African Journal of Biotechnology Vol. 8 (20), pp. 5383-5388, 19 October, 2009
Available online at http://www.academicjournals.org/AJB
ISSN 1684–5315 © 2009 Academic Journals

Full Length Research Paper

Needs assessment of cowpea production practices, constraints and utilization in South Africa

Asiwe, J. A. N.

Agricultural Research Council (ARC)-Grain Crops Institute, Private Bag X1251, Potchefstroom 2520, South Africa.
E-mail: AsiweJ@arc.agric.za. Fax: +27 18 294 7146.

Accepted 18 September, 2009

Cowpea is an important grain legume. Research and production of cowpea have been neglected in South Africa in the last three decades due to lack of funding and interest of researchers to work on the improvement of the crop. The consequence of these are that cultivated varieties are unimproved and the lack of knowledge of good agronomic practices worsen the limitations to cowpea production. In order to ascertain the extent of these problems and determine the needs of farmers, a baseline survey was conducted among cowpea production provinces of South Africa (Limpopo, Kwazulu-Natal and Mpumalanga) between 2004 and 2006 cropping seasons. Questionnaires were administered among farmers in co-operative societies. Data were collected on cropping systems, cultural practices, yield levels, constraints to production and utilization. Responses obtained from farmers were analysed using non-parametric or descriptive statistics. The data was summarised into averages, percentages or ranges. Results identified major production practices, importance and constraints to cowpea production in the provinces. The results form a useful pathway for needs towards the development of well-tailored breeding objectives to improve cowpea production in South Africa.

Key words: Cowpea, crop improvement, crop mixture, cropping systems, grain yield, limpopo, pests.

INTRODUCTION

Cowpea, *Vigna unguiculata* (L.) Walp, is an important grain legume. It is consumed by relatively rural and peri-urban people of less developed countries. Rural families derive food protein (Bressani, 1985), animal feed (Tarawali et al., 1997; Singh, 1999) and cash from the production of this crop (Quin, 1997). In addition, the crop fixes 80% nitrogen for its growth demand from the atomsphere (Asiwe et al., 2009), thereby reducing nitrogen fertilizer demand and cost for the crop. It is also an important companion crop in most cereal-legume cropping systems because of the benefit from the residual nitrogen originating from the decay of its leaf litter, roots and root nodules (Okereke et al., 2006). Research and production of cowpea have been neglected in South Africa in the last three decades. Research and production of cowpea have been neglected in South Africa in the last three decades.
Lack of improved varieties, knowledge of good agronomic practices, no availability of good seeds for planting and discouraging poor marginal returns to farmers further worsen the limitations to cowpea production in these provinces. Lack of knowledge of good agronomic practices, no availability of good seeds for planting and discouraging poor marginal returns to farmers further worsen the limitations to cowpea production in these provinces.

In order to ascertain the extent of these problems and propose a way forward for cowpea improvement, it was necessary to conduct needs assessment survey among the cowpea production areas of South Africa mainly Limpopo, Kwazulu-Natal and Mpumalanga provinces. Information on cropping systems, cultural practices, constraints to production, utilization and benefits would help to formulate breeding objectives and make decisions for the improvement of cowpea.

MATERIALS AND METHODS

South Africa is divided into provinces, districts, municipalities and villages or communities. Three provinces namely, Limpopo, Mpumalanga and KwaZulu-Natal were used in this survey because most cowpea production takes place there. Questionnaires were administered. For ease of access, local agricultural extension agents were recruited to direct the survey team to communities and also act as interpreters where necessary. In Limpopo and KwaZulu-Natal (KZN) provinces, where farmers exist in organized asso-

Table 1. Number and percentage of farmers in the provinces that participated during the survey.

Classification	Provinces		
	Mpumalanga	Limpopo	KwaZulu Natal
Men	24 (10%)	16 (59%)	30 (80.0%)
Women	219 (90%)	9 (33%)	7 (20%)
Children	0	2 (8%)	0
Total	243 (100%)	27 (100%)	37 (100%)

Table 2. Crops spatial distribution as grown by farmers in the provinces.

