Differentiated Gender Ownership of Cassava Fields and Implications for Root Yield Variations in Small Holder Agriculture of Southeast Nigeria

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Summary

As a result of their relatively limited access to production resources, it has been variously reported that women obtain lower yields from their individual crop fields than men. Cassava root yields obtained from farmers' fields in three villages of southeast Nigeria were compared using separate ownership of fields by gender as a factor. The result of the analysis fails to confirm lower yields from women's fields. Instead, mean fresh root yield was lower for fields owned individually by men than for those owned individually by women, and about the same for fields owned jointly by the whole family and those owned individually by women. This was apparently because of differences in the use of purchased inputs, especially hired labor and improved cassava varieties, and perhaps also due to differences in the age of cassava at harvest and the intercropping of cassava as a minor crop with yam.

Résumé

Propriété différenciée des champs de manioc selon le genre et implications sur les variations du rendement des tubercules dans l'agriculture paysanne du sud-est du Nigeria

Dû à leur accès limité aux facteurs de production, plusieurs études rapportent que les femmes obtiennent des rendements inférieurs pour leurs champs individuels de manioc par rapport aux hommes. Les rendements des tubercules de manioc relevés chez les champs des paysans dans trois villages du sud-est du Nigeria ont été comparés en utilisant la propriété séparée des champs selon le genre comme facteur. Le résultat de l'analyse ne confirme pas l'hypothèse conventionnelle des rendements inférieurs des champs des femmes. Au contraire, le rendement moyen des tubercules frais était inférieur pour les champs individuels des hommes par rapport à ceux des femmes, alors qu'entre les champs familiaux et les champs individuels des femmes, aucune différence de rendement a été constatée. Apparemment, cette différence était liée à l'utilisation d'intrants, notamment de la main-d'œuvre embauchée et des variétés améliorées de manioc, et peut-être aussi à des différences dans l'âge du manioc à la récolte et à l'association du manioc, comme culture secondaire, avec l'igname.

Introduction

In Africa, women are responsible for a substantial proportion of agricultural production (6). It is broadly estimated that women in rural areas account for at least 50% of the world's food (9). According to Mputela and Kraft (18), women farmers in many developing countries contribute more than 60% of the effort involved in the production of food crops. Boserup (3) described Africa as a region of female farming par excellence.

In the face of declining *per capita* food production in sub-Saharan Africa and the threatening increase in population pressure, use of purchased inputs has been variously reported as a possible means of avoiding African food crises. According to Vlek (27), in order to arrest the declining *per capita* food output in sub-Saharan Africa in the next century, estimates by the FAO indicate that 50% of the expected crop yield increases will depend on increased use of chemical fertilizer together with improved varieties and management practices. Nweke *et al.* (21) also reported a strong positive correlation between use of purchased inputs and cassava root yield.

In comparison with men, however, women have been widely reported to have limited access to food crop production resources (4, 5, 22, 25, 26). As a result, they have also been reported to obtain lower yields than men from food crops production. Palmer (25) observed that when men and women grow the same crop in their own accounting units, it has been noted that women's yields are generally lower than men's because of the absence of resource rationalization between them. Quisumbing *et al.* (26) also observed that many studies have shown that plots of land controlled by women have lower yields than those controlled by men because of lower use of labor and fertilizer per acre rather than managerial and technical inefficiency.

Cassava is a very important food crop in Africa. It pro-

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vides about 70% of the daily calorie intake of over 50 million Nigerians (28) and about 40% of all calories consumed in Africa (12). It is also the second most important human staple in sub-Saharan Africa (13). Lagemann (16) observed in southeast Nigeria that the great importance of cassava, in both physical and monetary terms makes it relevant to give special attention to this crop.

This paper, based on primary data collected within the framework of the Collaborative Study of Cassava in Africa (COSCA), examines differences in cassava root yields between fields individually owned by the males and those owned by the females or jointly by the whole family. The COSCA study was funded by the Rockefeller Foundation; its objective was to collect authoritative information over a wide area on cassava production systems, processing methods, market prospects and consumption patterns, which will guide research, extension and policy interventions in Africa.

