J. Agric. Food. Tech., 7(6)1-11, 2017

ISSN 2090 – 424X
Journal of Agriculture and Food Technology
www.textroad.com

Farmers' Preferred Traits and Perceptions of Cowpea Production and Constraints in Niger

M. Salifou[1], J. B. L. S. Tignegre[2], P. Tongoona[3], S. Offei[3], K. Ofori[3], E. Danquah[3]

[1]National Agricultural Research Institute of Niger, Tahoua Regional Research Centre, Niger
[2] The world Vegetable Centre, West and Central Africa Samanko research station, Bamako, Mali
[3] West Africa Centre for Crop Improvement, University of Ghana, Accra, Ghana.

ABSTRACT

Cowpea is an important crop in West African drought prone farming systems. Understanding farmers' knowledge regarding production constraints and varietal preferences is invaluable in breeding for cowpea improvement. A participatory rural appraisal was carried out in 2013 in three districts of Niger in order to identify the place of cowpea in the farming system and its production constraints as well as farmers' knowledge on *Striga* and their cowpea preferred traits. All the farmers ranked cowpea as the second most important crop after pearl millet. Cowpea is grown for both food (56 %) and cash (44 %). Farmers grew nine main varieties with one most popular in each district, Kware in Kollo, KVx30-309-6G in Aguié and IT90K-372-1-2 in Magaria. However, the top three farmers' preferred varieties across all the sites were: IT90K-372-1-2, KVx30-309-6G and TN5-78. The most important variety selection criteria used were respectively high yield potential, early maturity, white-colored grain coat and good taste. The major constraints to production were insects, *Striga*, drought, low soil fertility. The results indicated that farmers have their own preferences which should be considered in breeding strategies.
KEYWORDS: breeding strategies, cowpea, farmers, participatory rural appraisal, *Striga*

INTRODUCTION

Cowpea is an important and strategic crop for small-scale farmers in Niger because of its high protein content and market value. Its production has significantly increased from 515 MT to 1,700 MT during the last decade [1]. Cowpea is grown at all agricultural zones in Niger but its production is severely affected by *Striga gesnerioides* [2]. Several control methods such as cultural practices, biological, physical and chemical have been recommended however, S. gesnerioides is still a biological constraint to cowpea production in the country. In Niger, the adoption of new agricultural technologies has been slow by farmers [3; 4]. According to Mazzucato, [4] only 5% of improved millet seed and less than 1% of improved cowpea seed were grown by farmers in 1990. In 2013, the improved seeds rate of adoption range from 8 to 10 % for the same crops [5]. Due to the low adoption rates of improved varieties, it has become necessary to obtain information on the end-users perceptions and preferences, and constraints affecting the crop in the development of varieties for any successful and sustainable breeding programme. Participatory methods have been used in developing countries to make use of rural community's knowledge in agricultural research. A participatory rural appraisal (PRA) enables local communities to analyze their own conditions, plan and make decisions [6]. In 2008, a participatory study was implemented by the Netherland's "Development Organization" in Niger (SNV) to analyze cowpea production system and development opportunities in Maradi region. In another study, funded by the Generation Challenge Programme between 2008 and 2009, to identify potential sources of *Striga* resistance, farmers were engaged in order to understand their problems and preferences. Participating farmers
In Niger acknowledged that *Striga* was a serious and increasing challenge to cowpea production [7]. This present study focuses on other cowpea production districts.

The objective of this research was to obtain information on cowpea, production constraints, farmers' knowledge about *Striga gesnerioides* and their preferred cowpea traits.

MATERIALS AND METHODS

Study area

The PRA was conducted in Kollo (13°20'21''N and 2°18'59''E), Aguié (13°30'12''N and 7°46'37''E) and in Magaria (12°59'53''N and 8°54'35''E) from the 3rd to 12th February 2013. At Kollo the PRA was carried out in Sakay Koira Tegui, Sakay Koira Zeno and Winde Day Tegui. At Aguié the PRA was undertaken in Dan Saga,

Corresponding author: Dr Mahamadou Salifou, National Agricultural Research Institute of Niger, Tahoua Regional Research Centre, Tel. No: (00227) 92368468/89468874. Email: masalif2000@yahoo.fr.

Nakikarfi and Debi while at Magaria the PRA was conducted in the villages of Getshi, Angoual Gamji and Incharoua peulh. A total of 126 farmers attended in the PRA sessions with equity of gender (Table 1).

Table 1: Sites, number of farmers and dates of PRA sessions

Villages	Districts	Regions	No of farmers		Dates for PRA
			Females	Males	
Sakay K. Tegui.	Kollo	Tillabéri	7	7	03/02/2013
Sakay K. Zeno	Kollo	Tillabéri	7	7	03/02/2013
Winde D. Tegui	Kollo	Tillabéri	7	7	04/02/2013
Dan Saga	Aguié	Maradi	7	7	09/02/2013
Nakikarfi	Aguié	Maradi	7	7	09/02/2013
Debi	Aguié	Maradi	7	7	10/02/2013
Getshi	Magaria	Zinder	7	7	11/02/2013
Angoual Gamji	Magaria	Zinder	7	7	11/02/2013
Incharoua peulh	Magaria	Zinder	7	7	12/02/2013

Cowpea traders (13) and processors (14) were interviewed in addition to the group discussions to gather information on market and consumer's requirements.

A preparatory visit was conducted two weeks before the PRA sessions in each district agricultural office to discuss the questionnaires with a team of extension officers and identify the villages and farmer groups. The team sensitized the farmers about the PRA sessions.

