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Research Application Summary

Cowpea seed systems in the Central Region of Ghana: Agronomic performance and yield

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Abstract

Cowpea (*Vigna Unguiculata* L.Walp) is an essential legume crop in Ghana and mostly grown for its dry grains but the fresh leaves and pods are also consumed. The quality of seed determines the overall yield and market value of the final produce. The use of quality seeds helps greatly to achieve higher production per unit area necessary to attain food security However in Ghana, the seed system for cowpea is not well developed and there is always a challenge of obtaining high quality seed to plant coupled with the low yields recorded in farmers' fields. This research was therefore conducted to assess the quality of cowpea seeds as marketed in the Central Region of Ghana. Seeds were obtained from 16 different agro input shops in the Central Region of Ghana including a sample from a wholesale shop in the Greater Accra Region which was used as a check. The seeds were evaluated in the field for two seasons using a randomized complete block design with three replications. Data were collected on agronomic, yield and related traits. The data were subjected to the analysis of variance (ANOVA) procedure using Genstat edition 12 and means were separated using least significant differences at 5% probability level. The yield, number of branches per plant, number of peduncles per plant and number of pods per plant all showed' significant differences (<.001) among samples obtained from the 16 different agro input shops both in the minor and major seasons. Seeds obtained from the Grains and Legumes Development Board (GLDB) and Agrimat recoded the highest yield (2.6 and 1.89 tons ha^{-1} respectively). Seeds obtained from most of the agro input shops produced yields below the national average of 1.3 tons ha-` suggesting a problem with the cowpea seeds system in the region. For high yields, seeds should therefore be obtained from GLDB and Agrimat.

Key words: Certified seed, cowpea, Ghana, seed source, seed quality, *Vigna unguiculata*

Resume

Le niébé (*Vigna Unguiculata* L.Walp) est une culture de légumineuses essentielle au Ghana et est principalement cultivé pour ses grains secs, mais les feuilles et les gousses fraîches sont également consommées. La qualité des semences détermine le rendement global et la valeur marchande du produit final. L'utilisation de semences de qualité aide grandement à atteindre une production plus élevée par unité de surface nécessaire pour atteindre la sécurité alimentaire. Cependant, au Ghana, le système de semences pour le niébé n'est pas bien développé et il y a toujours un défi pour obtenir des semences de haute qualité à planter, couplé avec les faibles rendements enregistrés dans les champs des agriculteurs. Cette recherche a donc été menée pour évaluer la qualité des semences de niébé commercialisées dans la région centrale du Ghana. Les semences ont été obtenues auprès de 16 différents magasins d'intrants agricoles dans la région centrale du Ghana, y compris un

échantillon provenant d'un magasin de gros de la région du Grand Accra qui a servi de contrôle. Les semences ont été évaluées sur le terrain pendant deux saisons en utilisant un plan en blocs complets randomisés avec trois répétitions. Des données ont été recueillies sur les caractéristiques agronomiques, le rendement et les caractéristiques connexes. Les données ont été soumises à la procédure d'analyse de la variance (ANOVA) en utilisant Genstat édition 12 et les moyennes ont été séparées en utilisant les différences les moins significatives à un niveau de probabilité de 5%. Le rendement, le nombre de branches par plante, le nombre de pédoncules par plante et le nombre de gousses par plante ont tous montré des différences significatives (<.001) entre les échantillons obtenus à partir des 16 différents magasins d'intrants agricoles à la fois dans la petite et la grande saison. Les semences obtenues auprès du Conseil de développement des céréales et des légumineuses (GLDB) et d'Agrimat ont enregistré le rendement le plus élevé (2,6 et 1,89 tonnes ha-1, respectivement). Les semences obtenues dans la plupart des magasins d'intrants agricoles ont produit des rendements inférieurs à la moyenne nationale de 1,3 tonnes ha-1, ce qui suggère un problème dans le système de semences de niébé dans la région. Pour obtenir des rendements élevés, les semences devraient donc être obtenues auprès du GLDB et d'Agrimat.

Mots clés : Semences certifiées, niébé, Ghana, source de semences, qualité des semences, Vigna unguiculata.

Introduction

Cowpea [*Vigna unguiculata* (L.) Walp.] is one of the most important food and forage legumes grown in the semi-arid tropics and some temperate regions of the world (Timko and Singh, 2008; Timko *et al*, 2008). West Africa has genetically diverse forms of cultivated cowpea (Madamba *et al*., 2006). It is the second most consumed legume in Ghana (Egbadzor *et al*., 2013). An estimated 4.5 million metric tonnes of cowpea is produced worldwide on 12 to 14 million hectares of land (Singh *et al*., 2002; Boukar *et al*., 2016) with Nigeria and Niger being leading producers in Africa (Timko and Singh, 2008).

