respectively cultivated 'akpuocha' and 'achirinaka' based on their perceived pests and disease resistance. The high percentage of farmers cultivating TMS 30572 and TMS 30555 could be attributed to the fact that these improved cassava cultivars were specifically bred against pests and diseases. Earlier work of Nweke et al. (1997) reported that improved cassava cultivars such as TMS 30572 and TMS 30555 were modified for high yield, pests /disease resistance, good product quality and early maturity among other desired attributes while the TMS 4(2)1425 is moderately resistant to these pests/diseases. Texaco Inc. (1984) also noted that the improved cassava cultivars were more resistant than the local cultivars to common diseases such as cassava mosaic virus and bacterial blight and more tolerant to such pests as green mite and mealy bug. In other words, farmers are quite aware of the susceptibility of many local cultivars to pests and diseases. Various chemical control measures have been recommended, but the need for safe use and high costs restricts the use of these chemicals among small holder farmers who grow cassava in mixtures (FMANR, 1998). Hence this has resulted in the acceptance of the improved varieties such as TMS 30572, TMS 30555 and TMS 4(2)1425 which have been bred to resist most of these pests and diseases and hence could be cultivated without the use of chemicals. However, the local cultivar 'udukanani' which recorded high resistance to pests / disease as perceived by the farmers could be attributed to the fact that the cultivar has been in the environment for a very long time and as such became adapted to the environment thereby building up pests/disease tolerance.

Ability to shade off weeds

The cassava cultivars were perceived by the farmers to differ in their ability to shade off weeds and this was equally cited by the respondents as one of the reasons for choosing a particular cultivar. TMS 30572 had the highest ranking with 34.4% of respondents cultivating it for this attribute (Figure 3). This was followed by 'udukanani' (28.2%), TMS 4(2)1425 (7.4%), 'akpuocha' (3.7%) and 'achirinaka' (1.2%). This could be attributed to the breeding of the improved cassava cultivars with respect to the shading off of weeds. Nweke et al. (1992) work on attributes of the cassava cultivars released for cultivation in Nigeria showed that the TMS 30572 has a canopy development and branching habit which are both profuse in nature. The ability of 'udukanani' which is a local cultivar to shade off weeds to some extent is regarded by the farmers as one of the desirable attributes for maintaining this local cultivar. The ability of cassava to shade off weeds is an important attribute to the farmers because it determines the number of times these farmers weed their farms. Onwueme and Sinha (1991) observed that in appropriately spaced cassava farms, weeding is necessary for only the first three months after planting after which the canopy closes and no further weeding is needed.

Early and late maturity

Variations in maturity period played an important role in the farming systems of cassava farmers and therefore constituted one of the major reasons for which farmers cultivated the various cultivars (Figure 4). There is a distinct variation between cultivars that mature early and those that mature late. About 58.9% of the respondents indicated that they cultivated TMS 30572 because it matures early. Also 32.3 and 8.9% of the respondents respectively cultivated TMS 30555 and TMS 4(2)1425 because of their early maturity attributes. FMANR (1998) noted that the focus of germplasm development in Nigeria is to produce improved cultivars that have high yield, early maturity and pests/disease resistance. Jennings (1989) also observed that early maturity of cassava cultivars are desirable in some areas and are usually more palatable. Field observations showed that farmers who desired early maturity attributes cultivated only improved cassava cultivars.