PRA data collection and analysis

The PRA implementation team included a facilitator, a technician, and in each district an extension officer. At each site, the local extension officer facilitated the discussion in the local dialect. The focus group discussion was composed of fourteen farmers, seven of each gender (Figure 1). The discussions were conducted separately; women were taken before men wherever it was possible. The preferences of farmers were assessed using priority ranking and scoring. The different farmer groups were given 100 stones to rank cowpea varieties so that any given number to a variety was converted in percentage. The results obtained were recorded in Excel and analyzed using non parametric statistics in SAS 9.2.

Figure 1: Female (a) and male (b) farmers in discussion

RESULTS

Cowpea farming system

The predominant crops grown in the three districts were pearl millet (*Pennisetum glaucum*), cowpea (*Vigna unguiculata*), sorghum (*Sorghum bicolor*), groundnut (*Arachis hypogaea*), false sesame (*Ceratotheca sesamoides*), roselle (*Hibiscus sabdarifa*), Tiger nut (*Cyperus esculentus*) and Bambara groundnut (*Voandzea subterranea*). At all sites, farmers ranked cowpea as the second most important crop after pearl millet (Table 2).

Table 2: Main crops grown by farmers and their rank order

Crop grown	Ranking	Kollo %	Aguié %	Magaria %
Pearl millet	1	41	41	41.16
Cowpea	2	30.5	25.83	28.33
Sorghum	3	7.83	20.83	12.33
Groundnut	4	3.16	3.66	14.16
Roselle	5	13.66	1.66	-
False sesame	6	3.5	5.16	3.66
Tiger nut	7	-	1.86	-
Bambara groundnut	8	0.35	-	0.36

Cowpea was mostly intercropped with pearl millet or sorghum; however some farmers grow it in pure stand culture for seed multiplication purposes and for testing new varieties. Across the sites, 56 % of the farmers grew cowpea for food and 44 % for cash. About 83 % of the farmers in Kollo district grew cowpea for food, while 67 % of the farmers in Aguié grew it as a cash crop. For participating farmers in the Magaria district, 50 % of them grew cowpea for food and 50 % for cash. Farmers in all districts preferred early cowpeas, as a supplement for major staple food like pearl millet, and grew cowpea because of its protein content. Some also indicated that financial needs were the reason for growing cowpea as a cash crop. Farmers in the three districts used all parts of cowpea plant. However, dried seeds were ranked number one in importance followed by leaves, stems and roots.

At all sites, women had poor access to land which is mostly men's or family property. However, at Aguié and Magaria districts, some women had their own farms aside from or within the family property. Farm size was generally small across all the sites. The average farm size ranged between 0.5 and 2 hectares. Farmers principally managed soil fertility by adding manure. There was very poor access to inputs. Most farmers indicated that they used crop rotation in their farming systems where cowpea was rotated with pearl millet or sorghum every one to two years. However, the rotation was not practiced fully because of limited land sizes.

Most farmers obtained their seeds from the market as they were available when required. Some improved varieties have been adopted though most farmers still grew their low-yielding and photoperiod sensitive landraces.

Currently grown Cowpea varieties and production constraints

The main cowpea varieties grown at the three districts included both the landraces such as Doungouri Kware, Dan Baushi, Dan Malan Idi, Dan Moussa, Banjarass, Oloca and the improved varieties IT90K-372-1-2, KVx30-309-6G and TN5-78. The landraces were grown only at specific districts of the study area, while the improved varieties were grown in least at two districts. Doungouri Kware was grown only at Kollo; Dan Baushi, Dan Malam Idi and Dan Moussa were grown at Aguié; and Oloca was grown at Magaria district. The improved KVx30-309-6G was grown at all the district while IT90K-372-1-2 was grown at Aguié and Magaria; and TN5-78 was grown at Kollo and Magaria.

Farmers identified a number of constraints to cowpea production. Their importance varied across sites. Insect pests were the most important constraints reported by farmers (33.64 %; 38.69 % and 40.83 %) followed by *Striga* (33.5 %; 35.16 % and 35 %) respectively. Drought was scored 18.5 %; 16.66 % and 24.17 % in Kollo, Aguié and Magaria respectively. Low soil fertility, land scarcity, late sowing, poor access to inputs and diseases were identified as minor constraints by farmers in Kollo and Aguié (Table 3).

Table 3: Main cowpea production constraints in Kollo, Aguié and Magaria

Constraints to production	Ranking	Kollo %	Aguié %	Magaria %
Insect	1	31.16	38.69	40.83
Striga	2	31	35.16	35
Drought	3	18.5	16.66	24.17
Low soil fertility	4	12.6	7.66	-
Late sowing	5	3.33	1.83	-
Land lack	6	1.83	-	-
Poor access to inputs	7	1.75	-	-
Disease	8	1.66	-	-

- Constraints not listed by surveyed farmers in 2013.