Crop	Province		
	Mpumalanga	Limpopo	KwaZulu-Natal
Maize	219 (90%)	22 (81%)	35 (100.0%)
Groundnut	219 (90%)	22 (81%)	24 (68.6%)
Dry beans	219 (90%)	22 (81%)	33 (94.3%)
Soybean	24 (10%)	5 (19%)	8 (22.9%)
Sweet potato	24 (10%)	5 (19%)	0
Cowpea	24 (10%)	5 (19%)	30 (85.7%)
Bambara	219 (90%)	22 (81%)	14 (40.0%)
Sunflower	24 (10%)	5 (19%)	2 (5.7%)

Table 3. Cowpea cropping systems practiced by farmers in Limpopo and KwaZulu Natal provinces.

Cropping systems	Provinces	
	Limpopo	KwaZulu Natal
Sole cropping	2 (7.4%)	6 (16.2%)
Inter cropping	7 (25.9%)	21 (56.8%)
Mixed farming	21 (77.8%)	13 (35.1%)
Livestock farming	4 (14.8%)	0

ciations, administration of questionnaire was relatively easier and faster. In Mpumalanga province, however, two districts namely Ehlanzeni and Gert Sibande with a total of 243 farmers were sampled. A total of 64 cowpea farmers were interviewed in Limpopo (maximum, 27) and KwaZulu-Natal (maximum, 37). Coloured photos of major cowpea insects were displayed to respondents to assist them recognize the insects that attack their cowpea in the field. The survey data was analysed using non-parametric or descriptive statistics and summarised into averages or percentages.

RESULTS

Socio-demographic information of survey households/associations

The distribution of farmers interviewed in Mpumalanga province showed that 90% of them were women (Table 1). In Limpopo and KwaZulu-Natal (KZN), the distribution was different. 59% of the respondents were men, 33% women and 8% children. In KwaZulu-Natal province, 80% were men and 20% women. With the exception of few places where children represented their parents, the age of adult respondents varied from 38 to 60 years with an average of 48 years.

Crops grown in the surveyed areas

Results showed that crops grown in order of importance were maize, groundnut, dry beans, soybean, sweet potato, cowpea, bambara and sunflower (Table 2). Over 90% of the respondents grow maize, groundnut and bambara while 10% of them plant either sweet potato, soybean, cowpea or sunflower in addition. Bambara is a popular crop in Mpumalanga, with less than 10% of the farmers growing cowpea because of higher rainfall (750-1000 mm). Cowpea thrives better in drier province like Limpopo. For this reason, subsequent results and discussion on cowpea will be based on Limpopo and KZN Provinces where production is higher.

Cropping systems practiced in the surveyed areas

There were different cropping patterns practised. These included sole cropping, intercropping, mixed farming and livestock farming systems. Among these, intercropping and mixed farming (crop and animal integration) were predominantly practiced in KZN (56.8%) and Limpopo (77.8%) provinces, while a few farmers (2-6%) were engaged in sole cropping and livestock farming (Table 3).

Table 4. Common crop mixtures grown by farmers in Limpopo and KwaZulu Natal provinces.

Cropping mixtures	Provinces	
	Limpopo	KwaZulu Natal
Cowpea/Sorghum	16 (59.2%)	0
Cowpea/Maize	21 (77.7%)	26 (70.3%)
Cowpea/Bambara	18 (66.7%)	0
Cowpea/Groundnut	0	13 (35.1%)
Cowpea/Millet	0	2 (5.4%)
Cowpea/Drybeans	12 (44.4%)	7 (18.9%)
Cowpea/Soya bean	0	4 (10.8%)

Table 5. Cowpea cropping patterns practiced by farmers in Limpopo and KwaZulu Natal provinces.

Cropping patterns	Provinces	
	Limpopo	KwaZulu Natal
Row cropping	2 (7.4%)	31 (83.8%)
Mixed planting	26 (96.3%)	12 (32.4%)
Strip planting	2 (7.4%)	1 (2.7%)

Table 4 shows various crop mixtures where cowpea is grown in association with sorghum, maize, millet, dry beans and bambara. Cowpea-maize (77.7%), cowpea-bambara (66.7%) and cowpea-sorghum (59.2%) mixtures were predominant in Limpopo province, whereas Cowpea-maize (70.3%) was prevalent in KZN.

