

CHAPTER 3

SURVEY ON THE IMPORTANCE AND UTILISATION OF COWPEA BY RURAL COMMUNITIES IN THE MPUMALANGA PROVINCE OF SOUTH AFRICA

3.1. INTRODUCTION

Cowpea (*Vigna unguiculata* (L.) Walp) is an indigenous African legume crop that is widely cultivated throughout tropical and subtropical parts of Africa, the Middle East, Oceania, southern United States of America, Asia, southern Europe and South America (Singh *et al.* 2002). According to the Food and Agriculture Organisation of the United Nations (FAO) (FAOSTAT 2004), cowpea production in South Africa compares weakly (7000 t) with major grain crops like maize (*Zea mays* L.) (9,714,254 t) and wheat (*Triticum aestivum* L.) (1,600,000 t). Production levels for 2003 for other legume crops including soybeans (*Glycine max* L.) (148,000 t), groundnuts (*Arachis hypogaea* L.) (100,000 t), green peas (*Pisum sativum* L.) (18,545 t) and lupines (*Lupinus* spp.) (11,700 t) were much higher than cowpea, with the exception of dry peas, which was substantially lower at 1,033 t (FAOSTAT 2004). Cowpea production in South Africa is fairly minor when compared to other African countries (FAOSTAT 2004). Nigeria is the largest producer and consumer of cowpea with about 5 million ha and over 2 million t production during 2003. Cowpea seed set aside for sowing or planting in South Africa was also lower (365 t) when compared to Nigeria with 175,000 t and Niger with 140,000 t (FAOSTAT 2004).

Small-scale farmers and rural communities receive numerous benefits from the cultivation of this crop. These include the haulm used as fodder for animals, income through the trade of the seed and a source of nutritious food. The people obtain a good supply of proteins, carbohydrates and vitamins from all the plant parts used for food, especially from the seed (Quin 1997; Singh *et al.* 2002). Furthermore, it is a fast growing crop, prevents soil erosion by covering the ground and fixes atmospheric nitrogen making it a good intercrop (Singh *et al.* 2002). There are also reports on the use of the plant for medicinal purposes. Among these are seed decoctions taken to treat liver complaints associated with jaundice (Noorwala *et al.* 1995), blood in the urine and bilharzia (Nyazema 1987; van Wyk & Gericke 2000), and amenorrhoea (van Wyk & Gericke 2000).

Despite all the beneficial uses, there are numerous constraints that impede the optimal utilisation of the crop. Diseases induced by various pathogenic groups, including fungi, bacteria, viruses, nematodes and parasitic flowering plants, are considered as important constraints to cowpea production

(Emechebe & Lagoke 2002). Similarly, after harvesting when the seeds are stored, seed deterioration can occur as a result of physical (temperature, humidity), biological (fungi, bacteria, insects, rodents) and technical (method and duration of storage) factors (Appert 1987). When seeds are stored in conditions where high relative humidities and high temperatures prevail, certain fungi produce toxic metabolites, namely mycotoxins. These metabolites when ingested after consuming infected seed, can lead to dramatic adverse health conditions for both animals and humans (Moss 1996).

Previous surveys regarding cowpea were concerned with indigenous cowpea production practices (Kossou *et al.* 2001) and consumer preferences for cowpea (McWatters *et al.* 1990; Langyintuo *et al.* 2004). Kossou *et al.* (2001) conducted a survey in the Ouémé valley, Benin to investigate the importance of pests and diseases as constraints to cowpea production. Similarly, Alghali & Pratt (1995) gained insight into indigenous farming practices regarding pest management for cowpea in southern Sierra Leone.

This study was undertaken to gain insight into the current status of cowpea production and utilisation in rural communities in the Mpumalanga Province of South Africa. Given the focus areas of this thesis, particular emphasis was placed on gathering information on post-harvest storage practices and the problems encountered as well as possible medicinal uses of the crop.

3.2. METHODOLOGY

3.2.1. Survey area

The survey was carried out in various rural settlements in the Lowveld region in the Mpumalanga Province (Figure 3.1.). The areas included Nsikazi North, Malekutu, Clau-Clau, Tsonga, Buffelspruit, Numbi, Kahoyi, Mahushu and Goba. The survey was done during the period of September 2003 - August 2004.