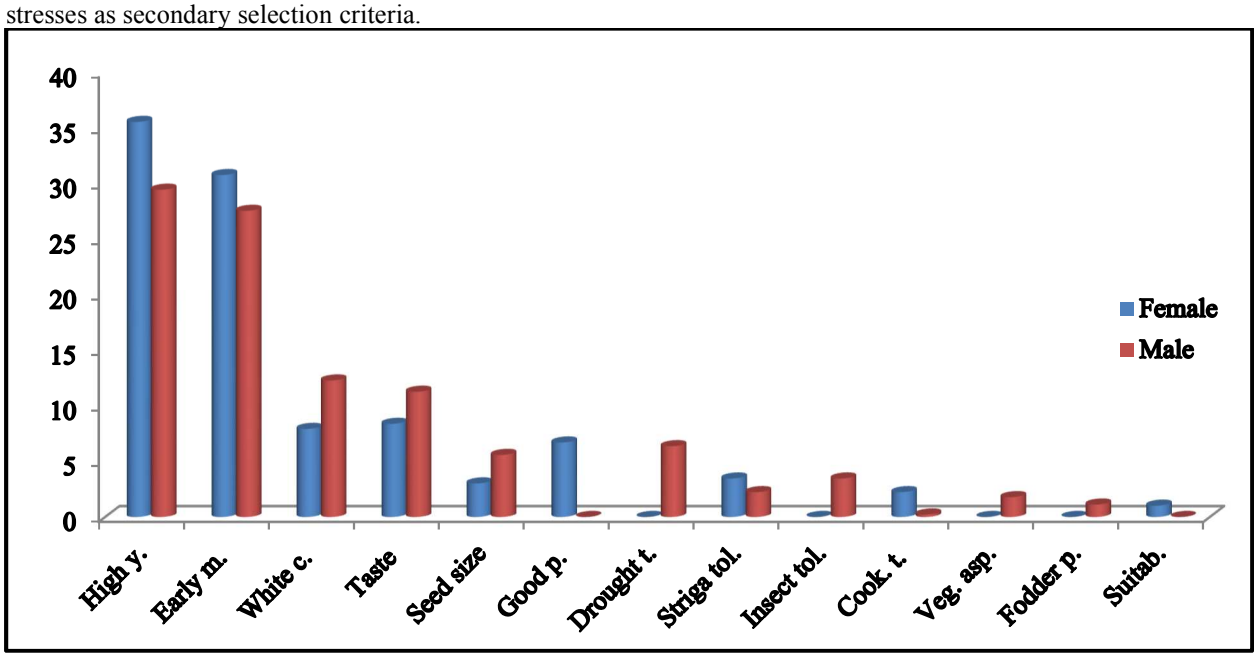
Farmers' knowledge about *Striga*

Across all the sites, farmers acknowledged having knowledge about *Striga*. They used a number of terms such as cowpea disease, weed that attacks cowpea, weed that emerges during rainy season, a scourge, a witch, etc.

Farmers mentioned several uses of *Striga* plants such as a cure for constipation, application to cut body surfaces; snake bite treatment, etc. Despite these beneficial uses of the *Striga* plant, farmers supported the eradication of this parasitic weed by any possible means. Farmers associated low soil fertility to *Striga* infestation. They were able to describe the major symptoms associated with *Striga* attack on cowpea plant. Farmers did not know any landrace that was resistant to *Striga*; and most of the improved varieties that were *Striga* resistant lacked their preferred traits such as white-colored seed and big sized grain. They mentioned hand-pulling followed by burning the dried biomass and fertilization as preventive measures but these are not always affordable to small-scale farmers.

Farmers' criteria for adopting varieties

Farmers rated high yield potential, early maturity, white-colored seed coat and good taste as the most important selection criteria in choosing cowpea varieties (Figure 2). Although insects, *Striga* and drought were the three major constraints to cowpea production identified, farmers considered resistance and/or tolerance to these stresses as secondary selection criteria.



High y.: high yield; **White c**.: white color; **Good p**.: good price; **Drought t**.: drought tolerance; ***Striga*, insect tol**: *Striga*, insect tolerance; **Cook. t.** cooking time; **Veg. asp**.: vegetative aspect; **Fodder p**.: fodder production; **Suitab**.: suitability for cooking local meal.

Figure 2: Farmers' criteria for adopting varieties

Study of grain quality

Farmers at all sites agreed that seed size and color were the most important features of grain quality. The results of their choices are presented in Figure 3 and 4. Most farmers (100% at Aguié and 75% at Magaria) preferred large seeded cowpea for consumption as well as for the market (83% at Aguié and 75% at Magaria). At Kollo district 58% of the farmers preferred the small seeded cowpea for their consumption and 55 % of farmers chose it for the market. White colored grain was preferred for consumption by all farmers in Kollo and Aguié, and 50% of the farmers in Magaria. About 99.96% and 100% preferred the white grained cowpea for market in Kollo and Aguié respectively. At Magaria district, 50% of the farmers preferred brown colored grain for the market, while only 25% of the farmers chose the white colored grain.

