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FARMERS' PRODUCTION CONSTRAINTS, PERCEPTIONS AND PREFERENCES OF COWPEAS IN BUHERA DISTRICT, ZIMBABWE

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ABSTRACT

Many smallholder farmers face crop production constraints, especially under rapidly changing climatic conditions. A survey was carried out to assess farmers' production constraints, traits, and preferred cowpea varieties. A semi-structured questionnaire was used in a survey of Buhera District, Zimbabwe, in March and April of 2018. Women farmers dominated the survey as they were 52% of the surveyed population, while men occupied 48% of the total population. Eighty-three percent of farmers cited the shortage, unavailability, and cost of fertiliser. Sixteen per cent of farmers acknowledged that they do not have access to quality seeds, and 1% cited labour as the major constraint in cowpea production. Cowpea yield varied from 100 to 500 kg/ha. However, 48% of farmers harvested 200 kg/ha. As for abiotic factors, farmers ranked heat (86%), drought (10%), and soil fertility (4%) as the most important abiotic factors. Ninety-one percent of farmers ranked rust as the most destructive disease, while 2% ranked storage rot, 1% ranked anthracnose, and 1% ranked downy mildew. Eighty-one percent of farmers cited aphids as the main pests, while 3% ranked thrips, 3% ranked legume borers, and 2% ranked pod borers as other pests. Fifty-two percent of farmers preferred varieties that are resistant to diseases such as rust, whereas 48% were not concerned about diseases. As for qualitative traits, 50% of farmers had no specific colour preference, 32% preferred white colour, 14% preferred brown colour, 3% preferred red colour, and 1% preferred tan colour. For quantitative traits, such as grain size, pod size, plant height, and head size, the preferences of farmers varied. Ninety-nine percent of the farmers interviewed preferred cowpea varieties that are bred for drought tolerance, as Buhera District is frequented by intermittent droughts. Farmers' experience in growing cowpeas ranged from 5 to 30 years. The top ranked accessions were CBC1, IT 18, and *Chibundi Chitsvuku*, while the least ranked was *Kangorongondo*. Identified constraints to cowpea farming included lack of education, insect pests, diseases, drought, weeds, harvesting difficulties and a lack of agriculture extension advice. The survey showed that there is a need to breed for biotic factors such as pests and diseases and abiotic factors such as drought and moisture stress.

Key words: Buhera District, Constraints, cowpeas, perceptions, preference, variety, Zimbabwe

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INTRODUCTION

Cowpea [*Vigna unguiculata* (L.) Walp.] has been grown and used in Africa for many years and is considered to be the single most important pulse in the dry areas of tropical Africa [1]. This is because cowpea is able to thrive in challenging environmental conditions such as sandy soils and with little rainfall. It provides strong support to the livelihoods of many small-scale farmers through its contributions to their nutritional security, income generation and soil fertility enhancement [2].

Cowpeas is an important grain and fodder legume grown around the world. It is a dual-purpose grain legume crop, providing food and feed. Cowpea is identified as a potential crop to diversify food production, minimize production input by improving soil fertility and improve micronutrients of seed, therefore, improving human nutrition [2]. It contains about 24% protein, 62% carbohydrate, and small amount of other nutrients [3]. High protein and carbohydrate contents with relatively low-fat content and complementary amino acid pattern to that of cereal grains make cowpea an important nutritional food in the human diet. Cowpea use worldwide is gaining prominence due to its exerted health beneficial properties including anti-diabetic, anti-cancer, anti-hyperlipidemic, anti-inflammatory and anti-hypertensive properties [4]. The presence of compounds such as soluble and insoluble dietary fiber, phytochemicals and proteins and peptides in cowpea have been cited as preventing chronic diseases in humans [4].

