

Research Application Summary

**Stakeholders' preference and participation in the development of improved cowpea varieties: Implications for Cowpea breeding**

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**Abstract**

Cowpea is Ghana's second-largest food legume. It is a vital source of plant protein, including minerals and amino acids that improve human nutrition and health. It plays a primary role in the livelihood of millions of relatively poor people, serving as a complete adult nutritional protein source, and the main protein source for many children. The main objective of this research was to examine Stakeholders preference and participation in the development of improved cowpea varieties in the Northern region of Ghana. The intent was to inform breeders about the cowpea features and qualities that stakeholders especially consumers prefer. A cross-sectional quantitative research design was used to collect the data using a multistage, snowball, and convenience sampling techniques from cowpea farmers (n= 415), marketers (n= 60), and consumers (n= 120), respectively. Content-validated questionnaires and structured interview schedules were used to collect the data. Descriptive statistics, Standard deviations, Chi-square test, and Kruskal-Wallis H test were used to analyse the data. The study revealed that there were low level of participation of all the stakeholders (farmers, consumers, and marketers) in development of new cowpea varieties in Northern Ghana. Also, farmers prefer improved cowpea varieties with crop attributes such as medium and straight pods size, varieties with yield potential, early maturing varieties, drought tolerant, and pest and disease resistant. The study revealed that stakeholders prefer cowpea which have smooth texture of the coat and easy to cook varieties. Further, farmers prefer medium grain sized cowpeas, while consumers and marketers prefer large grain size cowpeas. There were statistically significant differences among the stakeholders and their preference in terms of texture of the coat, grain size, and cookability. The study recommends, among others, need for scientists and breeders to incorporate crop and grain attributes such as texture of the coat, grain size, and cookability preferred by stakeholders in future cowpea breeding programmes.

Key words: Improved variety, participatory plant breeding, Stakeholder, preferences, *Vigna unguiculata*

**Resume**

Le niébé est la deuxième plus importante légumineuse alimentaire du Ghana. C'est une source vitale de protéines végétales, y compris de minéraux et d'acides aminés qui améliorent la nutrition et la santé humaine. Il joue un rôle primordial dans la subsistance de millions de personnes relativement pauvres, servant de source de protéines nutritionnelles complètes pour les adultes, et de principale source de protéines pour de nombreux enfants. L'objectif principal de cette recherche était d'examiner

la préférence et la participation des parties prenantes dans le développement de variétés améliorées de niébé dans la région nord du Ghana. L'intention était d'informer les sélectionneurs sur les caractéristiques et les qualités du niébé que les parties prenantes, en particulier les consommateurs, préfèrent. Un plan de recherche quantitatif transversal a été utilisé pour collecter les données en utilisant des techniques d'échantillonnage en plusieurs étapes, en boule de neige et de convenance auprès des cultivateurs de niébé (n=415), des commerçants (n=60) et des consommateurs (n=120). Des questionnaires validés par le contenu et des programmes d'entretiens structurés ont été utilisés pour collecter les données. Les statistiques descriptives, les écarts types, le test du chi carré et le test H de Kruskal-Wallis ont été utilisés pour analyser les données. L'étude a révélé un faible niveau de participation de toutes les parties prenantes (agriculteurs, consommateurs et commerçants) au développement de nouvelles variétés de niébé dans le nord du Ghana. En outre, les agriculteurs préfèrent les variétés de niébé améliorées avec des attributs de culture tels que la taille moyenne et droite des gousses, les variétés avec un potentiel de rendement, les variétés à maturation précoce, tolérantes à la sécheresse et résistantes aux parasites et aux maladies. L'étude a révélé que les parties prenantes préfèrent le niébé qui a une texture lisse de la couche et des variétés faciles à cuisiner. De plus, les agriculteurs préfèrent les niébés à grain moyen, tandis que les consommateurs et les spécialistes du marketing préfèrent les niébés à gros grain. Il existe des différences statistiquement significatives entre les parties prenantes et leurs préférences en termes de texture de l'enveloppe, de taille de grain et de facilité de cuisson. L'étude recommande, entre autres, que les scientifiques et les sélectionneurs intègrent les attributs de la culture et du grain tels que la texture de l'enveloppe, la taille du grain et la facilité de cuisson préférés par les parties prenantes dans les futurs programmes de sélection du niébé.

Mots clés : Variété améliorée, sélection végétale participative, parties prenantes, préférences, *Vigna unguiculata*.