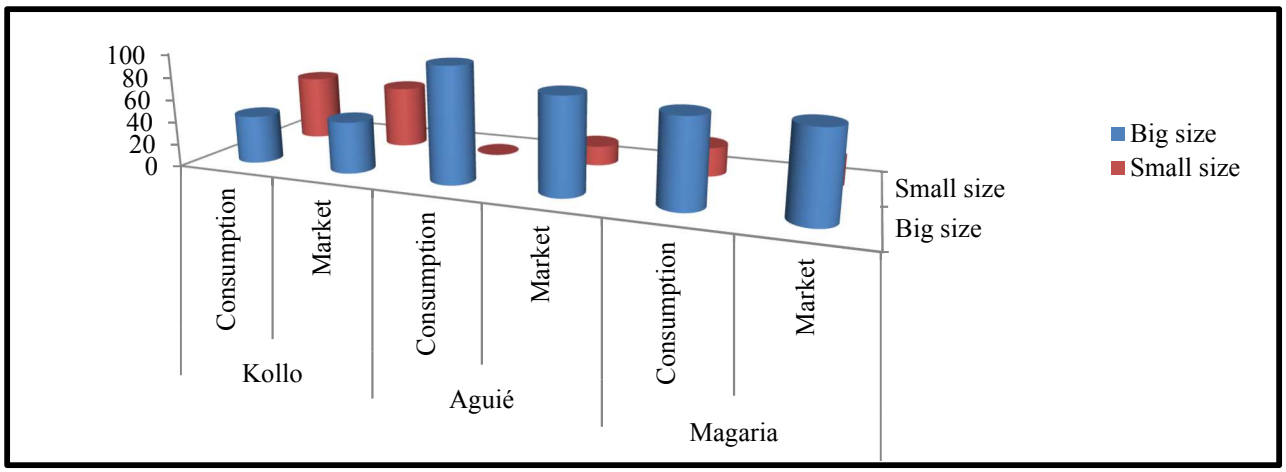


Figure 3: Farmers' preferences for grain size at Kollo, Aguié and Magaria districts

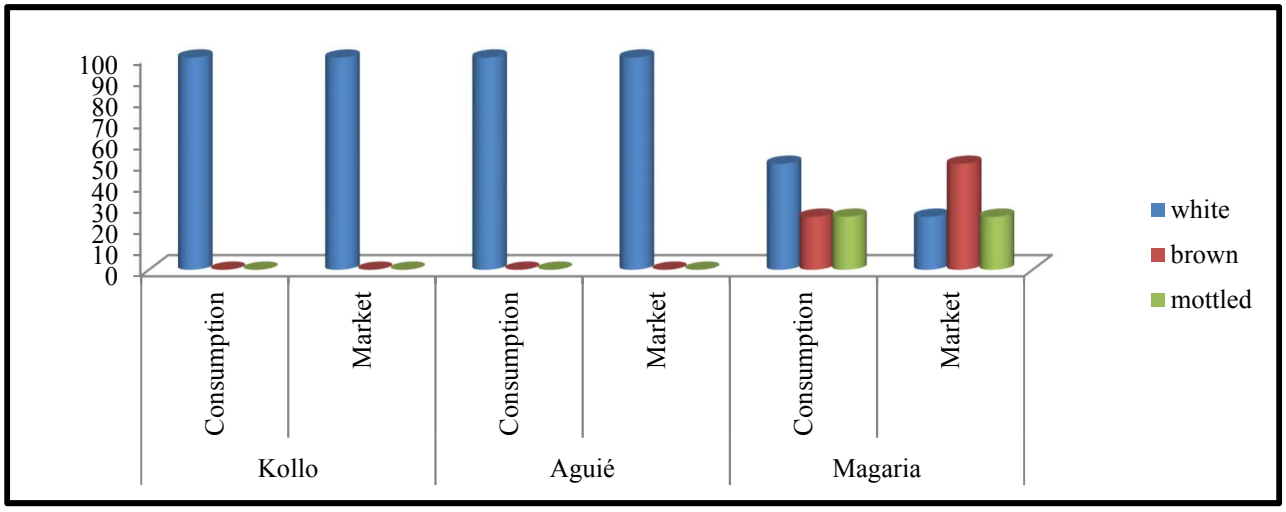


Figure 4: Farmers' preferences for grain color at Kollo, Aguié and Magaria districts

Farmers' preferred variety ranking based on grain characteristics.

In this section, only the top preferred varieties grown by farmers were used for the priority ranking (Figure 5).

Farmers' choice by sex and age (youth: below 40 years; elders: above 40 years old) is shown in Figures 6, 7, 8 and 9.

At Kollo district "Kware" (Figure 6) was rated higher than the two other varieties by all the groups except by the elders (45% by females; 43% by males and youths). KVx30-309-6G was ranked higher by elders (36% versus 35% for Kware).

At Aguié, KVx30-309-6G (Figure 7) was preferred to the four other genotypes by all the groups except by the youth, 28%, 27% and 30% of females, males and elders respectively. Dan Baushi was rated higher by youths (34% versus 20% for KVx30-309-6G).

Figure 5: Male (a) and female (b) farmers ranking cowpea varieties

At Magaria, 26% of females and 28% of youths preferred Banjaras (Figure 8) to the other four varieties while 28% of males rated IT90K-372-1-2 higher and 32% of elders preferred Oloca. The combined data across the three districts (Figure 9) shows that three varieties (KVx30-309-6G, IT90K-372-1-2 and TN5-78) were the top farmers' preferred varieties. However, farmers ranked Kware in Kollo, KVx30-309-6G in Aguié and IT90K-372-1-2 in Magaria as most popular variety.