Research and production of cowpea has been neglected in Zimbabwe in the last three decades due to lack of funding and interest of researchers to work on the improvement of the crop [5]. As a result, cultivated varieties are unimproved and the lack of knowledge of good agronomic practices worsen the limitations to cowpea production. According to 2015 statistical figures, the overall poverty prevalence in Buhera was 78% [6]. It was also observed that generally yields of cowpeas amongst farmers in Africa are low averaging 275kg/ha per season [7].

Surveys and interviews can help expand the range of drought tolerant and adaptable crops so that farmers and consumers have more options. Through participatory plant breeding many different lines can be released that meet both local and market preferences for taste and other seed traits [8]. Farmer-developed local varieties are an important resource and logical starting point for plant breeding programs that seek to strengthen these diverse systems. There is a need for cooperation between scientists and farmers in evaluating plant material and in establishing plant-breeding goals through participatory research. In this regard, extension has been shown to be more effective when client-oriented, focusing on supporting farmer experimentation and participatory approaches [9]. There are numerous opportunities to support farmer experimentation, local adaptation, and adoption of technical options. This process can be promoted through education and policy initiatives.

Participatory approaches to extension that involve farmer experimentation are essential for the adoption and adaptation of legumes to local environments. Collection of landraces and diverse germplasm is also essential to enhance local variation in genetic resource options that can support farmer experimentation. It is important to determine from

farmers their preferred traits in crop varieties or include the farmers in a variety selection process [10]. This ultimately enhances the potential for adoption of the varieties in the respective communities where studies are conducted. Agronomic and socio-economic requirements of smallholder farmers and consumers in marginal or stressed environments are very broad and diverse to be satisfied by a limited number of genotypes hence plant breeding must be able to make use of and maintain crop diversity that is available from the farmers [11]. Through surveys and interviews a lot of valuable scientific information is gathered and this can be very helpful in sustainable breeding programmes.

A survey approach on farmers' production constraints, perceptions and preferences using a semi-structured questionnaire was carried out to i) to determine farmers' perceptions on major constraints limiting cowpea production and ii) identify preferences regarding cultivars and quality and yield related traits.

MATERIALS AND METHODS

Description of the study area

The study was carried out in March and April of 2018 in Buhera District of Manicaland Province, in Zimbabwe (Figure 1). The coordinates of Buhera District are: 19° 19' 57.00"S, 31° 26' 6.00"E Latitude: -19.3325; Longitude: 31.4350 and is 1 190 m above sea level. Buhera District is a rural district and the local economy depends mainly on farming. About 689 mm of precipitation falls annually. Buhera is a dry low-lying area with low rainfall and exhausted infertile sandy soils contributing to poor harvests and food shortages. Main crops grown in the district are maize, sorghum, millet, cowpeas and groundnuts. The rains are not very reliable, the area is infertile, and a few irrigation schemes supplement the populace's meager harvests.

Data Collection

A survey was carried out to assess the farmers' production constraints and quality and yield related traits and types of varieties of cowpeas that they prefer. Purposive sampling was used to identify the wards and farmers for the survey. The wards were purposely selected as they are well known as areas of high cowpea production. A formal approach was employed to collect data for the study with agriculture extension staff assistance in the district and various wards. Key informants and lead farmers were selected as part of the survey. The formal survey involved individual interviews with all 100 farmers from the district and from various wards. This enabled individual farmers to express their own views freely and relaxed. At ward level, farmer selection for the survey was random but based on knowledge and experience of growing cowpeas. A semi-structured questionnaire was used in the survey. The questionnaire had four components: demographic information, cowpea farming systems (farm size, land allocated to maize, sorghum, millet, cowpeas and groundnuts), cowpea production constraints and farmers' trait preferences of cowpea varieties.