Location of the study sites

The three villages studied by Lagemann in 1973 and subsequently used for the follow up study of Enete *et al.* (7) were used: Owerre-Ebeiri in Orlu (7.03°E 5.77°N), Umuokele in Abor-Mbaise (7.21°E 5.48°N) and Okwe in Umuahia (7.48°E 5.52°N), all of which are in southeastern Nigeria.

Differences in population density were Lagemann's dominant criterion for selection. He made use of the 1963 census information which showed the estimated densities for the three villages as 100-200 persons/km^2 for Okwe, 350-500 persons/km^2 for Umuokele, and 750-1000 persons/km^2 for Owerre-Ebeiri. Since 1963, Nigeria has conducted two population censuses, one in 1973 and the other in 1991, but neither was accepted by the Nigerian government as accurate (2).

There are fairly homogeneous climatic conditions in all the three villages. According to Lagemann (16), the mean annual rainfall in the survey area was estimated to be in the order of 2200 mm, with peaks in July and September and the so-called 'August break' in between. Mean daily maximum temperatures are highest in January/February (33°C) and lowest in July (28°C), and mean daily minimum temperatures lowest in January/February (20°) and highest in March-April (22°C).

Method of the study

A list of farm households was compiled in each village with the assistance of key informants: 68 households were listed in Okwe, 53 households in Umuokele and 76 households in Owerre-Ebeiri. The farm households were next grouped into 'large', 'medium' and 'small' smallholder units, also with the assistance of the key informants. Seven farm units were randomly selected from each stratum making a total of 21 in each village; one household was later dropped in Owerre-Ebeiri because it provided no information.

The data collection was conducted in two parts. Part one was aimed at a broad characterization of the village level cassava production systems; farmer groups consisting of men and women with a wide age range were constituted and interviewed in each village using a structured instrument to collect qualitative information on crop mixtures, and crop rotation systems. Following the interview meetings, the investigators went to the cassava fields and classified the varieties as local or improved. Part two of the data collection was a detailed characterization of cassava production methods; the unit of analysis was the individual field. The information collected included field history, cassava production methods adopted, inputs applied, the gender of field owner and cassava root yield, along with certain agronomic yield components. Yield estimation was made for fields which were six months old and above, except when the farmer harvested at less than that age. The estimation was based on a representative sample plot of 40 m^2, except when the field was too small in which case a 20 m^2 plot was used. There were one or two plots per field depending on the size and heterogeneity of the field in terms of soil and toposequence. Cassava stands within the sample plot were counted and then harvested. Both the roots and the tops were weighed separately and the roots counted.

Results and discussion

The cropping patterns

Cassava was entirely intercropped; sole cropping was not mentioned as a major cropping pattern in any of the three villages. This is not surprising because according to IITA (14), more than 70% of the food crops consumed in the humid tropics, especially tropical Africa comes from intercropping. Onochie (24) also observed that as a rule, most crops in West Africa are sown mixed in a plot though in a number of fashions including intercropping and relay cropping. The advantages of intercropping include higher combined yields of intercrops (1, 10), maximization of output of food crops on limited areas and with limited resources (24), and minimization of risks associated with pests, diseases and price variability as well as optimization of labor and food supplies during the year (8, 23).

In Okwe, two cropping patterns were described. These are cassava/maize/vegetable/melon, with cassava as the main crop; and yam/vegetable/maize/melon, with yam as the major crop. In both systems, the intercrops are grown for one year and the field is left fallow for six years after which the cycle is repeated with the same crops.

In Umuokele, three cropping patterns were described: cassava/groundnut/maize/vegetable/melon, with cassava as the main crop; yam/cassava/maize/vegetable, with yam as the major crop; and cocoyam/maize, with cocoyam as the main crop. The first pattern is used for two successive years on the same field, after which the field is left fallow for four years. The same crops are replanted at the end of the fallow period. The second follows the same pattern as the first. The third is grown for only one year and the field is left fallow for four years after which the same crops are replanted.