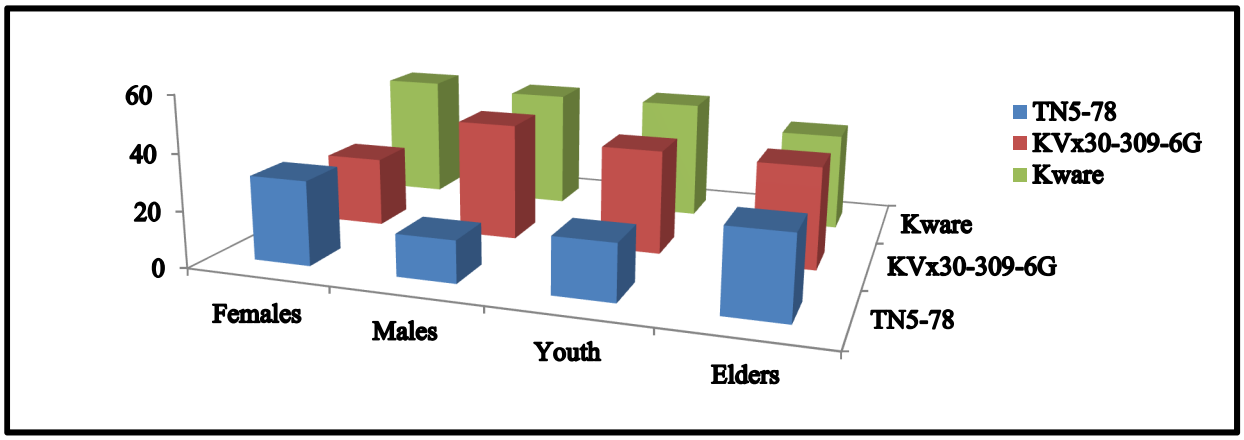


Figure 6: Farmers' 'preferred varieties by rank order based on grain characteristics and according to the sex and age at Kollo, 2013.

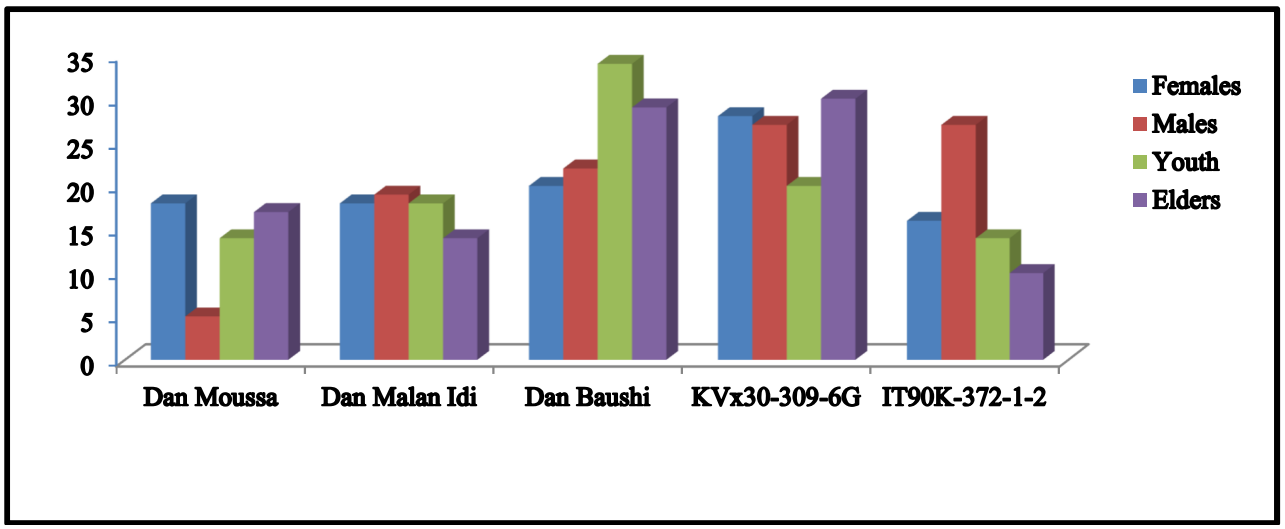


Figure 7: Farmers' 'preferred varieties by rank order based on grain characteristics and according to the sex and age at Aguié, 2013.

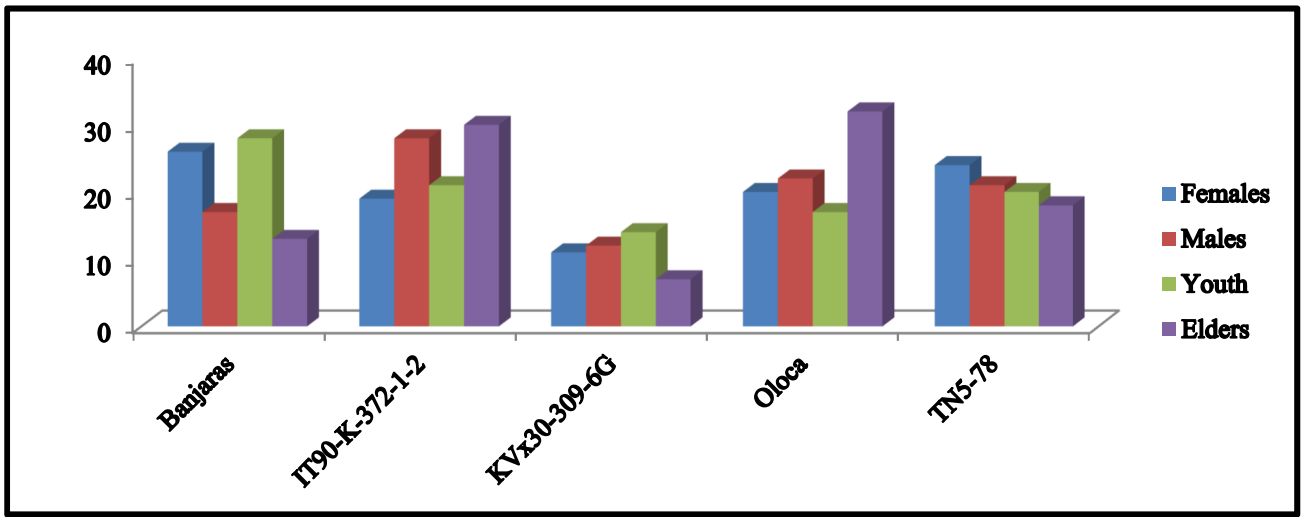


Figure 8: Farmers' 'preferred varieties by rank order based on grain characteristics and according to the sex and age at Magaria, 2013.