However, in terms of late maturity, the local cultivars were highly preferred to the improved ones. About 85% of the respondents indicated that they cultivated 'udukanani' cultivar on the basis of this attribute. This cultivar matures late and can stay for 2 - 3 years in the soil without rotting. This was one of the desired attribute given by the farmers as a major reason for still main-taining the local cassava cultivars found in the area. Also, 10.3 and 4.7% of the respondents respectively indicated that they cultivated 'akpuocha' and 'achirinaka' for this same attribute. This was equally pointed out by Jennings (1989) that while, some areas desire early maturity; others may require their cassava cultivars to remain long in the ground without deterioration as a famine reserve. In other words, since the improved cassava cultivars do not meet the farmers' desire in terms of this attribute, there is need for research efforts to inculcate this attribute into their breeding improvement programmes so as to meet the

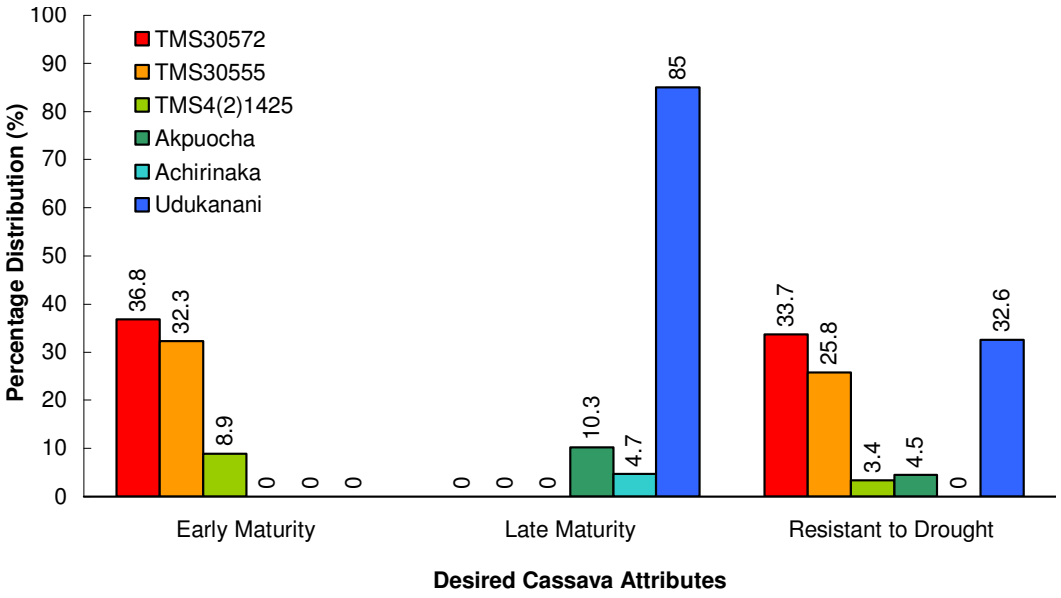

Figure 4. Percentage distribution of cassava cultivars cultivated on the basis of early maturity, late maturity and resistance to drought.

farmers' varietals needs.

Resistance to drought

Resistance to drought was the least cited reason for choosing particular cassava cultivars possibly due to the fact that the area of study which falls within the humid tropics do not really experience drought for a long period of time. The farmers in this area do not see drought as a major problem which particularly affect their choice of cultivars. Resistance to drought refers to the ability of cultivars to withstand long periods of dryness or lack of rains. Data in Figure 4 show that 33.7% of the respondents cultivated TMS 30572 based on its resistance to drought. This was followed by 'udukanani' with 32.6% of the respondents cultivating it for the same attribute. Also 25.8%, 3.4% and 4.5% of the respondents indicated that they cultivated TMS 30555, TMS 4(2)1425 and 'akpuocha' respectively, based on this attribute.

Major constraints militating against the effective use of improved cassava cultivars

Data on Table 6 shows that non-availability of inorganic fertilizers in the area was rated the most important constraint militating against effective use of improved cassava cultivars in the area with a mean score of 4.72. This is in line with FMANR (1998) report which noted that the need for fertilizer is unmatched by availability due to the combined effects of insufficient supply, costs and an inefficient distribution system. This was followed by high cost of labour in the area with a mean score of 4.64. This could be attributed to the high rural-urban migration of the youths prevalent in the area. Other factors which constrain the use of improved cassava cultivars in the area include lack of finance ($\bar{x}$ = 4.58) implying that majority of the farmers in the area were resource poor farmers and do not have adequate financial resources to acquire improved materials; non-availability of agrochemicals ($\bar{x}$ = 4.55) and lack of infrastructure/processing facilities ($\bar{x}$ = 3.46).