In Owerre-Ebeiri, three cropping patterns were described: yam/cassava/maize/vegetable, with yam as the major crop; cassava/maize/vegetable/melon, with cassava as the main crop; and cocoyam/maize/cassava/vegetable, with cocoyam as the major crop. All the crop mixtures in each of the three patterns are grown in the same field, year in year out, without fallow.

Overall level of cassava root yield

The cassava fresh root yield reported by Enete *et al.* (7) and used for this analysis was on the average for the three villages, 6.06 t/ha, the range was 0.50-19.25 t/ha, and the mode was 6-7 t/ha. Similar estimates by Nweke *et al.* (20) showed the mean cassava root yield for villages around Onitsha to be 10.7 t/ha, 9.2 t/ha for villages around Abakaliki and 36.9 t/ha for villages around Zaki-Biam, all in different ecological zones of southeast Nigeria. Also, Nweke *et al.* (19) estimate for Nigeria as a whole, a mean of 14.74 t/ha and a range of 1.25-67.30 t/ha.

The yield from these villages do not compare favorably with the above estimates probably because of soil conditions. The soil types in these villages as described by Lagemann (16) differ from the major soil types found in the forest and the moist savanna where 75% of cassava in West Africa is grown as described by Lawson *et al.* (17). In addition, Enete *et al.* (7) observed that while the mean cassava plant density was higher, the average age of cassava at harvest in months after planting (MAP) was lower in these villages than the average for the whole of Nigeria. Hence, while cassava plant densities may be higher, age at harvest may be lower than necessary for maximum root yield in these villages. Nweke and Spencer (21) had reported that cassava root yield increases with plant density up to a point, and then declines with further increases in plant density. Moreover, cassava can be harvested from 6 MAP but the edible root continues to grow for up to 48 MAP depending on the cultivar (15).

Cassava root yield by gender of field owner

The mean cassava fresh root yield was significantly (P < 0.01) lower for fields owned individually by men (3.64 t/ha) than for those owned individually by women (6.27 t/ha)(Table 1). It was also significantly (P= 0.02) lower for individual male owned than for jointly owned fields (6.22 t/ha) (Table 1). Yields were about the same for the female and jointly owned cassava fields. These estimates fail to corroborate the observations by Palmer (25) and Quisumbing *et al.* (26) that yields from women's fields are generally lower than those from men's fields.

The frequency of use of inorganic fertilizer was 14% for male owned fields, 19% for female owned and 41% for jointly owned cassava fields. That of organic manure was 71% for male owned fields, 19% for female and 22% for jointly owned fields (Table 3). The differences in the yields between the fields owned individually by men or women or jointly by the family could not however be attributed to these differences in the use of fertilizer and manure since yields did not seem to respond positively to the use of these inputs in the area. The mean fresh root yield was significantly lower in fields in which inorganic fertilizer or organic manure was applied than in fields in which they were not applied in the three villages (Table 2). Hahn (11) noted that no positive cassava yield response was observed either to N or K applications on newly cleared land. Instead, tuber yields were depressed with increasing rates of N, particularly without K. Yield tended to increase with liming and with K for certain varieties.

Table 1: Cassava root yield components by gender of field owner

Gender		Fresh root (t/ha)	Plant density (stds/ha)	Average root wt (kg)	Number of roots/plant	Harvest Index	Age at harvest (mths)
Male	mean	3.64	7714	0.19	2.78	0.38	9.60
	minimum	1.75	4000	0.09	1.74	0.24	6.00
	maximum	5.45	11500	0.32	3.71	0.51	21.00
	standard dev.	1.38	2391	0.09	0.71	0.09	3.45
	No. of fields	7	7	7	7	7	20
Female	mean	6.27	11476	0.14	4.64	0.49	11.06
	minimum	1.50	5500	0.06	1.39	0.19	6.00
	maximum	16.35	20500	0.36	8.36	0.75	21.00
	standard dev.	3.49	4275	0.07	2.23	0.13	4.82
	No. of fields	21	21	21	21	20	51
Joint	mean	6.22	11969	0.14	3.68	0.44	9.98
	minimum	0.50	5000	0.01	0.61	0.06	6.00
	maximum	19.25	25500	0.26	9.48	0.70	21.00
	standard dev.	5.05	4477	0.06	2.10	0.15	3.73
	No. of fields	32	32	32	32	32	119