3.2.2. Survey questionnaire

A questionnaire was designed to gather information firstly on the importance and role of cowpea in the livelihoods of the people, secondly on the cultivation and storage practices followed, and thirdly health implications encountered. The questionnaire is presented as Appendix A. Although most of the farmers were interviewed on their farms, some farmers were interviewed as a group in a community hall. Trained interviewers administered the questionnaire to the people (Figure 3.2.). In certain instances a translator was needed to facilitate communication between the interviewer and the person interviewed. Where possible, digital photographs were taken of seed storage containers and facilities.



Figure 3.1. Survey area, indicated by the red ring, in the Mpumalanga Province, South Africa



Figure 3.2. Farmer and his family together with interviewers during an interview in Mpumalanga

3.2.3. Analysis of results

All the data gathered was entered in the Microsoft Excel Spreadsheet programme to calculate percentages and to construct graphical representations of the data.

3.3. RESULTS AND DISCUSSION

3.3.1. Biographical profile

A total of 71 people were interviewed in the survey, of which 43 were male and 28 were female. The age demographics of the people interviewed are indicated in Figure 3.3. The majority of the respondents (28.2%) were in the middle-age group (40-49 years) and the oldest people interviewed were between 80 and 89. A relatively large group (23.9%) stated that their age was unknown. All the farmers interviewed belonged to various farmer associations.

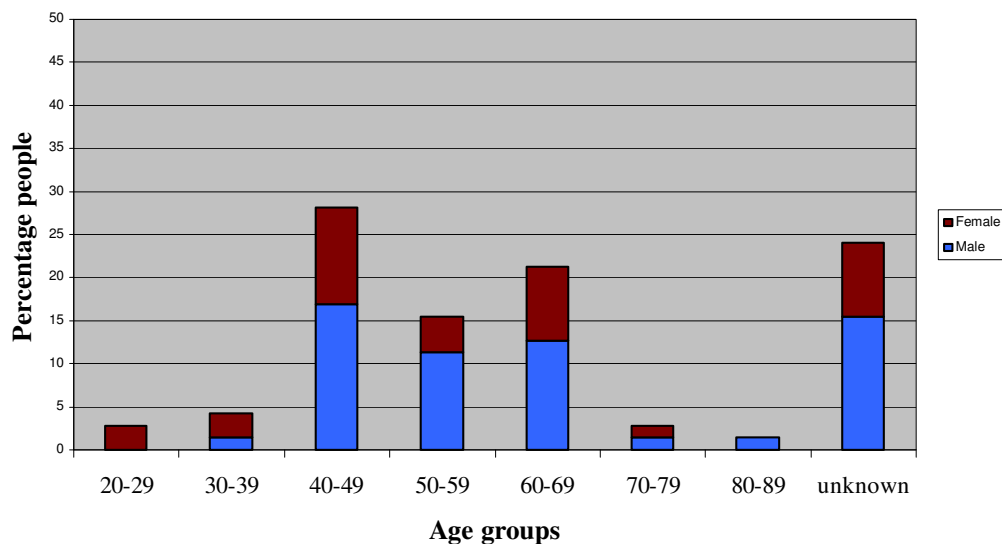


Figure 3.3. Age demographics of people interviewed in Mpumalanga

It was found that 29% of the respondents relied only on agricultural activities for a source of income (Figure 3.4.). Almost 70% of the people interviewed received income from agricultural activities together with other employment. Half the number of people who relied on agricultural activities as their major livelihood were pensioners. The additional jobs included teaching, taxi drivers, shop owners, social workers, mechanics, plumbers, ministers and selling clothes.