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## Introduction

Cowpea [*Vigna unguiculata* (L.) Walp.] is one of the world's commonly grown and eaten grain pulses, especially in the dry and semi-dry areas in the tropics (Noubisie *et al.*, 2010). In present times, varietal growth in Ghana has seen greater investment culminating in the release of multiple crop varieties such as maize, sorghum, millet, groundnut and cowpea. Despite the accessibility to these new varieties in combination with the government's and its development partners advertising attempts, the awareness and acceptance of these new varieties appears to be declining due to poor distribution schemes in place and some varieties are not preferred by farmers and consumers (Etwire *et al.*, 2013). In spite of cowpea's monetary and dietary significance to consumers and farmers, the discrepancy between improved cowpea varieties and consumer preference hampers cowpea production (Faye *et al.*, 2004).

Several studies have reported mainly on breeding for improved cowpea varieties in sub-Saharan Africa, but adoption rates remain poor and some varieties may not be accepted in some instances due to non-compatibility or relevance with the requirements and views of stakeholders (Saidou *et al.*, 2011). There are several visual features of cowpeas preferred, at least in Ghana, by stakeholders. Stakeholders, however, perceive little benefit from the improved varieties as such varieties do not meet their needs.

Participatory plant breeding (PPB) is a crop breeding approach based on the concept that farmers and other stakeholders share their knowledge, expertise and seeds as equal partners alongside agricultural researchers. Such partnerships lead not only to more efficient crop management methods, but also enhance the ability of farmers to experiment, learn and adopt new varieties (Steinke *et al.*, 2016). The vital element of highly efficient participatory plant breeding is cooperation among farmers,

other stakeholders, and formal breeders through different phases of the breeding cycle.

In addressing the degree of participation of stakeholders in the development and release of improved cowpea varieties, the five (5) main levels or degree of participatory plant breeding, i.e., conventional, consultative, collaborative, collegial, and farmer experimentation as describe-try Lilja and Ashby (1999) needed to be used.

According to Lilja and Ashby (1999), at the conventional degree of participatory plant breeding, scientist make breeding choices alone without structured communication with farmers and other stakeholders. In terms of consultative degree of development and release of improved cowpea varieties, scientist make plant breeding decision with a systematic one-way communication with stakeholders. At this stage cowpea varietal preference and priorities of farmers may or will not be factored in during the final decision making among scientists. Collaborative stage of participatory plant breeding involves activities such as setting of goals for breeding process, selection of varietal preferences, collection of cowpea lines, selection of project site, multiplication of new cowpea lines and distribution of new cowpea lines with a two-way structured communication between scientist and stakeholders.

Collegial level of participatory plant breeding involves setting of goals for breeding process, selection of varietal preferences, collection of cowpea lines, selection of project site, multiplication of new cowpea lines and distribution of new cowpea lines among stakeholders through a structured communication with scientists. At this level of participation farmers or stakeholders acquire data on the priorities of scientists through a structured communication, while Farmer experimentation (no scientist participation) mainly involves collection of cowpea lines, selection of project site and multiplication of new cowpea lines without a structured interaction with scientist (s).

In order to guarantee recognition and eventual adoption, farmer or stakeholders involvement in the breeding of crop varieties is essential (Gyawali *et al.*, 2007). This is critical when it comes to determining which features farmers value or prefer. Owing to the characteristics deemed undesirable, the breeders sometimes remove many lines during the selection phase.

The objectives of this study were therefore to compare stakeholders (farmers, marketers, and consumers) preferred traits and attributes of new cowpea varieties to be developed and to compare the degree of participation of major stakeholders (farmers, marketers, and consumers) in the development and release of new cowpea varieties. The hypothesis tested were;

1.  $H_0$ . There is no statistically significant difference in all the preferred grain attributes of new cowpea varieties to be developed among cowpea farmers, marketers, and consumers, and,
2.  $H_0$ . There is no statistically significant difference in the degree of participation in the development and release of new cowpea varieties between cowpea farmers, marketers, and consumers.

## Methodology

The study was conducted in the Northern region off Ghana. The region occupies an area approximately 70,384 square km and lies between latitude 9 ° 29' 59.99 "N and longitude 1 000' 0.00" W. This is much drier than the southern regions of Ghana because of its closeness to the Sahel and the Sahara. The vegetation comprises mainly of grassland, particularly savannah with clusters of dry trees such as baobabs and acacias.

A cross-sectional survey design was used to determine the status and inter-relationships of the research variables. This survey design was employed because the data were gathered at one stage in time. The population for the study was major cowpea stakeholders (farmers, marketers, and consumers) in the Northern region of Ghana. Collection of primary data for this study involved the

use of content-validated questionnaires and structured interview schedules.