Cowpea grain is highly nutritious and contains about 15.06 - 38.5% protein (this differs among cowpea varieties) (Ravelombola *et al*., 2016), and has the ability to improve soil fertility by fixing nitrogen in the soil in association with soil bacteria (*rhizobia*) (Agyemang *et al*., 2014). It is an important legume produced mainly by resource-poor smallholder farmers for livelihood purpose in Ghana. It is a source of employment for farmers in rural areas as well as for traders in the urban areas (Langyintou *et al*., 2003). The bulk of the crop is produced within the Sahel and Sudan agro-ecological zones and the fringes of the forest agro-ecological zones (CRI, 2006; Chiamaka, 2014). The fresh leaves, fresh pods and dry seeds are consumed in various dietary combinations throughout Ghana. The dry grains are boiled and eaten with `gari' and fried ripened plantain. The flour obtained from the dry cowpea seeds can also be made into dough and fried in cooking oil called, `kose'.

Inspite of the significant contribution of cowpea to food and nutrition security in Ghana, the current average yield of the crop (1.3 mt ha^{-1}) recorded from farmers' fields across the country is lower than the achievable yield (3 t/ha) and yields have declined over the years (MoFA, 2016). The wide yield gap has been attributed to several biotic and abiotic constraints including low supply of certified seeds to the farmer due to the non-existent of a well-developed cowpea seed system. Source of seed supply to most cowpea growers has been largely through the informal sector and, to a smaller extent, through some agro input dealers who in most cases have been criticized for selling low quality seeds to the farmers. The objective of this study was therefore, to determine the agronomic performance and yield of seeds obtained from different agro input dealers and some markets (for grains) across the Central Region of Ghana.

Methodology

The Central Region of Ghana was demarcated into six zones (Table 1) from which agro input dealers were sampled. In all cowpea seeds were purchased from 16 different agro input shops and these included one wholesale shop from the Greater Accra Region (Agrimat) and another sample from the Grains and Legumes Development Board (GLDB) in the Central region to serve as controls for the experiment. During seed sampling from the various agro input dealers, questionnaires were also administered to collect information such as the use of seed, packaging used, type of building material used in constructing the shops, e.t.c. The GPS coordinates were taken for the purpose of traceability.

Table 1. Summary of shops sampled as source of cowpeas

Sample	Name of shop	Location	Sources of seeds supply
1	Kotokuraba	Cape Coast	Techiman
2	Abura	Cape Coast	Techiman
3	Tina	Cape Coast	Winneba
4	Set Apart	Kasoa	Winneba
5	Big Joe	Kasoa	Winneba
6	Pejamc	Kasoa	Winneba
7	Kwafo	Assin Fosu	Winneba
8	Original	Assin Fosu	Assin Fosu
9	E.ofori	Assin Fosu	Kumasi
10	Ato	Assin fosu	Kumasi
11	Grains and Legumes Development Board (GLDB)	Winneba	Kumasi
12	Grace	Winneba	Accra
13	Agrimat	Accra	Accra
14	Esi	Jukwa	Assin Fosu
15	Fosu branch	Mankessim	Winneba
16	Francisco	Mankessim	GLDB

The seed samples were evaluated in the field during the 2018 minor season (September - December), and then repeated during the 2019 major season (April - August) at the Teaching and Research Farm, University of Cape Coast, Cape Coast. The experiments were laid out in a randomized complete block design with three replications. Data on yield and yield components were collected from the six plants in the middle row of each plot and the data were subjected to the analysis of variance (ANOVA) using Genstat edition 12 and means were separated using Fisher's least significant difference (LSD) test at 5% probability level.

Results and discussion

Among all the agro input shops, seeds obtained from'Ato' recorded the highest number of branches per plant (7) whiles samples obtained from GLDB and 'Big Joe' recorded the lowest number of branches (4) in the minor season while in the major season, 'Esi' recorded the highest number of branches (7) with Pejamic' recording the lowest number of branches (4.3) (Table 2). Peduncles are formed from the branches and therefore the higher the number of branches the higher the number of peduncles. The yield of cowpea depend on the number of peduncles as pods are borne on peduncles formed.

Samples obtained from 'Set Apart' and Agrimat recorded the highest number of peduncles per plant (33 and 37) in the minor and major seasons, respectively. On the other hand, samples obtained from 'Esi' recorded the lowest number of peduncles per plant (20 and 24) in both (minor and major) seasons, respectively. Samples which produced higher number of peduncles also had higher number of pods and hence, higher yield. On the other hand, some samples which recorded higher number of peduncles recorded lower yield. This was dirr attributed to the effect of some diseases which were recorded during the study (see Agrios 2005) and also due to genetic variability of the seed type (Acquaah, 2007).

Samples obtained from GLDB recorded the highest number of pods per plant both in the minor and major seasons (17 and 51, respectively) while samples obtained from 'Esi' recorded the lowest number of pods per plant both in the minor and the major seasons (9 and 13, respectively).