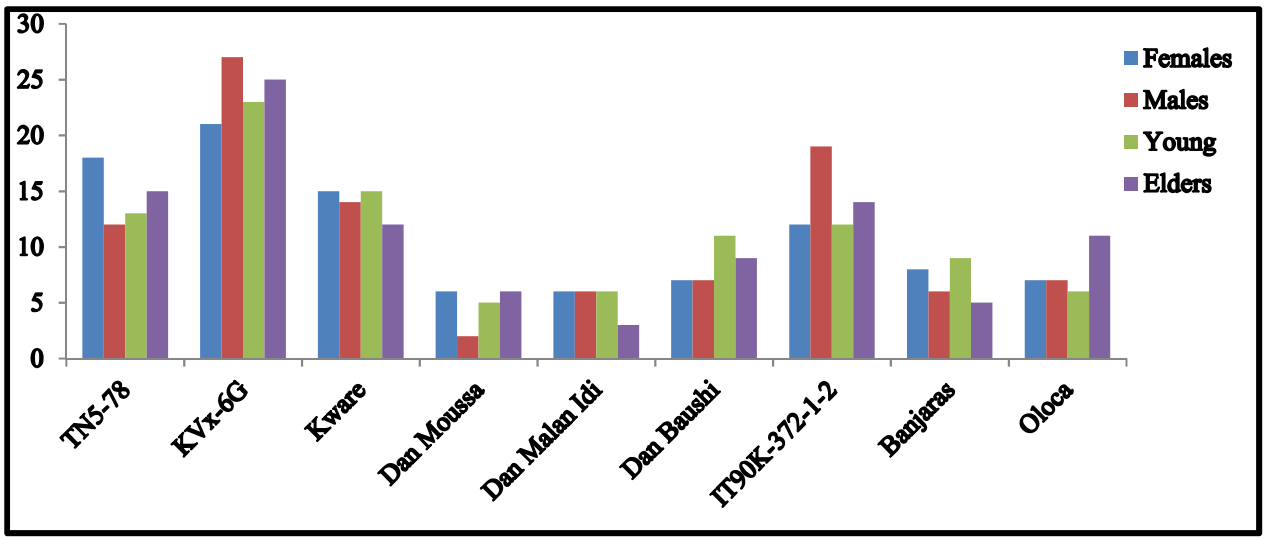


Figure 9: Farmers' preferred varieties by rank order based on grain characteristics and according to the sex and age in 2013 (multi-sites combined data).

In addition to the focus group discussions, traders and foods processors were interviewed about grain quality. Most traders (90%) sold large seeded and white-colored cowpea at the market. They also mentioned that the same characteristics were suitable for consumers. For 75% of traders at Magaria district, the small seeded and mottled cowpea was preferred by consumers. Most food processors (80%) used white-colored and large seeded cowpea in processing. They indicated that these had the best taste and were suitable for preparing local meals.

DISCUSSIONS

Cowpea farming systems

The results showed that cowpea plays an important role in the cropping system in the three districts. It was mainly intercropped with pearl millet or sorghum. This confirms the findings of Langyintuo, [9] who reported that in the drier savanna and sahelian zones of West and Central Africa cowpea is usually grown as an intercrop with pearl millet or sorghum and, less frequently as a sole crop or intercropped with maize, cassava or cotton. Cowpea was grown for food and cash but mostly for household consumption where farmers (56%) grew it for food. This is contrary with an earlier report which indicated that 80 % of cowpea production in Niger was exported [1]. This may be due to the contribution of seed enterprises whose production is essentially exported or due to some unexpected circumstances that lead farmers to sell crops originally meant for home consumption. Farmers were interested in adopting improved varieties that combine their preferred traits and were adapted to the local conditions. However, they were more accustomed to their widely grown landraces. This is similar to a study conducted in Zinder region [10] where 85% of seeds grown by farmers were from landraces versus only 15% of improved seeds. Similarly, Tignegre, [11] in Burkina Faso, reported that farmers had access to improved varieties but were still growing landraces under mixed-cropping. Despite the availability of improved varieties, adoption rate is low due to seed shortage or cost and the lack of information on their availability. Cowpea productivity can be increased by promoting a wide range of productive varieties and crop management options. Access to and availability of seed of preferred varieties can be improved by undertaking sustainable seed production and delivery schemes [12]. Indeed by developing the seed sub-sector and enhancing farmers' field productivity through improved cultural practices a strong seed production and distribution system can be achieved in the country Farmers managed soil fertility by use of manure in their farms. Therefore, fertilizers were used at sub-optimal levels with very little or no crop rotation practiced by the farmers due to land insufficiency. This probably restricts the productivity of the landraces they grow and even some improved varieties with high yield potential. The importance of fertilizers as key inputs in accelerating food production in West African Semi-Arid Tropics is well recognized by researchers and policy makers [13]. This can be explained by a very wide gap between experiment station yields and those on farmers' fields. It was demonstrated that improved cowpea varieties can give higher grain yield in farmers' field under optimum management, especially in sole cropping [14]. Hence, appropriate and intensive extension work needs to be done towards improvement of cultural practices and new varieties' adoption. At all districts visited, the results showed that land belonged only to males, except in the case of families where a widow possesses land. However, in general females can get a piece of land within the family property for farming. This is in line with the findings of a

study [10] in Zinder region where it was reported that 70.33 % of land were owned by males versus the 8.33 % owned by females.

