An Overview of Cowpea (*Vigna unguiculata* (L.) Walp) Production in the Equatoria Region of South Sudan

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ABSTRACT

Cowpea (*Vigna unguiculata* (L**.**) Walp) is an important socio-economic grain legume. Research on cowpea improvement has not seen progress for decades due to political instability and lack of funding because cowpea is not considered an elite crop. The project implementation began with a baseline survey in Greater Equatoria region. The objectives of the survey were: to know and understand farmers cowpea trait priorities and varietal preferences; to assess farmers access to improved cowpea varieties with particular references to source of seed and availability; and to understand and prioritise farmers' production and utilisation constraints. Thirty farmers were selected randomly for interview in each of the five counties, making a total of 150 farmers. Structured questionnaires were used to obtain information from respondents. Agricultural Commissioners and other agricultural personnel gave information about cowpea production in their respective counties. The data were summarized into means, percentages and ranges. The findings of the survey validate the undisputable importance of cowpea in South Sudan's agriculture. Therefore, the establishment of a breeding programme to improve yield, quality, storability and tolerance to stresses would be a step in the right direction. Thus, re-modifying the breeding objectives towards; research in growing cowpea in mixtures should be carried out to elucidate spacing and plant arrangement in various mixtures of crops adapted by the farmers. Furthermore, research in growing cowpea as mono crop for the leaves and grain should also be carried out to establish its husbandry. Methods of controlling storage pests and storage methods should be found out to be adopted by farmers.

Keywords: Cowpea, Preference, Production, Constraints and Prospects

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INTRODUCTION

Cowpea (*Vigna unguiculata* (L) Walp) is an important indigenous socio-economic, self-pollinated, diploid (2n = 2x =22) African grain legume crop capable of producing appreciable yields under 500 mm of rainfall in sub-Saharan Africa (SSA), with an outcrossing rate of less than 10% (Fatokun and Ng, 2007). It is estimated that Africa produces more than 96.1% of the cowpea in the world with grain production of 6.99 million tonnes in 12.32 million hectares (FAOSTAT, 2016). Compared to other annual crops grown in drought-prone areas in SSA, cowpea could be one of the best options to grow, although drought stress is still a major production constraint for the crop (Fatokun *et al.*, 2012). The crop provides food for both human and livestock and serves as a dependable revenue generating commodity, serving as source of income (Ajeigbe *et al.*, 2008). World's major cowpea producing countries are in Africa, with Nigeria as a leading producer and consumer, producing over 3.03 million metric tons of grain on 3.61 million hectares, followed by Niger 1.99 million metric tons on 5.19 million hectares (FAOSTAT, 2016). Cowpea is widely grown by nearly all the smallholder subsistence farmers in all agro-ecological zones across sub-Saharan Africa for its grain. Young leaves and pods are eaten as vegetable by pregnant women and lactating mothers. The crop is referred to as "*redeeme*r" due to its nutritional value and taste. It can be used as fodder for livestock and its grain could be eaten green or dried by farmers. Both the grain and leaves of the cow pea contain protein (about 22 - 25%), good quantity of B vitamins - thiamine, (vitamin B1), riboflavin (vitamin B2), niacin (B3), and folic acid, important in preventing birth defects, and contains several minerals such as iron, calcium, zinc, copper, potassium, phosphorous and selenium (Cisse and Hall, 2003). The leaves particularly are significant source of β−carotene and ascorbic acid (vitamin C) (Ngalamu *et al.*, 2014).

Cowpea in South Sudan, is the most important legume among other legumes, grown by small-scale subsistence farmers in nearly all agro-ecologies. Nevertheless, its yield is very low, with average yield of approximately 0.4 t/ha. There are several plausible reasons for this low productivity and small size of farms per family. The most important of which includes non-application of agricultural technology (reliance on cultivation of low-yielding unimproved crop varieties and traditional non-scientific agronomic crop husbandry, and non-application of fertilisers), the use of family labour alone in crop production, lack of credit facilities to rural farmers, and very miserable infrastructure exacerbated by constant insecurity in rural and urban areas all over South Sudan. Despite the problems associated with crop production, rural farmers in all the agro-ecologies in South Sudan continue to cultivate several varieties of crops including cowpea in mixed cropping pattern for their own household survival with some little surplus to sell in the near-by markets to earn some cash for purchasing household necessities, which they are unable to produce such as salt and clothes. In the Greenbelt and the Ironstone plateau agro-ecologies where the rearing of livestock is precluded by the presence of tse−tse flies and where malnutrition is