A multistage sampling procedure was employed in the selection of cowpea farmers from four districts, namely, Yendi municipal, Savelugu municipal, Nanumba North and South districts all in the Northern region of Ghana. At the first (I) stage of the sampling, simple random sampling was used to select the four districts. At the second (2) stage 20 communities/villages, five from each district were selected by simple random selection based on the number of cowpea farmers in the various communities/villages. Finally, the systematic random sampling was used to select 495 cowpea farmers from the selected 20 communities/villages. Snowball sampling procedure was employed to select 60 cowpea marketers, 15 from each district, while Convenience sampling procedure was used to select 120 cowpea consumers, 30 from each district. An overall sample size of 595 cowpea major cowpea stakeholders was used for the study.

The data obtained were subjected to both descriptive and inferential statistics, using IBM Statistical Package for Social Science (SPSS) version 25 software. Descriptive statistics, Chi-square test and Kruskal-Wallis H test were the main statistics used in analysing the data.

## Results and discussion

**Comparison of stakeholders (farmers, marketers, and consumers) preferred traits and attributes of new cowpea varieties to be developed.** The results showed that more than one-quarter of the farmers preferred improved cowpea varieties with medium pod size and varieties with straight pods. This may be attributed to the fact that cowpeas with straight pods usually set several seeds. In decreasing order of importance, yield potential, early maturing, drought tolerance, pest and disease resistant varieties, varieties with high above ground plant morphology, tenderness of the leaves, and varieties with more leaves were the most preferred traits of improved cowpea varieties to be developed.

In terms of stakeholders preferred grain attributes of improved cowpea varieties to be developed, the results showed that there was a statistically significant difference between stakeholders (farmers, consumers, and marketers) in terms of their preference for texture of the coat ( $\chi^2 = 10.150$ ,  $p = 0.006$ ), grain size ( $\chi^2 = 13.819$ ,  $p = 0.006$ ), and cookability ( $\chi^2 = 6.033$ ,  $p = 0.049$ ). This implies that stakeholders preference for texture of the coat, grain size, and cookability are very important attributes which need to be incorporated in breeding of new cowpea varieties since they differ significantly among stakeholders.

The study, therefore, rejected the second null hypothesis which stated that ‘there was no statistically significant difference in all of the preferred grain attributes of new cowpea varieties to be developed among cowpea farmers, marketers, and consumers’.

**Participation of major stakeholders (farmers, marketers, and consumers) in the development and release of the new cowpea varieties.** The results in Table 1 showed that there was low participation of individual stakeholders [Farmers ( $\bar{x} = 1.96$ ,  $SD = 1.03$ ), Consumers ( $\bar{x} = 1.94$ ,  $SD = 1.05$ ) and Marketers ( $\bar{x} = 2.08$ ,  $SD = 1.27$ )] in terms of participation in the development and release of improved cowpea varieties. In other words, currently farmers, marketers, and consumers do not make any significant contribution during the development and release of improved cowpea varieties. This implies that the three categories of stakeholders were not involved in an organized communication with scientists or breeders during development and release of improved cowpea varieties.

There was ‘low’ participation of individual stakeholders [Farmers ( $\bar{x} = 2.46$ ,  $SD = 1.43$ ), Consumers ( $\bar{x} = 2.29$ ,  $SD = 1.26$ ) and Marketers ( $\bar{x} = 2.38$ ,  $SD = 1.42$ )] in the development and release of improved

cowpea varieties at the consultative stage. This implied that scientists make cowpea breeding decisions alone without organized communication with the stakeholders. This shows that scientist or breeders rely on the opinions and varietal preferences of stakeholders to only a small extent during the development and release of new improved cowpea varieties (Table 1).

The results also showed that, the level of participation of the stakeholders were ‘low’ [farmers ( $\bar{x}$  = 2.22, SD= 1.31), consumers ( $\bar{x}$  = 2.07, SD= 1.17), and marketers ( $\bar{x}$  =1.90, SD= 1.11)] at the collaborative stage of development and release of improved cowpea varieties. The result implies that there was a weak link between scientists and stakeholders in terms of a structured two-way communication in understanding each other’s thoughts and priorities for the breeding of improved cowpea varieties (Table 1).

The results further showed that, the level of participation in the development and release of improved cowpea varieties of individual stakeholders [Farmers ( $\bar{x}$  = 2.23, SD= 1.28), consumers ( $\bar{x}$  = 2.07, SD= 1.20) and marketers ( $\bar{x}$  = 2.29, SD= 1.43)] at the collegial level were ‘low’. This suggests that stakeholders rely on breeding protocols from scientists to only a small extent during the development of improved cowpea varieties (Table 1).