Table 2. Growth parameters of cowpea from seeds sourced from 16 different agro input shops

	Means (number of branches / plant)		Means (number of peduncles / plant)		Means (number of pods / plant)	
Names of agro shops	SEASON 1	SEASON 2	SEASON 1	SEASON 2	SEASON 1	SEASON 2
Abura-CC	5	6.33	25.5	31.67	10.33	14.33
Agrimat-AC	4.33	5.33	32	36.67	16	43.33
Ato-AF	7	5.33	23.7	28	10.33	17
Big Joe-KS	4	5.33	25	27.33	13.33	41.67
E. Ofori-AF	5.33	6	31	32.33	12.33	16.67
Esi-JK	4.33	7	19.7	24	9	13
Fosu Branch-MK	4.67	5.67	26.7	29.33	11.33	20.67
Francisco-MK	0	0	0	0	0	0
GLDB-WN	4	5.67	32.2	30.67	17	51.33
Grace-WN	4.33	6.33	22.7	26.33	12	31
Kotokoraba-CC	5.67	6.67	26	32.67	10.33	15.67
Kwafo-AF	5.67	6	22.7	25.67	9.67	14.33
Original-AF	6.33	6.33	24.3	27.33	9.67	15
Pejamic-KS	4.33	4.33	28.3	28.67	15.67	35.67
Set Apart-KS	4.67	5.67	33	31.33	14	36
Tina- CC	5.67	6.67	20	26	9.67	17.67
LSD (5%)	2.23	1.1	12.21	10.72	3.9	9.06
CV (%)	28.4	11.9	29.9	23.6	20.9	22.7
F Pr.	<.001	<.001	0.002	<.001	<.001	<.001

Yields of cowpea from 16 different agro input shops. Figure 1 shows the yield of cowpea both in the minor season of 2018 and the major season of 2019. There were highly significant differences (<.001) among the samples obtained from the different agro input shops both in the minor and major seasons. In the minor season, samples obtained from Agrimat in the Accra region recorded the highest yield of 971 kg/ha followed by GLDB with 927 kg/ha while sample obtained from 'Original' in Assin Fosu had the lowest yield of 297 kg/ha. On the other hand, seeds obtained from GLDBid the highest yield of 2,615 kg/ha followed by seeds obtained from Agrimat with 1,893 kg/ha yield. Seeds obtained from Esi in Jukwa had the lowest yield of 192 kg/ha. It is worth knowing that seed samples from Agrimat and GLDB served as checks in the study as these two sources were

either wholesale points (Agrimat) or the main government agency which handles foundation and registered seeds developed by the research institutes or plant breeders; they are also charged with the responsibility of producing certified seeds to make them available. The high yields recorded for samples obtained from these two outlets were therefore not surprising as the quality of seeds handled by these two outlets were expected to be of higher quality.

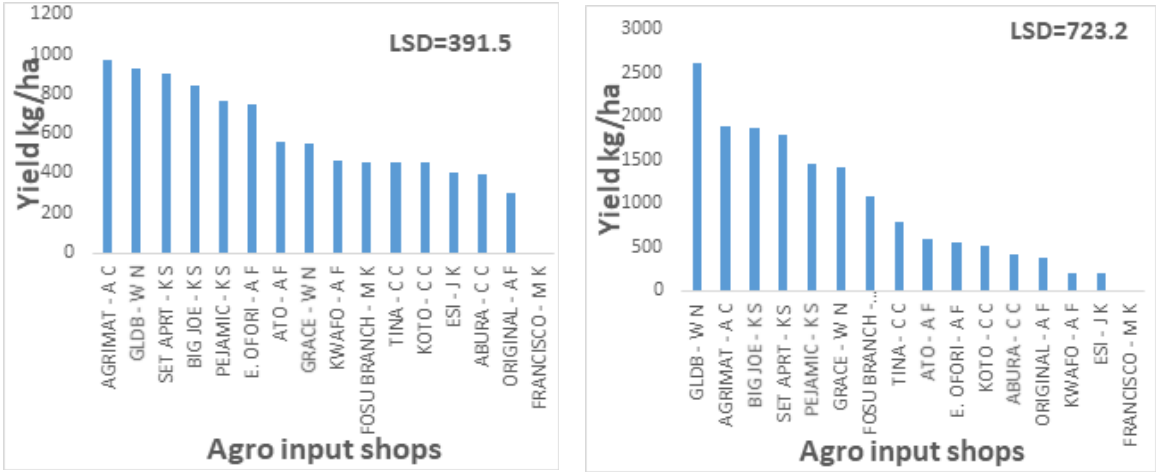

Figure 1. Yield of cowpea seeds obtained from 16 different agro input shops during the minor and the major seasons

Conclusions

Most of the samples obtained (9 out of 16) recorded yields below the average yield of 1.3 tons/ha reported for the country. However, seed samples obtained from the Kotokoraba market (grain) produced relatively higher yield compared to five other samples obtained from agro input shops which were expected to have higher quality. Overall, cowpea seeds sold at most of the agro input shops were of low quality. Seeds obtained from Agrimat and GLDB yielded best and could therefore be recommended to farmers and other seed users as reputable source of quality seeds are required.

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