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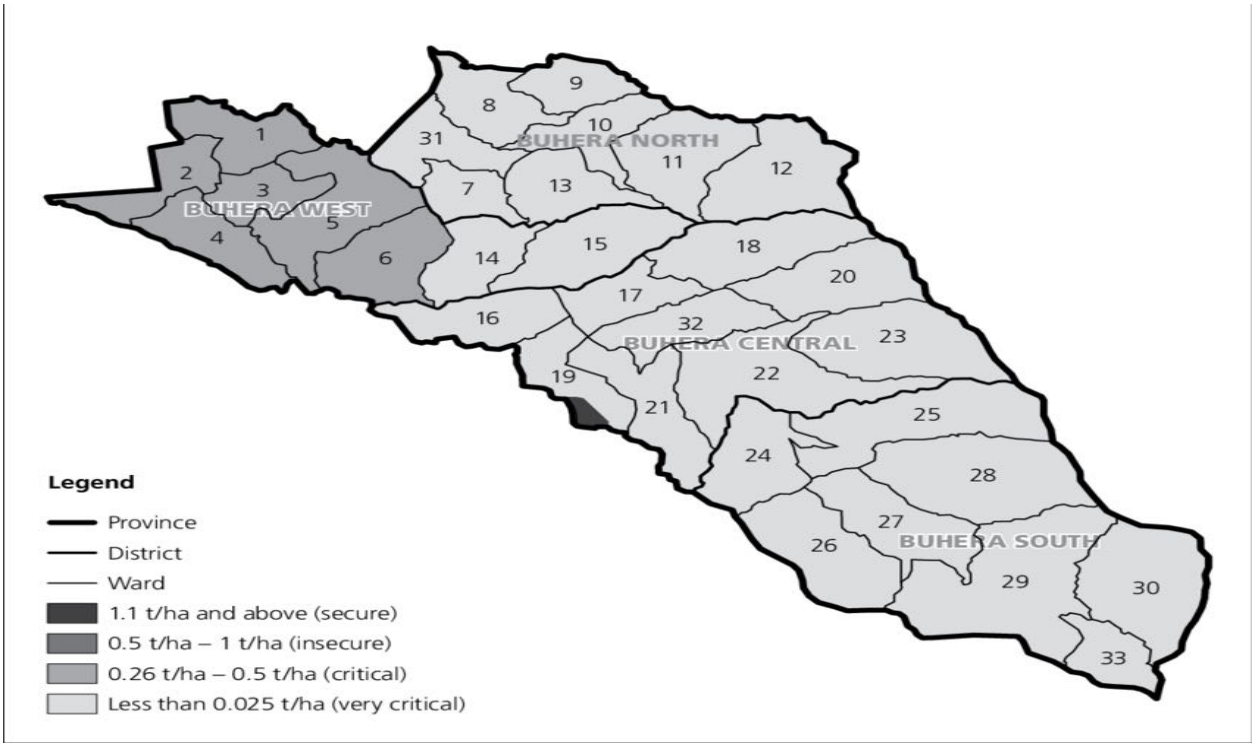

Figure 1: Buhera District block and ward map
Adapted [12]

Data Analysis
Statistical analysis was performed using IBM SPSS Statistics Version 20 computer package. Tables, means and percentages were used to summarize the data.

RESULTS AND DISCUSSION

Cowpea farming systems
A total of hundred farmers was sampled for a structured survey as presented in Table 1. The results show that women farmers dominated the survey as they were 52% of the surveyed population and men occupied 48% of the total population. Ward 14 had the largest number of male respondents at 13 while ward 10 had the largest number of female respondents at 10 (Table 1). The least number of male respondents was at 2 in ward 12 while for females it was one respondent in ward 18. The ratio of interviewed men and that of women, with figures of 48% and 52% respectively, confirms that cowpea production is mainly dominated by women in Buhera District. The level of education of the farmers varied with 58% having been to secondary, 28% with primary school education and 14% attained tertiary level qualifications. Only 27% of the farmers were trained in cowpea production by extension officers or during tertiary training while 73% of farmers did not receive any training.

Cowpea yield per ha varied considerably amongst the farmers with 2% harvesting 500kg of while 4% had only 100kg of cowpeas and less. Apart from cowpeas, 83% of farmers interviewed grew maize, sorghum 16% and groundnuts 1%. Maize and sorghum are

important staple crops for the district. Most farmers intercrop cowpeas with sorghum, millet, maize, finger millet and sunflower.