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prevalent, especially in Greater Equatoria, the diet of family is dependent mainly on cereal carbohydrate and protein from various pulses. The most common and generally cultivated pulse is the cowpea, which provides protein and also increases crop productivity. However, there is little scientific information about the genetic variability of drought tolerance related traits of the existing preferred varieties adapted by farmers in South Sudan. To explain this variability, AGRA financed Cowpea Breeding Project and drew up two strategies: the short-term and long-term strategies. The short-term strategy required the understanding of cowpea production in Greater Equatoria in general, farmers preference and production constraints before identification of superior lines and breeding for higher yields, tolerance to drought stress and resistance to diseases and pests in long-term.

A baseline survey was planned with the objectives of understanding farmers' trait priorities and varietal preferences and assessment of farmers' accessibility to improved varieties with particular reference to source and availability and understanding and prioritizing farmers production and utilisation constraints. The information generated will act as an essential repository for knowledge needed for future cowpea improvement projects.

MATERIALS AND METHODS

Farmer preference baseline survey was carried out between March and April 2014, in five counties of the three Greater Equatoria States of South Sudan. In Central Equatoria State, surveys were carried out in Juba and Yei counties; while in Western Equatoria State, they were done in Mundri West and Yambio; and in Magwi County of Eastern Equatoria State. A small random sampling technique was used to select 30 farmers for the interview in each of the five counties, making a total of 150 respondents. Pre-tested structured questionnaires were used to obtain information from the respondents. In addition, information on cowpea production in the counties was obtained from Agricultural commissioners and senior agricultural personnel of the counties. A software SSPS 18th edition was used to analyze the data.

RESULTS AND DISCUSSION

Socio-economic characteristics of cowpea farmers

Mean age of the farmers engaged in the study presented in Table 1, ranges between 30–60 years, and they constitute 70% of the farmer's population. This is reasonable since farming is a strenuous task, which requires mature and fully grown up persons. Out of the 150 farmers interviewed, females were 36% and the 64% majority were male. In terms of marital status, 74% of the farmers were married (Table 1).

The survey showed that 76% of the cowpea farmers were small-scale subsistence farmers producing mainly for household consumption, 23.3% were medium scale and only one farmer was cultivating on large scale. This study has clearly shown that commercial farming has hardly started in South Sudan. Results also revealed that most of the households as expected were male-headed (74%) and a few, 24 % were female-headed. Two households were headed by juveniles who lost their parents.

Table 1: Distribution of socio-economic characteristics of categories of cowpea farmers

Variables	Description	Frequency	%
Gender	Female	54	36.0
	Male	96	64.0
Age (year)	18 – 30	32	21.3
	30 – 40	69	46.0
	40 – 50	37	24.7
	50 – 60	12	08.0
Marital status	Married	111	74.0
	Single	13	08.7
	Divorced	9	06.0
	Widowed	10	06.7
	Separated	7	04.7
Type of farming	Small scale	114	76.0
	Medium scale	35	23.3
	Large scale	1	00.7
Type of household	Male headed	112	74.7
	Female headed	36	24.0
	Juveniles headed	2	01.3

Source: Field survey data (March - April 2014)

Reasons for growing cowpea

In South Sudan, farmers grew cowpea for different reasons: 19.3% grow it for their own household consumption, 8.7% for cash; 4.7% as a culture and the majority 67.3% for both consumption and income (Figure: 1).