The result also showed that the level of participation of individual stakeholders [Farmers ( $\bar{x}$  = 2.59, SD= 1.52), consumers ( $\bar{x}$  = 2.09, SD= 1.26) and marketers ( $\bar{x}$  = 2.27, SD= 1.43)] at the farmer experimentation stage of the development and release of improved cowpea varieties was ‘low’. The ‘low’ level of participation of the individual stakeholders at the farmer or stakeholder experimentation (no scientist participation) suggest that farmers and other stakeholders do not experiment (multiplication of seeds) with the introduced new genetic material in the course of variety development (Table 1).

The results suggested that stakeholders were also not actively involved in the development and release of improved cowpea varieties. The Kruskal-Wallis H test revealed no statistically significant difference in the overall participation in the development and release of improved cowpea varieties among the three stakeholders (farmers, n = 412: consumers, n= 119: marketers, n= 60),  $1-1 (2, n= 592) = 2.144, p= 0.342$ .

The study, therefore, accepted the first null hypothesis that stated that ‘there were no statistically significant difference in the degree of participation among cowpea farmers, marketers and consumers in the development and release of new cowpea varieties’.

**Table 1. Differences and degree of participation in the development and release of improved cowpea varieties among Stakeholders**

Degree of Participation	Farmers (n=415)			Consumers (n=120)			Marketers (n=60)			All stakeholders (n=592)		
	No Participation		Participation	No Participation		Participation	No Participation		Participation	No Participation		Participation
	(%)	$\bar{X}$	SD	(%)	$\bar{X}$	SD	(%)	$\bar{X}$	SD	(%)	$\bar{X}$	SD
Conventional	1.2	1.96	1.03	0.8	1.94	1.05	-	2.08	1.27	1.0	1.95	1.01
Consultative	46.5	2.46	1.43	45.0	2.29	1.26	50.0	2.38	1.42	45.9	2.43	1.37
Collaborative	37.8	2.22	1.31	40.0	2.07	1.17	43.3	1.90	1.11	38.0	2.21	1.27
Collegial	46.5	2.23	1.28	44.2	2.07	1.20	46.7	2.29	1.43	45.0	2.24	1.27
Farmer Experimentation	39.8	2.59	1.52	41.7	2.09	1.26	45.0	2.27	1.43	39.7	2.48	1.46
Overall Participation	0.7	2.03	0.89	0.8	1.82	0.79	-	1.85	0.79	0.9	2.79	0.54

**Table 2. Kruskal-Wallis H test of stakeholders participation in the development and release of improved cowpea varieties**

Stakeholders	n	Median		Value
Farmers	412	3.00		
Consumers	119	2.92	Kruskal-Wallis H	2.144
Marketers	60	3.00	Df	2
Total	591	3.00	P	0.342

n=595,  $p < 0.05$  Scale on level of Participation (1=Very low, 2=Low, 3=Moderate, 4=High, 5=Very high). Source: Field Survey (2019)

### Conclusion and recommendation

The participation of the three stakeholders (farmers, marketers, and consumers) at the conventional, consultative, collaborative, collegial, and farmer experimentation degree of participation in the development and release of improved cowpea varieties were low, with no significant difference in participation among the three stakeholder groups.

In terms of crop attributes, majority of the farmers showed preference for medium and straight pods which are high yielding, early maturing, drought tolerant, and resistant to pests and diseases. Also, attributes such as above ground biomass, tenderness of leaves, and varieties with more leaves were preferred as key attributes in development of improved cowpea varieties.

Regarding grain attributes, stakeholders expressed preferences for varieties with smooth seed coat, medium grain size, and easy to cook grains while Consumers and marketers preferred varieties with smooth seed coat, large grain size, and easy to cook grains.

The study therefore recommends that;

1. In breeding of new cowpea varieties, research institutions and plant breeders should also incorporate preferred crop and grain characteristics such as texture of the coat, grain size, and cookability of cowpea grains as preferred by stakeholders;
2. Plant breeders should focus on identified consumer preferences namely smooth seed coat, large grain size, and easy to cook grains in their breeding programmes;
3. Research institutions and plant breeders need to strengthen the participatory plant breeding (PPB) process, particularly collaborative type of PPB which involves a two-way structured communication between scientists and major cowpea stakeholders. With this kind of PPB, breeding priorities and decision-making power concerning cowpea breeding is shared among scientists and stakeholders.

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