A total of 49% of farmers had total plot size at 2 hectares, while 1% had 4 hectares and above. Farmers with six household members were 27%, while those with ten household members were 2% of the population.

Constraints to cowpeas production

Farmers identified several constraints to cowpea production as shown in Table 2. Eighty-three per cent of farmers cited shortage, unavailability and cost of fertilizer, 16% of farmers acknowledged that they do not have access to quality seed and 1% cited labour as the major constraint in cowpea production. On major field pests 81% of farmers identified aphids as major pests, while 3% identified thrips, 3% for legume pod borers while 2% identified stem and stalk borers. In field production and storage, 91% of farmers ranked rust as the major disease, 2% storage rots, 1% anthracnose. Five percent of farmers were not also able positively identify problematic diseases in storage.

In cowpea production most smallholder famers do not consult or attend field days with extension officers. As a result, farmers do not use modern farming techniques that incorporate usage of fertilizers which can ultimately increase yield Cowpeas in Buhera district is mostly grown through experience passed on from generation to generation. All farmers concurred that weevils are the major pest in storage. This was compounded by the high temperatures of above 45 degrees [13]. Buhera district experiences very high temperatures and weevils breed and multiply faster. A total of 55% of farmers acknowledged existence of parasitic weeds such as *Striga s*pecies and the damage it caused in cowpea production while 45% did not experience any problematic weeds. Thirty-four percent of farmers concurred that at times low market prices affect selling of cowpeas especially years in which they have good harvests. *S. gesnerioides* causes 40 to 70% yield losses and total crop loss of susceptible cultivars have been reported [14]. Most of the damage to the crop occurs even before the parasite emerges from the soil where it produces thousands of seeds thereby making weeding an ineffective option in reducing yield losses [15].

On abiotic factors, farmers interviewed ranked heat (86%), drought (10%) and soil fertility (4%) as the most important abiotic factors. Most farmers grow cowpeas without use of inorganic fertilizers as they are perceived as expensive and unaffordable in this drought prone region. Most farmers would prefer using fertilizers in other crops such as maize and sorghum which are staple.

Farmers' variety preferences

Fifty percent of famers had no specific colour preference, while 1% favoured the tan colour. Ninety-four percent of interviewed farmers were not concerned about the pod shape and 1% preferred the globular type.

On variety preference, 99% of farmers agreed that they needed high yielding varieties and only 1% were not quite sure. Fifty-two per cent of farmers preferred varieties that are resistant to diseases such as rust whereas 48% were not concerned about diseases.

Farmers acknowledged that rust was a major problem when cowpeas were planted with cereals such as millet and sorghum. Farmers intercropped due to limited hectarage and high cost of inputs such as fertilizer and seed. Ninety-nine per cent of farmers interviewed preferred cowpea varieties that are bred for drought tolerance as Buhera district is frequented by intermittent droughts. In 2015, Buhera district suffered one of its worst farming seasons due to an *El Nino* induced drought [16]. It is against this background that smallholder farmers in the district prefer growing crops that are drought tolerant as they are the hardest hit by changing weather patterns especially erratic rainfall.

For postharvest insect pests such as weevils, 94% of the farmers' preferred varieties that are resistant while 6% did not consider it a priority. For maturity period, 59% preferred early maturing varieties while 36% had medium to late maturing varieties as preferences. Other attributes preferred by the farmers were early maturing varieties, high yield and large grain size. Others (5%) preferred the late maturing varieties as their leaves can be cooked and sundried as a vegetable for later use. This forms an important component of farmers' diets when green vegetables are scarce as the region is prone to severe and frequent droughts.

Thirty-four per cent of farmers concurred that low market prices were a major problem especially when selling cowpeas after harvest whereas 66% of farmers were not concerned about the market price as the crop was saved mainly for home consumption.