Cropping pattern is the spatial arrangement of crops in the farm. Data collected on cropping patterns revealed that it was only in KZN that row planting was practiced widely (83.8%), while in Limpopo province, the opposite was the case, 96.3% of the farmers practice mixed planting, without row arrangement (Table 5).

Major pests of cowpea and other production constraints

Major and important insect pests of cowpea reported in the provinces were aphids, thrips, pod-sucking bugs and cowpea weevil (bruchids) (Table 6). Among the diseases (fungal, bacterial and viral), virus diseases ranked first as the most common disease attacking cowpea in both provinces (Table 6). Other constraints mentioned were drought and poor seed supply. Grasses were most common weeds in both provinces (Table 6) than the broad leaves. However, only a few respondents mentioned Striga and Alectra as important weeds in their fields. Other constraints included lack of market for their produce, poor pricing, pilfering and lack of storage facilities.

The survey also revealed that the land area planted by local farmers ranged between 0.25 and 2.0 ha per farmer (Table 7). Similarly, obtainable grain yield was very low.

Table 6. Pests incidence reported by farmers in Limpopo and KwaZulu Natal provinces.

Insect pests	Provinces	
	Limpopo	KwaZulu Natal
Aphids	5 (18.5%)	30 (81.1%)
Thrips	0	20 (54.1%)
Maruca pod borer	0	1 (2.7%)
Pod-sucking bugs	8 (29.6%)	19 (51.4%)
Weevils	18 (66.7%)	3 (8.1%)
Rodents (Meercat)	2 (7.4%)	20 (54.1%)
Diseases		
Viruses	16 (59.3%)	18 (48.6%)
Bacterial diseases	4 (14.8%)	1 (2.7%)
Fungal (root/stem rot)	2 (7.4%)	3 (8.1%)
Weeds		
Alectra	0	1 (2.7%)
Striga	0	6 (16.2%)
Grasses	27 (100%)	33 (89.2%)
Broadleaf	5 (21.5%)	8 (21.62%)

Grain yield was between 0.25 and 1.0 ton ha^{-1} with an average of 0.5 ton ha^{-1} per farmer (Table 7). The reasons adduced by farmers in Limpopo and KZN provinces for cultivating cowpea were mainly for family income and food (Table 8). Data collected on farmers' preferences on cowpea varieties and seed characteristics showed that crop maturity (whether early or late), growth habit, cowpea seed coat and seed size have strong influence on farmers' choice which may have direct link with consumers preferences (Table 9).

DISCUSSION

The survey showed that the average age of respondents was 48 years thus indicating that majority were relatively old men and women, which implies that farming in these communities might not be too lucrative as to attract young farmers or graduates. Most of them were retirees who farm only to subsidize their pension stipends to make a living. The predominance of women engaged in farming in Mpumalanga may not be unconnected to mining activities which have taken most of the men as preferred job opportunity thus leaving their women in the villages to take care of subsistence farming.

The types of crops grown in the three provinces were similar. Maize, groundnut, dry beans, bambara (in Mpumalanga) and cowpea (in KZN) were commonly grown across the provinces thus indicating that they are important food security crops. Others are grown in lesser extent indicating that they are minor, alternate or companion crops.

The results on cropping systems suggest that mixed farming and intercropping were predominant and that

Table 7. Land area under cowpea cultivation and cowpea grain yield in Limpopo and KwaZulu Natal provinces.

Land area	Province	
	Limpopo	**KwaZulu Natal**
>0.25 ha	6 (22.2%)	2 (5.4%)
0.25-0.5 ha	10 (37.0%)	5 (13.5%)
0.5 –1.0 ha	3 (11.1%)	1 (2.7%)
1.0 – 2.0 ha	7 (25.9%)	23 (62.1%)
Yield/ land area		
>0.25 - 0.5 ton.ha^{-1}	24 (88.9%)	20 (54.1%)
0.6 – 1.0 ton.ha^{-1}	1 (3.7%)	3 (8.1%)
>1.0 ton.ha^{-1}	1 (3.7%)	7 (18.9%)

Table 8. Farmers' reasons for cultivating cowpea.