Production constraints

Striga was among the top two constraints to cowpea production listed by farmers. Tignegre, [11] found similar results in Burkina Faso where *Striga* was ranked among the top three constraints to cowpea production. Insect pests were ranked first, while drought was ranked third at all sites. Previous studies [15; 16; 17] reported similar finding and indicated that insect pests were the top constraint to cowpea production in Africa. Recently, Egbadzor, [18] found that insects, drought and weeds are the most important limiting factors to cowpea production in Ghana. The consistency in ranking of these constraints by farmers at all the districts suggested that they were the major constraints for which priority should be given in breeding objectives. The other constraints such as low soil fertility, late planting, insufficient land, poor access to inputs and disease pressure were ranked low. This may be due to the limited knowledge of farmers about consequences of some of these constraints like diseases and low soil fertility. Meanwhile, in a participatory study [19] the main constraints identified were low soil fertility, low yield, and high cost of inputs. In that particular study the surveyed population was larger and the whole cowpea production value chain was considered in Maradi region where Aguié district is located. Experiments have shown that by using improved seeds and adequate doses of fertilizers the average yields can be raised 3 to 4 times [20]. However, in practice only limited quantities of these are available and are also not easily accessed by small-scale farmers due to distance and cost [14].

Knowledge about *Striga*

Surveyed farmers recognized *Striga* as a major problem in cowpea production. Each ethnic group designated *Striga* with a precise name. And most of the names reflected the yield losses induced by *Striga* to the cowpea plant. This showed that farmers had awareness of this pest. They even highlighted the symptoms of infested cowpea plants and linked *Striga* infestation to low soil fertility. All the landraces and the preferred improved varieties they grew were susceptible to *Striga*. Farmers had no means to control *Striga* except through hand weeding which is tedious and laborious. Also, by the time weeding is done most of the damage may have been done to the crop, and in some cases the *Striga* plants would have set seeds therefore increasing the *Striga* seed bank in the soil. Preventive control measures such as fertilization were mentioned by farmers, but the implementation was not affordable for them. This may be why farmers supported the idea of breeding for resistant varieties even if it would eradicate the *Striga* despite its use for medical purposes. This study revealed that farmers have a deep knowledge about *Striga* but effort should be made to educate them in integrated *Striga* control to minimize its damage to cowpea productivity. A study on integrated *Striga* control conducted in 2005-2006 in Niger, [21], showed that the number of emerged *Striga* shoots was reduced by 56 % and 83 % in Dan Gao and Kala-paté respectively while cowpea yield increased by 88% at Dan Gao.

Farmers' preferred traits

Farmers stated yield potential, early maturity, white-colored seed coat and good taste as the most important traits in cowpea varieties. Similarly, in Uganda, Orawu, [22] indicated that preferred traits were white seed color, earliness, yield potential, good taste, and tolerance to insect pests and diseases. In a participatory evaluation of improved cowpea lines and cropping systems in Maradi and Zinder regions in Niger, Saidou, [14] found that farmers were interested in early maturing varieties with good seed germination and high pod load as well as the white seed coat color and yield potential as an important consideration for cowpea variety adoption.

Resistance to pests and disease as well as tolerance to drought were not considered by farmers as important criteria of adopting varieties though pests and drought were major constraints identified. This may be due to the fact that these constraints are difficult to control at their level and all the varieties they grow are susceptible. Although farmers did not consider *Striga* resistance as a major criterion for their preferred varieties it is necessary breeding for resistance to *Striga* is considered for any variety targeted for these communities while also taking account the preferred quality traits.

Grain' characteristics preferred by most farmers were white colored and large grain for their own consumption as well as for sale. This also was confirmed by cowpea processors and traders. Similar results were reported [9; 11; 18]. However, in Magaria district only 25% of farmers preferred the white colored grain for the market while 50% of farmers chose brown seeds for sale. This may be due to the proximity of that district to Nigeria where Kormawa, [8] reported that generally consumers preferred brown colored cowpea grains over white colored grains in the Nigerian markets they studied.

The top three farmers' preferred varieties in this study were KVx30-309-6G, IT90K-372-1-2 and TN5-78. Similarly, in 2008, the results of a study conducted by SNV in Maradi region revealed that farmer' top preferred varieties were KVx30-309-6G and IT90K-372-1-2 because of their seed characteristics (big sized, white colored grain and good taste). This is consistent with the fact that the three varieties are the top commercial cowpea varieties in Niger to date. These are the recommended varieties in multiplication at INRAN stations and seed companies. In another participatory farmer evaluation, IT90K-372-1-2 was identified at the top of varieties having higher grain and fodder yields on-farm [14]. This variety was also recommended to be grown on fields with less *Striga* infestation and to be improved urgently by incorporating *Striga* resistant genes in it. Though these improved varieties were not highly adopted by farmers they were recognized as superior to their local landraces. This demonstrated again farmers' willingness to adopting new technology when it is consistent with their perceptions and affordable to them. In some cases significant differences were observed between males and females' choice of varieties. For example, at Aguié district where Dan Moussa was grown, females preferred it three times over males. Similarly, the variety TN5-78 was ranked doubly higher by females over males at Kollo district. This may be due to some characteristics like cooking time or suitability to local meals these varieties had and that were more or less women' concern than to be men worries.