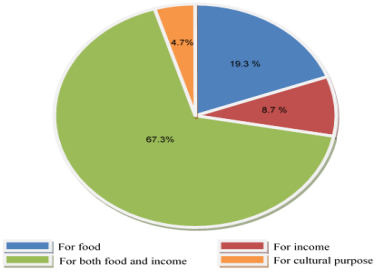

Figure 1: Reasons for growing cowpea (n = 150)

The greater number of farmers growing cowpea for both cash and consumption is an indication that farmers are now slowly beginning to understand the importance of farming as a business given the potential for profitable farming in Juba County where the climate is favourable and a ready market is available at the capital city, Juba. It also implies that farmers are making a transition to emerge from relief dependency to production of own food to attain self-sufficiency. Quin, (1997) and Ogbonnaya *et al.* (2003) both stated that from the fresh leaves to the dry grain, the whole plant is utilized either for human

consumption or animal feed. The production provides an important source of income to most rural families and is, therefore, considered as a cash crop for rural people.

Major sources of cowpea seed for the farmer

The primary source of cowpea seed for cultivation in South Sudan were found to be: local market (41%) and seeds saved from their own harvest (47%). A few of the farmers obtained theirs from various sources including Seed Company, Research Station, input dealers or relatives and friends (Table 2).

Table 2: Percentage of farmers getting seeds

Sources	Frequency	%
Own Saved Seed	71	47.3
Seed company	4	2.7
Local market	62	41.3
Research station	2	1.3
Input dealer	6	4.0
Neighbour/Relative/ Friend	5	3.3

Source: Field survey data (March – April 2014)

The reasons for farmers growing their own saved seed might be because they may be discouraged by the low quality of seed (particularly low germination) obtained from other sources. Own saved seed also ensures timely planting as seed is readily available. Local markets are equally important sources of seed due to availability of different varieties obtained from different local farmers in the area, hence facilitating timely planting, ensuring good germination and optimum plant population. Seed business is quite new to South Sudan. Most traders are still operating on small-scale and combine trading with farming. Hence, they are familiar with the names of local varieties, areas in which they are adapted and even planting times. They commonly procure cowpea grain from other small-scale farmers and sell them as seed. However, the local traders possess poor marketing skills, low access to capital, little ability of differentiating products, and poor linkage with research that provides new varieties and technical advice. Langyintuo *et al.* (2003) reported that lack of market research on cowpea could be one of the contributing factors for the poor provision of advisory service to cowpea farmers.

Cowpea research

A large proportion of farmers comprising 44.4% did not participate in any cowpea research. Those who participated in demonstration were similarly 44.4%, but they did so by giving their land for research and those who gave cowpea seeds for research were 11% (Figure 2). This is not surprising because there are no established institutions doing research in South Sudan for farmers to associate with except very few individuals carrying out research on particular crops, who may not be within the vicinity of farmers.

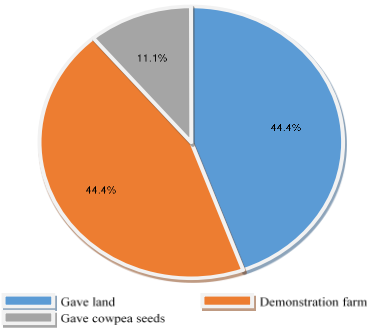

Figure 2: Cowpea research

Farmer preference for cowpea production characteristics

Characteristics farmers often desire in cowpea plant shown in the Table 3 indicate that 94% of the farmers perceived high grain yield as the major characteristic required for cowpea production, followed by high leaf yield (92%) and early maturity (87%) as well as leaf and grain taste (82%).

Table 3: Farmer preferences of characteristics of cowpea for production (n = 150)

Characteristics	Description	Frequency	%
Early maturity	Yes	130	87
	No	20	13
Leaf and grain taste	Yes	122	82
	No	28	18
Leaf texture	Yes	49	32
	No	111	68
Seed colour	Yes	80	55
	No	70	45
Grain size	Yes	99	66
	No	51	34
Grain texture	Yes	48	32
	No	102	68
Cooking ability	Yes	81	54
	No	69	46
Storage ability	Yes	54	36
	No	96	64
Drought tolerance	Yes	88	59
	No	62	41
Pest resistance	Yes	60	40
	No	90	60
Disease resistance	Yes	87	58
	No	63	42
High leaf yield	Yes	139	92
	No	11	8
High grain yield	Yes	141	94
	No	9	6

Source: Field survey data (March – April 2014)

The characteristics considered by the farmers to have less importance were the grain texture (32%) and storage ability (36%). Storage-ability was not considered

important due to the fact that the cowpea the farmers produce are not stored, but eaten in a short period. These findings are contrary to a report that depicts storage-ability as a major production constraint in Burkina Faso (Batieno, 2014). Burkina Faso is ranked among countries in the sub-Sharan Africa that produces cowpea for export. This disparity maybe due to the fact that farmers in Burkina Faso produce cowpea for sale which needs storage for a long time whereas in South Sudan it is produced for family consumption and eaten in a short period.