Table 2: Cassava root yield under alternative input applications in the three survey villages

Input		mean	minimum	maximum deviation	standard	No. of fields	T-value
Hired labor:	used	6.63	0.50	19.25	4.53	46	-1.81 (P=0.08)
	not used	4.41	1.20	12.10	3.11	16	
Improved cassava variety:	used	9.33	3.80	16.50	6.10	5	-1.81 (P=0.08)
	not used	5.77	0.50	19.25	4.05	57	
Organic manure:	used	3.91	1.20	16.35	3.58	16	2.41 (P=0.02)
	not used	6.81	0.50	19.25	4.31	46	
Inorganic fertilizer:	used	4.41	0.50	8.80	2.52	18	2.52 (P=0.01)
	not used	6.74	0.90	19.25	4.70	44	

The differences in the root yields may be attributed to differences in the uses of hired labor and improved cassava varieties. Hired labor was used in 57% of the male owned fields, 76% of the female owned and 78% of the jointly owned fields. The mean yield from fields where hired labor was used in the three villages was significantly higher than that from fields where it was not used (Table 2). Nweke *et al.* (19) observed that the higher the number of farm tasks executed with hired labor, the higher the cassava root yield. The frequency of use of improved cassava variety was 5% for female owned fields, and 13% for jointly owned fields, while it was not recorded in male owned fields (Table 3). The mean yield from fields where improved variety was used was significantly higher than that from fields of local land races in the three villages (Table 2). Nweke and Spencer (21) made similar observations in southwest Nigeria.

Table 3
Percentage distribution of cassava fields by use of inputs by gender of field owner

	Male	Female	Joint
Fertilizer	14	19	41
Manure	71	19	22
Improved variety	0	5	13
Hired labor	57	76	78

In addition, there were differences in the age of cassava at harvest. Mean age at harvest in MAP was higher for female owned fields than for male owned or jointly owned fields. There were also differences in the rate at which cassava was intercropped as a minor crop with yam. In about 86% of the male owned cassava fields, 10% of the female owned and 19% of the jointly owned fields, cassava was grown as minor in yam/cassava intercrop. Nweke *et al.* (19) observed that cassava has low plant density and is often planted late in the season in the yam/cassava intercrop where cassava was the minor crop. They however noted that the effect on cassava root yield may not be so adverse because yam-based intercrops are generally cultivated in fields of fertile soils. In the three villages studied, mean fresh root yield was lower (4.67 t/ha) but not significant (P= 0.18) in fields where cassava was intercropped as a minor crop with yam than where it was not (6.46 t/ha). It would appear that plant densities were in most cases lower than necessary for maximum root yield in male than in female or jointly owned cassava fields because of the yam/cassava intercrop. Mean cassava plant density was lower for male than for female or jointly owned fields (Table 1).

Although these observations did not confirm Palmer (25) and Quisumbing *et al.* (26) observations on yields from men's and women's fields, they however, suggest that lower yields from women's fields if and when they happen do not imply managerial or technical inefficiency on the part of women but limited access to resources as also noted by Quisumbing *et al.* (26).

Conclusion

Cassava root yield was higher for female than for male owned fields. It was also higher for jointly than for male owned fields and about the same for female and jointly owned fields. This was due to differences in the use of hired labor and improved cassava varieties by gender of field owner. In addition, the age of cassava at harvest was higher for female owned than for the male and jointly owned fields. Cassava was a minor crop in yam/cassava intercrop in predominantly more of the male owned than female or jointly owned cassava fields.

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