For quantitative traits such as grain size, pod size, plant height, and head size, the preferences of farmers varied. Forty-four percent of farmer respondents preferred larger cowpea grains while 56% were not concerned about the size of the grain. A paltry 2% of farmers were interested in pod size while 98% did not regard it as important. Thirteen per cent of farmers were interested in climbing varieties while 87% considered high grain yield as of utmost importance. Three per cent of farmers preferred cowpeas with plenty of biomass for livestock feed while 97% were mainly concerned with grain yield.

Some cowpea landraces grown include *Barapara, Chibundi, Ziso, Kangorongonda, Mutonono Dahwa, Zvenyika* and *Mupengo* while as other cowpea hybrids grown include IT 18, CBC1 and CBC 2 (Table 3). The top ranked accessions were CBC1, IT 18 and *Chibundi Chitsvuku* while the least ranked was *Kangorongondo*.

Farmers' experience of growing cowpeas varied from 5 to 30 years (Table 4). From the survey, farmers with 10 to less than 15 years' experience dominated the group at 30%. The lowest number of farmers were those with 30 years and above of farming experience who were all at 1% of the population. This could be attributed to the fact that as farmers aged very few would be active in farming.

The survey indicated that cowpea is a women's crop as 52 % of the participants were women and 48% men which concur with the studies [17, 18]. Women play a pivotal role in food security as they tend to and feed children while most men opt to look for work in towns. The hypothesis tested was that farmers are very much aware of production constraints and that they prefer certain traits and cultivars in cowpeas. Farmers highlighted the importance of drought tolerance, high yield potential, early maturity,

pests and disease resistance and sweet taste as the most important traits in cowpea varieties. In Niger, it was also observed that farmers preferred traits such as earliness, high yield potential, sweet taste, and tolerance to insect pests and diseases in cowpea production [19]. In Ghana, it was observed that farmers preferred cowpeas with cream, large seeds which are sweet and easy to cook [20].

From the survey all participants concurred that cowpeas were to be used for domestic consumption first before any extras could be sold. This is probably because Buhera district is generally dry and receives rainfall less than 650 mm annually on average hence, cowpea is an important food crop for the district [21]. Farmers grow cowpea for food security and in years of surplus mostly for cash. Most farmers in the district preferred early cowpeas, as a supplement for major staple food crops such as maize, sorghum pearl millet. Cowpea is mostly grown for its protein content and as a buffer crop against total crop failure due to recurrent droughts in the district. Some farmers indicated that financial needs were the reason for growing cowpea as a cash crop.

Future of cowpeas and way forward

The survey also underscored the need for extension services to be up scaled. Most farmers in the district rely on knowledge passed on from generation to generation. While this is important, it is necessary to fuse the knowledge gained with modern farming techniques. Farming requires improved decision-making in the use of resources and linking farmers to markets and extensionists can aptly fill this void. To be successful farmers need the skills to produce what the market wants and what satisfies consumers. Small-scale farmers grow cowpea intercropped with maize, millet, sorghum, finger millet and cotton. Small-scale farmers mostly grow cowpea intercropped with these cereals. This is highly beneficial through nitrogen fixation as cowpeas is a legume, animal fodder and soil erosion protection. Buhera District is characterized by loose sandy soils and these are prone to erosion. Intercropping is highly beneficial in controlling high rates of soil erosion. The other benefit observed was that when cowpea is intercropped with sunflower, it reduces evaporation of soil moisture by increasing soil cover [22]. Several interventions are needed to enhance the uptake and growing of cowpea in the district so as to meet food security and income needs of smallholder farmers. Yields are generally low in Buhera District amongst all crops grown and severely affected by intra and inter-seasonal rainfall variability and recurrent droughts. Drought is a perennial problem in Buhera and over the years *El Nino* induced drought has ravaged the district leaving dry land patches and massive livestock deaths [23]. Therefore, stable and high-yielding early maturing varieties are needed that can withstand moisture stress. There is a need to upscale extension services to farmers and integrate this with locally available techniques to increase cowpea production and mitigate against effects of recurrent droughts in the district. Cowpea can be regarded as the backbone of sustainable farming in semiarid lands [24].