Cowpea marketing constraints

Most farmers sold dry grains of cowpea. Those who sold both dry and fresh leaves were 35% and only fresh leaves comprised 30% of the respondents. A large proportion of farmers (71%) sold their products in the local market within their reach. In South Sudan, market information through extension agents is non-existent. Cowpea farmers in this study obtained information through fellow farmers (36%) and a few through radio (29%) (Table 4). This agrees with (Van der Laan (1999) who attributed lack of information on cowpea to marketing research due to focusing on export crops such as cocoa, coffee, cotton, and groundnut, and to a lesser extent cereals and cowpea.

Table 4: Forms of selling, location and sources of cowpea market information

Variables	Description	Frequency	%
Forms of selling cowpea	Fresh and dry leaves	27	18.0
	Whole grain, dry and	53	35.3
	fresh leaves	25	16.7
	Split grain & fresh leaves	45	30.0
Place of selling	Farm gate	16	10.7
	Buyer in town	7	4.7
	Trading centre	10	6.7
	Local market	107	71.3
	Road side	10	6.7
Sources of cowpea price information	Traders	24	16.0
	Fellow farmers	54	36.0
	Neighbours	28	18.7
	Radio	44	29.3

Source: Field survey data (March – April 2014)

When cowpea is produced for sale in the market, majority of the respondents (93%), considered storage to be the most important constraint followed by oversupply of cowpea in the markets (79%), and distance to markets from home was the third important constraint (70%) (Table 5). Langyintuo *et al*. (2003) reported similar findings from the market study conducted in the sub-regions of West and Central Africa.

Table 5: Identified cowpea marketing constraints

Constraints	Description	Frequency	%
Oversupply	Yes	118	78.7
	No	32	21.3
Packaging	Yes	77	51.3
	No	73	48.7
Low prices	Yes	81	54.0
	No	69	46.0
Distance to market	Yes	105	70.0
	No	45	30.0
Storage	Yes	139	92.7
	No	11	7.3
Low production	Yes	90	60.0
	No	40	40.0

Source: Field survey data (March – April 2014)

Cowpea production constraints

Although agricultural production in South Sudan is constrained by several factors, 58% of the farmers perceived lack of improved varieties as the major production constraint, 43%, recognized lack of access to market and 42% thought low selling price as the major constraints to cowpea production (Table 6). Farmers perceived shortage of land, poor soils and infestation by weeds as constraints of less importance. Poor yields, diseases and storage pests, were recognized to be moderate. This agrees with the previous findings which grouped the production constraints of cowpea into abiotic and biotic constraints (Singh and Tarawali, 1997; Tignegre, 2010).

Table 6: Cowpea production constraints

Constraint	Extent of constraint	Frequency	%
Field pests	Severe	57	38.0
	Moderate	74	49.3
	Low	19	12.7
Credit	Severe	51	34.0
	Moderate	35	23.3
	Low	64	42.7
Land	Severe	25	16.7
	Moderate	26	17.3
	Low	99	66.0
Price fluctuation	Severe	35	23.3
	Moderate	76	50.7
	Low	39	26.0
Drought	Severe	47	31.3
	Moderate	46	30.7
	Low	57	38.0
Poor yields	Severe	33	22.0
	Moderate	68	45.3
	Low	49	32.7
Lack of access to market	Severe	67	43.3
	Moderate	48	32.0
	Low	37	24.7

Table 6 (continue)