CONCLUSION

In this study, a participatory rural appraisal was very useful in gathering important information that will help to make decisions beneficial to farmers. Breeding cowpea for *Striga* resistance is a priority objective. *Striga* is a particularly serious challenge to cowpea production in Niger. Development of new cowpea varieties should include criteria such as high yield potential, earliness, white color and good taste. Most farmers preferred white colored and large sized cowpea grain. However, small sized cowpea grain was preferred by farmers at Kollo district and brown colored cowpea seed coat was considered for market at Magaria district. There is an urgent need to incorporate *Striga* resistant genes into the top three farmers' preferred varieties identified: KVx30-309-6G, IT90K-372-1-2 and TN5-78 in order to meet farmers demand and improve food security.

ACKNOWLEDGEMENTS
The authors would like to acknowledge AGRA for its entire financial support to this project research.

REFERENCES

[1]. Anonym, 2013. Amélioration de la production du niébé au Niger. PROVIGNA, **1**: p. 14.
[2]. Aggarwal, V. and J. Ouedraogo, 1989. Estimation of cowpea yield loss from Striga infestation. Tropical agriculture, **66**(1): p. 91-92.
[3]. Charlick, R.B., 1992. Niger: Personal rule and survival in the Sahel. , ed. A. Affairs. Vol. 91.
[4]. Mazzucato, V. and S. Ly, 1994. An economic analysis of research and technology transfer of Millet, Sorghum and Cowpeas in Niger. ISNAR, The Hague, Netherlands., in MSU International Development Working Papers p. 121.
[5]. MDA, 2013. Direction des statistiques/Ministère du developpement agricole du Niger.
[6]. Chambers, R., 1992. Rural apprasial: rapid, relaxed and participatory: Discussion Paper 311. Institute of Development Studies, University of Sussex (UK).
[7]. Muranaka, S., O. Boukar, A. Abdoulaye and C. A. Fatokun, 2010. Cowpea improvement via farmer participatory varietal selection activity in the republic of Niger. Proceeding of the Fith World Cowpea Conference. IITA, p. 46-55.
[8]. Kormawa, P.M., J.N. Chianu, and V.M. Manyong, 2002. Cowpea demand and supply patterns in West Africa: the case of Nigeria. In Fatokun, C. A., Tarawali, S. A., Singh, B. B., Kormawa, P. M. & Tamo, M. (Eds.) Challenges and Opportunities for enhancing sustainable Cowpea production. International Institute of Tropical Agriculture.,
[9]. Langyintuo, A., J. Lowenberg-Deboer, M. Faye, D. Lambert, G. Ibro, B. Moussa, A. Kergna, S. Kushwaha, S. Musa and G. Ntoukam, 2003. Cowpea supply and demand in West and Central Africa. Field Crops Research, 2003. **82**(2): p. 215-231.
[10]. SNV, 2009.Etude de référence sur la filière niébé dans la région de Zinder. p. 80p.

[11]. Tignegre, J.B.D.L.S., 2010. Genetic study of cowpea (*Vigna unguiculata* (L.) Walp) resistance to *Striga gesnerioides* (Willd.) vatke in Burkina Faso. Ph.D thesis. School of agricultural sciences and agribusiness. Univ. of Kwazulu-Natal, South Africa, p. 167 p.

[12]. ICRISAT, 2013. Tropical legume farming in Niger. Bulletin of Tropical Legumes, **22**: 7p.

[13]. Bationo, A., B. J. Ndunguru, B. R. Ntare, C. B. Christianson, and A. U. Mokwunye, 1991. Fertilizer management strategies for legume-based cropping systems in the West African Semi-Arid Tropic. In: Johansen, C., Lee, K. K. and Sahrawat, K. I. (eds) Phosphorus Nutrition of Grain Legumes in the Semi-Arid Tropic. ICRISAT, 1991, Pantacheru, A. P. India,: p. 216-236.

[14]. Saidou, A.K., H.A. Ajeigbe, and B.B. Singh, 2011. Participatory evaluation of improved cowpea lines and cropping systems for enhancing food security and income generation in Niger republic. Journal of Agriculture and Environnemental Science, **11**: p. 55-61.

[15]. Adipala, E., P. Nampala, J. Karungi, and P. Isubikalu, 2000. A review on options for management of cowpea pests: experiences from Uganda. Integrated Pest Management Reviews, 2000. **5**(3): p. 185-196.

[16]. Asante, S., M. Tamo, and L. Jackai, 2001. Integrated management of cowpea insect pests using elite cultivars, date of planting and minimum insecticide application. African Crop Science Journal, **9**(4): p. 655-665.

[17]. Makoi, J.H., A. K. Belane, S. B. Chimphango and F. D. Dakora, 2010. Seed flavonoids and anthocyanins as markers of enhanced plant defence in nodulated cowpea (*Vigna unguiculata* L. Walp.). Field Crops Research. **118**(1): p. 21-27.

[18]. Egbadzor, K., M. Yeboah, S. Offei, K. Ofori and E. Danquah, 2013. Farmers' key production constraints and traits desired in cowpea in Ghana. Journal of Agricultural Extension and Rural Development, **5**: p. 14-20.

[19]. SNV, 2008. Etude de la filière niébé dans la région de Maradi, Juillet, 2008: p. 59 p.

[20]. Singh, B.B. and A.M. Emechebe, 1997. Advances in research on cowpea *Striga* and *Alectra*. Advances in Cowpea Research, p. 215-224.

[21]. FAO, 2007. Progress on farmers training on parasitic weed management Food and Agriculture Organization of the United States, 162p.

[22]. Orawu, 2007. Occurrence of cowpea aphid-borne mosaic virus and prospects of improving resistance in local cowpea landraces in Uganda. Ph.D thesis. School of Biochemistry, Genetics, Plant pathology and Microbiology. Univ. of Kwazulu-Natal, South Africa. p. 117 p.