During 2016/2017 farming season, Manicaland had the lowest proportion of planted legumes at 26% cowpeas included [25]. In 2015/2016 farming season most of the cowpea seed planted was from retained stock and 25% was bought from retail outlets [25]. However, in Southern Africa in 2016/2017 more than 60% of cowpea seed used by farmers was recycled or retained seed [26]. From the survey it was concluded that most

of the seed planted by farmers is sourced from on-farm seed saved from past harvests. This might have contributed to low harvest and thus there is a need for provision of hybrid early maturing seed at affordable prices for the farmers to purchase. Farmers highlighted several concerns with retained seed such as poor emergence, weevil attack, loss of vigour and poor yields. There is thus a need to make sure that quality high yielding seed is available for farmers so that they plant on time. This can be aptly achieved through conveyance of improved quality seed through formal channels such as agro-dealers and farmer groups. It has been argued that agriculture extension officers must demonstrate a technology to early adopters in farming as the slow learners would learn later from the early adopting farmers [27]. The role of agriculture extension officers cannot be over emphasised. However, agriculture extension officers need to be continually equipped with modern knowledge and skills to ensure that training is responsive to the current needs of farmers [28]. Through extension services, farmers' problems are identified for further investigation and policy direction.

CONCLUSION

Farmers noted the absence of new cowpea varieties and generally low cowpea yields. They also recognised and highlighted declining soil fertility and increasing effects of drought. Farmers' knowledge of plant, soil and water interactions is lacking and thus they have formed misconceptions about their current farming practices. Rapidly changing climatic conditions especially with respect to high temperatures and reduced rainfall have played havoc on cropping systems in the district. However, from the survey farmers showed willingness to try new cowpea varieties as well as get consistent agronomic information from extension workers. The identified constraints to cowpea farming included insect pests, diseases, drought, *Striga* spp. weeds, and harvesting difficulties. This shows that there is a great need to breed for both biotic and abiotic factors, such as drought and moisture stress, as well as against diseases and pests.

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Table 1: Number of farmers interviewed and distribution of respondents and cowpea farming systems

Ward	Male	Female	Total
7	4	6	10
10	3	10	13
11	4	7	11
12	2	5	7
13	8	7	15
14	13	6	19
15	3	2	5
16	5	5	10
17	3	3	6
18	3	1	4
Total	48	52	100
Level of education	Frequency	Percent	Cumulative
Primary	28	28	28
Secondary	58	58	86
Tertiary	14	14	100
Extension Services			
Training in cowpea production	27	27	27
No training in cowpea production	73	73	100
Cowpea yields	Frequency	Percent	Cumulative
100kg	4	4	4
150kg	32	32	36

200kg	48	48	84
250kg	12	12	96
300kg	2	2	98
500kg	2	2	100
Other Crops Grown	Frequency	Percent	Cumulative
Maize	83	83	83
Groundnuts	1	1	84
Sorghum	16	16	100
Farm Size	Frequency	Percent	Cumulative
1ha	43	43	34
2ha	49	49	92
3ha	7	7	99
4ha	1	1	100
No of Members per Household	Frequency	Percent	Cumulative
3	3	3	3
4	9	9	12
5	19	19	31
6	27	27	58
7	23	23	81
8	13	13	94
9	4	4	98
10	2	2	100

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Table 2: Production constraints and farmers seed trait preferences