Utilization of cowpea	Provinces	
	Limpopo	**KwaZulu Natal**
Source of food for the family	18 (66.7%)	37 (100.0%)
Source of income	20 (74.1%)	29 (78.4%)
Testing the varieties	0	0
Leisure	0	0

Table 9. Farmers' preferences in cowpea varieties.

Preference	Provinces	
	Limpopo	**KwaZulu Natal**
Seed colour	19 (70.4%)	19 (51.4%)
Seed size	7 (25.9%)	15 (40.5%)
Growth habit (spreading/upright)	5 (18.5%)	24 (64.9%)
Leaf types Dual types	1 (3.7%)	3 (8.1%)
Maturity periods (early / late)	21 (77.8%)	13 (35.1%)

cowpea is intercropped with cereals. This practice of intercropping cowpea with cereals is in conformity with those practices in other parts of sub Saharan Africa. This explains the importance of cowpea as a companion crop in cereal-legume cropping systems which are common practices adopted by farmers in sub Saharan Africa to avert risk, crop failure and distribution of farm labour (Singh et al., 1997; IITA, 1998; Olufajo and Singh, 2002). Other crops such as groundnut, dry beans and soybean were also grown in association with cowpea but to a lesser extent. This also points to the need to develop varieties suitable for intercrop systems as well as crop-livestock integration.

The cropping pattern whereby farmers plant without any row arrangement (mixed planting) as found in Limpopo is an indicator of bad cultural practice that should be replaced with row or strip planting (Singh and Ajeigbe, 2001, 2002). This needs the attention of agronomists and extension agents to organize demonstration plots and famers' school in the affected areas. This could be achieved through farmer participatory research and introduction of compatible ideotypic cowpea varieties such as erect cowpea varieties. The practice is bad and will not allow mechanization and application of farm inputs. This practice should be discouraged through enlightenment programmes such as farmers' school, demonstration plots and information days.

The survey revealed that insect pests, diseases (virus), common and parasitic weeds pose major constraints to cowpea production in Limpopo and KZN provinces. Development of Striga/Alectra resistant varieties, use of zero tillage in conjunction with suitable herbicide application would reduce the problems posed by weeds. These findings confirm the report of (Mathews, 2005; Asiwe, 2005, 2009) that insects especially aphids and viral diseases constitute a major constraint to cowpea produc-

tion in Limpopo province. These indicate the need to breed cowpea varieties resistant to these important insect pests, drought and diseases in order to increase yield and sustain cowpea productivity. The results also confirm the reports of previous workers on the importance of these biotic factors to cowpea production (Emechebe and Soyinka, 1985; Jackai and Daoust, 1986; Singh et al., 1990; Singh et al., 1992; Asiwe et al., 2005). Two strong reasons given by farmers for cultivating cowpea were source of family income and food. This is also in agreement with the result of a survey conducted on bambara (Greenhalgh, 2000), and on cowpea (Quin, 1997; Rachie, 1985). In many rural communities in Limpopo province, cowpea meal is served with maize meal, rice and as vegetable. Cowpea productions also serve as source of income generation to support family livings. Breeding high yielding varieties will contribute to the food security and improve their income generation to alleviate poverty. Acreage cultivated per farmer was small because grain yield was also very low. Yield was low but generally higher than those obtainable from West Africa (Van Ek et al., 1997; Singh et al., 1997). Farmers are likely to cultivate more land if crop yield is made higher through the introduction of improved varieties as well as cultural practices (Singh and Ajeigbe, 2001, 2002). The results suggest that cowpea production is still at subsistence level and needs a lot of improvement in terms of yield and constraints to its production.