Constraint	Extent of constraint	Frequency	%
Poor soils	Severe	32	21.3
	Moderate	49	32.7
	Low	69	46.0
Poor soils	Severe	32	21.3
	Moderate	49	32.7
	Low	69	46.0
Poor soils	Severe	32	21.3
	Moderate	49	32.7
	Low	69	46.0
Lack of improved varieties	Severe	87	58.0
	Moderate	28	18.7
	Low	35	23.3
Extension services	Severe	51	34.0
	Moderate	37	24.7
	Low	62	41.3
Diseases	Severe	42	28.0
	Moderate	81	54.0
	Low	27	18.0
Access to seed	Severe	36	24.0
	Moderate	70	46.7
	Low	44	29.3
Storage pests	Severe	39	26.0
	Moderate	66	44.0
	Low	45	30.0
Weeds	Severe	32	21.3
	Moderate	61	40.7
	Low	57	38.0
Low price	Severe	63	42.0
	Moderate	52	34.7
	Low	35	23.3

Source: Field survey data (March – April 2014)

Cowpea pests and diseases

A large proportion of farmers (93%) perceived the existence of cowpea pests. The major pests included aphids feeding on green growing plants, pod suckers and weevils attacking the seeds. Tignegre (2010) reported pests a constraint in the cowpea production areas of Burkina Faso. The pests occurred every season and whenever cowpea is planted and harvested. The pest prevalence was considered to be moderate attacking mainly the leaves, pods and flowers and were mainly controlled by use of traditional methods (Table 7).

The major diseases recognized by the farmers affecting cowpea were bacteria and fungi. These diseases mainly occurred moderately at flowering. Farmers mainly controlled the diseases by use of traditional methods (55%) and the major weed control methods were found to be hand hoe and hand weeding (Table 8) as South Sudan has not graduated from traditional agriculture to the use of pesticides, fungicides and herbicides.

Table 7. Identified cowpea pests and control methods

Variables	Description	Frequency	%
Existence of pests	Yes	140	93.3
	No	10	6.7
Type of pests	Aphids	95	61.3
	Weevils	24	16.9
	Thrips	8	5.6
	Pod suckers	20	14.1
	Others	3	2.1
Seasonality of ccurrence	Yes	95	63.3
	No	55	36.7
Parts attacked	Leaves	85	55.5
	Root	8	5.5
	Stem	8	5.5
	Flowers	34	32.3
	Pods	15	10.3
Timing of occurrence	Before flowering	20	13.3
	After flowering	77	50.0
	During pod development	28	19.2
	During storage	4	2.7
	Throughout growing cycle	21	14.4
Pest prevalence	Severe	45	31.8
	Moderate	78	50.7
	Mild	27	18.5
Control methods	Spraying	13	8.8
	Use of traditional	92	60.6
	methods	20	13.6
	Crop rotation	5	3.4
	Intercropping	10	6.8
	Early planting	1	0.7
	Row planting	9	6.1

Source: Field survey data (March – April 2014)

Table 8: Major identified cowpea diseases and methods of control

Variables	Description	Frequency	%
Type of diseases	Viral	34	22.7
	Bacterial	61	40.7
	Fungal	55	36.7
Seasonality of currence	Yes	70	46.7
	No	80	53.3
Timing of occurrence	Vegetative	16	10.7
	Prior flowering	25	16.7
	Flowering	61	40.7
	Podding	25	16.7
	Throughout growing cycle	23	15.3
Disease prevalence	Severe	40	26.3
	Moderate	84	56.0
	Mild	26	17.3
Control methods	Spraying	5	3.3
	Use of traditional	82	54.7

Table 8 (Continue)

Variables	Description	Frequency	%
Control methods	methods	15	10.0
	Crop rotation	18	12.0
	Intercropping	2	1.3
	Use of resistant varieties	20	13.3
	Early planting	1	0.7
Control methods	Row planting	1	0.7
	Others	7	4.7
Weed control methods	Hand hoe	76	50.7
	Herbicide	1	0.7
	Fine seedbed	1	0.7
	Early/late planting	15	10.0
	Hand weeding	54	36.0
	Others	3	2.0

Source: Field survey data (March – April 2014**)**

The importance of cowpea as a crop was assessed; 41% of the farmers considered cowpea a major crop in their diet whereas 33 % considered it a minor crop (Figure 3). A large proportion of farmers (74%) had knowledge of health benefits of cowpea (Table 9) but surprisingly 50% thought cowpea is good for body building. This finding corroborates with Nwofia (2012) who reported that despite the importance and popularity of this nutritionally important vegetable legume, little information exists on its production as vegetable and most of the information relies on work on grain cowpea and this is unsatisfactory.