Implications

For any scientific innovation to be meaningful, it must get to the ultimate users. An innovation that is not adapted to the farmers' own conditions as well as based on their needs and interests in view of utilizing it to improve their productivity and hence increase income is useless and is as good as not being discovered. Not withstanding the wide spread of these improved cassava cultivars in southeast Nigeria as noted by Nweke et al. (1992) and the desirable attributes found in these cultivars, this study showed that farmers who use these improved cassava cultivars still retain some of their local cultivars. The findings revealed that both the improved cultivar TMS 30572 and local cultivar 'udukanani' were popular among the farmers in the area. Many reasons were given by farmers for retaining this local cultivar which contributed to its persistence in the area. Most farmers indicated that the most outstanding attribute of the 'udukanani' cultivar is its capacity to stay for two to three years in the soil without rotting and at the same time maintaining its optimum yield and acting as a famine reserve. However most

Table 6. Mean scores of factors that militate against effective use of biotechnological cassava materials.

Constraints	Mean scores ($\bar{x}$)	Standard Deviation
Lack of finance	4.58*	0.82
Weed problems	2.47	0.84
Disease problems	2.62	1.17
Water constraints	1.33	1.07
High labour cost	4.64*	0.77
Inadequate storage facilities	2.00	1.00
High risk and uncertainty in cassava Production	1.33	0.79
Poor extension contact	1.25	0.89
Lack of infrastructure/processing facilities	3.46*	1.21
Shortage of planting materials	1.64	0.79
Low soil fertility	1.75	1.00
Low consumer preference encountered with Products of improved cassava varieties	1.17	0.63
Non-availability of improved cassava cuttings	2.23	1.07
Non-availability of inorganic fertilizers	4.72*	0.47
Lack of technical knowledge about recommended practices associated with growing improved cassava cultivars	1.03	0.16
Not aware of practices	1.14	0.64
No market for products	1.06	0.35
Non-availability of agrochemical	4.55*	0.87

*Major constraints.

improved cassava cultivars cannot last this long in the soil without rotting. This implies that research efforts should be geared towards breeding cassava cultivars that are not just high yielding and pests/disease resistant but that can also stay longer in the soil without rotting. The next outstanding trait of this local cultivar 'udukanani' which allowed for its persistence is its ability to be white in colour when processed and to have a high starch content which is normally desired by consumers as opposed to the improved cultivars which are more or less 'milkish' in colour with perceived low starch content.

From the above, it could be deduced that there are fundamental problems, which research efforts have not addressed. Hence, quite often, the technological options offered by the extension service do not fully address the needs of the farmers and at times do not fit into the farming systems and the socio-economic conditions under which the rural people operate. Furthermore, most farming problems that seek for research investigations are studied often only from the point of view of the researcher's discipline without taking an integral view of the farm as farmers do. The result is the dissemination of products from research which partly satisfies farmers' needs. The findings corroborate the need to make technology relevant to farmers' needs and values and confirm the concerns of Haverkort et al. (1991) and Agwu (2002) which dwelt with the relevance of farmers' participation in technology development so as to accommodate the perspectives of farmers' assessments and also bridge the differences between on-station research and farmers' fields (Agbamu et al., 1996).

For effective extension work, a broader range of improved cultivars that match different ecologies and end – users' requirement should be developed and released to the farmers. Researchers and extension personnel should encourage the broad participation of farmers in technology development and transfer. The current ADP focus on farmer groups should be encouraged as a means of targeting farming issues that need research investigation as well as dissemination of research results to farming population. Such a framework should be well articulated and organized in order to capture the full benefits of group dynamics.

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