Farmers' preferences as shown in the results indicate that farmers generally preferred important traits such as seed colour and size, growth habit and early maturity. Some group of farmers may prefer a particular variety because of its seed coat colour, early maturity or seed size. Seed coat colour preference varied from farmer to farmer. The colours identified among farmers included, red (from light red to dark red), cream, white with varying eye colours (back, brown and grey), black and mottled colours (brown, white, grey or red). Preference for maturity groups was based on the length of rainfall. Farmer in Limpopo preferred early-maturing varieties to evade drought and frost damage whereas some preferred bushy types or late-maturing cowpea because of higher fodder yield for their livestock. These imply that breeding objectives must be geared toward developing cowpea varieties with different seed coat colours, maturity groups (early and medium maturity) and seed sizes (large and medium) in order to meet farmers' and consumers' preferences. This finding is in line with past reports (Singh et al., 1997, 2002; Asiwe, 2007)

In conclusion, results of this survey identified production practices, production constraints, farmers' preferences and important reasons for growing cowpea. The results are important guides to formulate good farmer-consumer oriented breeding objectives. The information will be helpful to breeders and agronomists starting a new cowpea improvement programmes. Some of the breeding objectives and on-going activities in the cowpea breeding programme at ARC-Grain Crops Institute, Potchefstroom, were formulated based on the results of this survey, and are already addressing some of these constraints and findings to improve the livelihoods of farmers in their rural communities.

ACKNOWLEDGMENTS

The contribution of Mcknight Foundations (USA) to fund the cowpea project on which this survey was conducted is greatly appreciated. The author gratefully appreciates the technical assistance of staff of the Grain Crop Institute, Potchefstroom.

REFERENCES

Asiwe JAN, Nokoe S, Jackai LEN, Ewete FK (2005). Does varying cowpea spacing provide better protection against cowpea pests? Crop Prot. 24: 465-471.

Asiwe JAN (2007). Recent progress in cowpea breeding in Agricultural Research Council (ARC)-Grain Crop Institute, Potchefstroom, South Africa. Proceedings. The First International Conference on indigenous vegetables and legumes: Prospects for fighting poverty, hunger and malnutrition. Jointly organized by IPGRI, ICRISAT and the International Society for Horticultural Science (ISHS) 12-15 December 2006 at AVRDC-Regional Center for South-Asia, ICRISAT Campus, Patancheru, Hyderabad, AP, India, pp. 381-385

Asiwe JAN (2009). Insect mediated outcrossing and geneflow in cowpea *Vigna unguiculata* (L.) Walp: implication for seed production and provision of containment structures for GT Cowpea. Afr. J. Biotechnol. 8(2): 226-230, 19 January, 2009, ISSN 1684 5315 2009 ©Academic Journals. http://www.academicjournals.org/AJB

Asiwe JAN, Belane A, Dakora FD (2009). Evaluation of cowpea breeding lines for nitrogen fixatrion at ARC-Grain Crops Institute, Potchefstroom, South Africa. Paper presented at the 16th International Congress on Biological Nitrogen Fixation, Montana, USA, 14-19 June, 2009.

Bressani R (1985). Nutritive value of cowpea. In: Singh SR, Rachie KO (eds). Proceedings, cowpea research production and utilization, John Wiley and Sons, Chichester, London, pp. 353-356.

Emechebe AM, Soyinka SA (1985). Fungal and bacterial diseases of cowpea in Africa. In: Proceedings, cowpea research, production and utilization, pp. 173-192, (Eds. Singh SR & Rachie KO). John Wiley and Sons, Chichester, London.

Greenhalgh P (2000). The market potential for bambara groundnut. Natural Resources Institute (NRI), University of Greenwich, Chatham Maritime, Kent ME4 4TB UK, p. 33.

IITA (1998). Cowpea-cereals Systems Improvement in the dry Savannas. Ann. Report project 11. p. 69.

Jackai LEN, Daoust RA (1986). Insect pests of cowpeas. Ann. Rev. Entomol. 31: 95-119.

Okereke GU, Egwu SE, Nnabude P (2006). Effect of cowpea organic residues and fertilizer N on soil fertility, growth and yield of upland rice. Proceedings of the Eighteenth World Congr. Soil Sci. Philadelphia, Pennsylvania, USA, July 9-15, 2006.