Table 9: Cowpea knowledge and associate health benefits

Variables	Description	Frequency	Percentage
Knowledge of health benefits	Yes	111	74.0
	No	39	26.0
Health benefits	Source of vitamin	31	27.4
	Body building	57	50.4
	Children develop fast and fat	25	22.1

Source: Field survey data (March – April 2014)

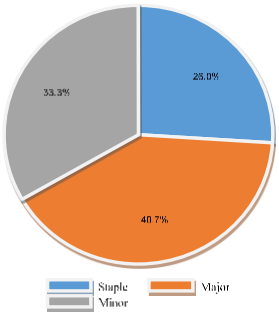

Figure 3: Importance of cowpea in farmers' diet

Cowpea consumption

On average, farmers in South Sudan consume cowpea twice in a week (Table 10), and 86% of the farmers were of the opinion that both grains and leaves constituted the most important parts of the cowpea eaten by the family (Figure 4). In African family setting, main meals are eaten together with the children and what remains would be given to children alone. This is the reason why 50% of the farmers said cowpea was eaten by the whole family and 40.7% said it was eaten by children (Table 11).

Table 10: Frequency of cowpea consumption per household (n = 150)

Mean	Minimum	Maximum
2.4	1	7

Source: Field survey data (March – April 2014)

Table 11: Category of cowpea consumers

Category	Frequency	%
Children	61	40.7
Pregnant women	2	1.3
Breast-feeding mothers	5	3.3
Whole family	82	54.7

Source: Field survey data (March – April 2014)

The average price of cowpea per 300 g during the time of survey was 5 SSP. The average income earned by selling cowpea during the last season (August–November 2013) was 189 SSP per farmer. The average cowpea harvested by farmer for seed was 52 kg whereas that for grain was 93 kg (Table 12).

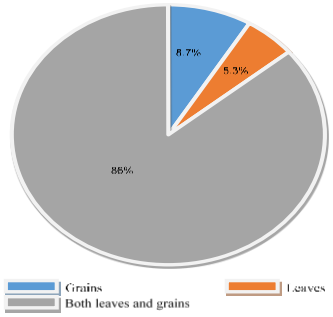

Figure 4: Importance of cowpea parts

Table 12: Cowpea income (SSP: South Sudanese Pounds)

Variables	Mean	Minimum	Maximum
Price per cup last season	5.3	2	25
Income last season	189.0	50	1500
Cowpea harvested for seed	52.0	10	500
Cowpea harvested for grain	92.9	35	800

Source: Field survey data (March – April 2014)

CONCLUSION

Cowpea production in South Sudan restarted after signing of the Comprehensive Peace Agreement in 2005, in the traditional farming system by nearly all the subsistence farmers for family consumption with little, if at all, for sale. The varieties grown are predominately the local unimproved accessions which require serious and

rigorous improvement. Farmers save their own seed from the previous harvest for planting in the next season as there no source of improved seed available in South Sudan. Farmers plant and look after the crop while growing in the field in the traditional ways passed to them by their forefathers. Government extension agents seem to be non-existent except for limited extension services offered by national and international NGOs covering very limited areas of South Sudan. If a fully operational cowpea breeding programme takes off in South Sudan, drought tolerance, high grain and leaf yield, early maturity, good taste and storability appear to be the characteristics considered by farmers to have improvement priority. Cowpea marketing in South Sudan, like any other crops, is constrained by long distance to market, lack of improved varieties resulting in very low yields and poor income from cowpea production as a business, difficulties in getting to the markets due to horrible conditions of the roads and very poor transport facilities. This survey recommends the need for a serious cowpea breeding programme to improve the yields of the existing landraces in South Sudan.

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