Category	Item	Frequency	Percent	Cumulative
Inputs	Fertiliser	83	83	83
	Seed	16	16	99
	Labour	1	1	100
Field pests	Aphids	81	81	81
	Thrips	3	3	84
	Pod borer	3	3	87
	Stem borer	2	2	89
	None	11	11	100
Diseases	Downey mildew	1	1	1
	Rust	91	91	92
	Anthracnose	1	1	93
	Storage rots	2	2	95
	None	5	5	100
Post-harvest pests	Weevils	100	100	100
Weeds	Parasitic weeds			
	Yes	55	55	55
	No	45	45	100
Abiotic factors				
	Drought	10	10	10
	Soil fertility	4	4	14
	Heat	86	86	100
Qualitative traits	Grain colour			
	White	32	32	32
	Tan	1	1	33
	Brown	14	14	47
	Red	3	3	50

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Category	Item	Frequency	Percent	Cumulative
	None	50	50	100
	Pod shape			
	Spherical	2	2	2
	Kidney	3	3	5
	Globular	1	1	6
	None	94	94	100
Yield	High yield			
	High	99	99	99
	Not sure	1	1	100
|Resistance/tolerance	Resistance to diseases			
	Resistant/tolerant	52	52	52
	None	48	48	100
	Tolerance to drought			
	Tolerant	99	99	99
	Not sure	1	1	100
	Resistance to storage Pests			
	Resistant	94	94	94
	None	6	6	100
Maturity	Maturity period			
	Early	59	59	59
	Medium	36	36	95
	Late	5	5	100
Other	Low market prices			
	Low prices	34	34	34
	Not sure	66	66	100
Quantitative traits	Grain size			

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Category	Item	Frequency	Percent	Cumulative
	Large grains	44	44	44
	Any types	56	56	100
	Head size			
	Large	2	2	2
	Not interested	98	98	100
	Plant height			
	Climbing types	13	13	13
	Not interested	87	87	100
	Biomass			
	Large biomass	3	3	3
	Not interested	97	97	100

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Table 3: Cowpea varieties grown by farmers in Buhera District and their characteristics

Variety	Characteristic and colour	Growth habit	Advantages	Early, Medium or late maturity	Purpose	Rank
Barapara purple	Purple, landrace	Upright and bushy	Locally available	Late	Grain/Leaves	9
Mupengo black	Black, landrace	Upright and bushy	Locally available	Late	Grain/Leaves	13
Chibundi chemavara	Speckled/brown, landrace	Upright and bushy	Locally available	Late	Grain/Leaves	11
Dahwa	Brown, landrace	Upright and bushy	Locally available, sweet, good cooking qualities	Late	Grain/Leaves	10
Chibundi chitsvuku	Brown, landrace	Upright and bushy	Locally available	Late	Grain/Leaves	3
Barapara jena	White, landrace	Upright and bushy	Locally available	Late	Grain/Leaves	6
Mupengo mavara	Brown, landrace	Upright and bushy	Locally available	Late	Grain/Leaves	7
Ziso dema	Black and white, landrace	Upright and bushy	Locally available	Late	Grain/Leaves	12
Barapara mavara		Upright and bushy	Locally available	Late	Grain/Leaves	4
Kangorongondo	White, landrace	Climber	Locally available	Early	Grain	15
Mutonono	Brown, landrace	Upright and bushy	Locally available	Late	Grain/Leaves	14
Zvenyika	Brown, landrace	Upright and bushy	Locally available	Late	Grain/Leaves	5
CBC 1	Brown, hybrid	Upright and bushy	Good emergence, high yield	Early	Grain/Leaves	1
CBC 2	Brown, hybrid	Upright and bushy	Good emergence, high yield	Early	Grain	8
IT 18	Brown, hybrid	Upright and semi-bushy	Good emergence, high yield	Early	Grain/Leaves	2

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Table 4: Years of experience in growing cowpeas

Years	Frequency	Percent	Cumulative percent
0>x ≤5	3	3	3
5>x ≤10	18	18	21
10>x ≤15	30	30	51
15>x ≤20	22	22	73
20>x ≤25	21	21	94
25>x ≤30	5	5	99
30>x ≤35	1	1	100

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