Olufajo OO, Singh BB (2002). Advances in cowpea cropping system research. In: Fatokun CA, Tarawali SA, Singh BB, Kormawa PM, Tamo M (eds). Proceedings, World Cowpea Conference III, Challenges and opportunities for enhancing sustainable cowpea production, IITA, Ibadan, Nigeria, 4-8 September, 2000, pp. 267-277.

Mathews C (2005). Minor edible legumes in Mpumalanga, South Africa. Proceedings of first International edible legume conference in conjunction with the fourth world cowpea congress, University of Pretoria, Pretoria, Published in IELC website. http://www.up.ac.za/conferences/ielc/ held at Durban, 17-21 April, 2005.

Quin FM (1997). Introduction. In: Singh BB, Mohan Raj DR, Dashiell KE, Jackai LEN (eds). Proceedings, Advances in cowpea research ix-xv, Sayce Publishing, Devon, UK.

Rachie KO (1985). Introduction. In: Singh SR, Rachie KO (eds). Proceedings, cowpea research, production and utilization, John Wiley and Sons, Chichester, London, pp. xxi-xxviii.
Singh SR, Jackai LEN, Dos Santos JHR, Adalla CB (1990). Insect pests of cowpea. In: Singh SR (ed). Proceedings, insect pests of tropical food legumes, John Wiley & Sons, Chichester London), pp. 43-90.
Singh SR, Jackai LEN, Thottappilly G, Cardwell KF, Myers GO (1992).
Status of research on constraints to cowpea production. In: Thottappilly G, Monti LM, Mohan Raj DR, Moore AW (eds). Proceedings biotechnology: enhancing research on tropical crops in Africa, Sayce Publishing, Exeter, UK. pp. 21-26
Singh BB, Chambliss OL, Sharma B (1997). Recent advances in cowpea breeding. In: Singh BB, Mohan Raj DR, Dashiell KE, Jackai LEN (eds). Proc. Adv. Cowpea Res., Sayce Publishing, Devon, UK, p. 375.
Singh BB (1999). Improved drought tolerant cowpea varieties for the Sahel Project 11. Cowpea-cereal system improvement for the savannas, IITA, Ibadan, Nigeria, p. 36.
Singh BB, Ajeigbe HA (2001). Breeding improved cowpea varieties for different cropping systems and Agro-ecologies in West Africa. Afr. Crop Sci. Conf. Proc. 5: 35-41
Singh BB, Ajeigbe HA (2002). Improving cowpea-cereal based systems in the dry Savannas of West Africa. In: Fatokun CA, Tarawali SA, Singh BB, Kormawa PM, Tamo M (eds). Proceedings, the World Cowpea Conference III, Challenges and opportunities for enhancing sustainable cowpea production, International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria, 4-8 September 2000, pp. 278-286
Singh BB, Ehlers JD, Sharma B, Freire Filho FR (2002). Recent progress in cowpea breeding. In: Fatokun CA, Tarawali SA, Singh BB, Kormawa PM, Tamo M (eds). Proceedings, the World Cowpea Conference III, Challenges and opportunities for enhancing sustainable cowpea production, Int. Inst. Trop. Agric. (IITA), Ibadan, Nigeria, 4-8 September 2000, pp. 22-40
Singh BB, Chambliss OL, Sharma B (1997). Advances in cowpea breeding. In: Singh BB, Mohan Raj DR, Dashiell KE, Jackai LEN (eds). Proceedings, Adv. Cowpea Res., Sayce Publishing, Devon, UK, pp. 30-49
Tarawali SA, Singh BB, Peters M, Blade SF (1997). Cowpea haulms as fodder. In: Singh BB, Mohan Raj DR, Dashiell KE, Jackai LEN (eds). Proceedings, Adv. cowpea res., Sayce Publishing, Devon, UK. p.375
Van Ek GA, Henriet J, Blade SF, Singh BB (1997). Quantitative assessment of traditional cropping systems in the Sudan Savannah of Northern Nigeria II. Management of productivity of major cropping system. Samaru J. Agric. Res. 14: 47-60.