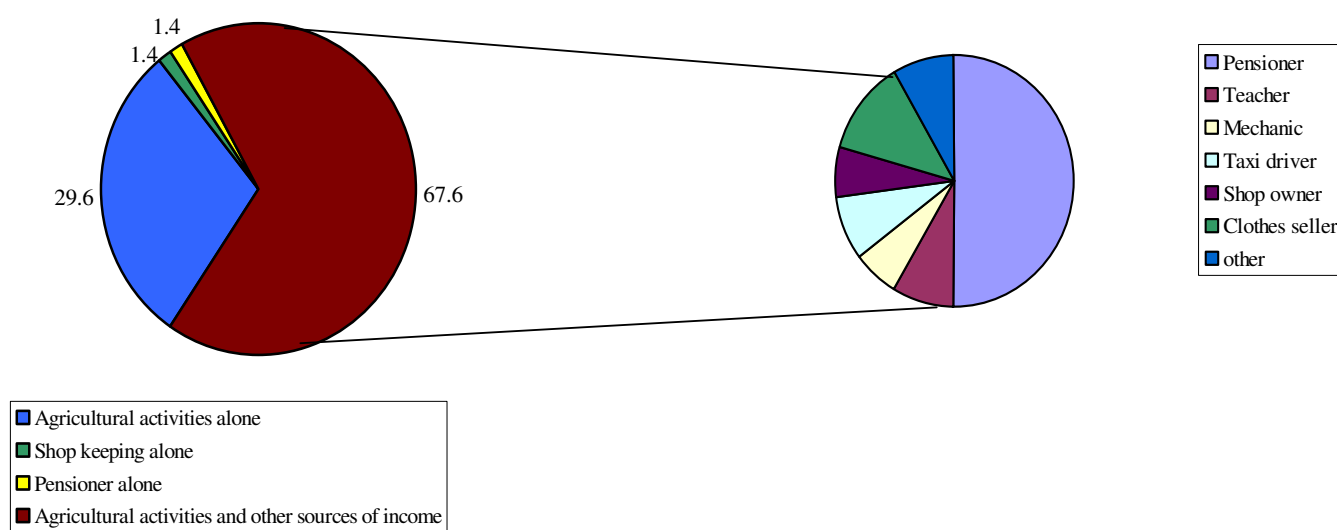


Figure 3.4. Source of income of the people interviewed in Mpumalanga

3.3.2. Agricultural profile

Crop production was ranked as the most important (98.5%) and only agricultural activity practiced whilst one farmer (1.4%) ranked livestock farming as most important. The size of land available for agricultural activities varied between less than 0.5 ha to more than 20 ha (Table 3.1.) with 81 ha being the largest piece of land for crop production. The majority of the farmers had small farms between 0.1 and 4 ha with many farms below 1 ha. The total area of land that was used in South Africa for cowpea production during 2003 was approximately 13,500 ha (FAOSTAT 2004).

Table 3.1. Size of land used for agricultural activities by farmers interviewed in Mpumalanga

	0.1-0.9*	1-1.9	2-2.9	3-3.9	4-4.9	5-5.9	6-10	11-15	16-20	>20
Male	17	4	4	6	4	2	1	2	1	2
Female	9	11	2	3	1	0	2	0	0	0
Total	26	15	6	9	5	2	3	2	1	2

* ha

3.3.3. Importance and role of cowpea

As expected, cowpea was generally not seen as a crop of major importance for household security. It ranked third highest together with a variety of other crops including groundnuts, fruits, cotton (*Gossypium* spp.) and other legumes. Maize and vegetable production was ranked as being most and second most important, respectively, by the respondents. This is in contrast with many African countries, especially in Central and West Africa, where cowpea plays a major role in the livelihoods of many subsistence farmers and rural communities (Singh *et al.* 2002). In Sierra Leone, cowpea is grown mostly as a secondary crop (Alghali & Pratt 1995).

A large number of the people chose to grow cowpea as it was a tradition (71.8%) passed on to them by their forefathers. The use of the crop for food consumption (23.9%) was also an important factor in their choice to produce cowpea. Other reasons why people chose to produce cowpea were; the right climate prevailed (4.2%), a source of good income (2.8%), drought resistant (1.4%) and a good crop for crop rotation (1.4%).

3.3.3.1. Use as a food crop

Of the 71 people interviewed, 98.6% use cowpea for own consumption. As indicated in Figure 3.5, cowpea was not readily consumed, as is the case in many other African countries. The majority of the respondents (52.1%) consumed cowpea less than once a week.

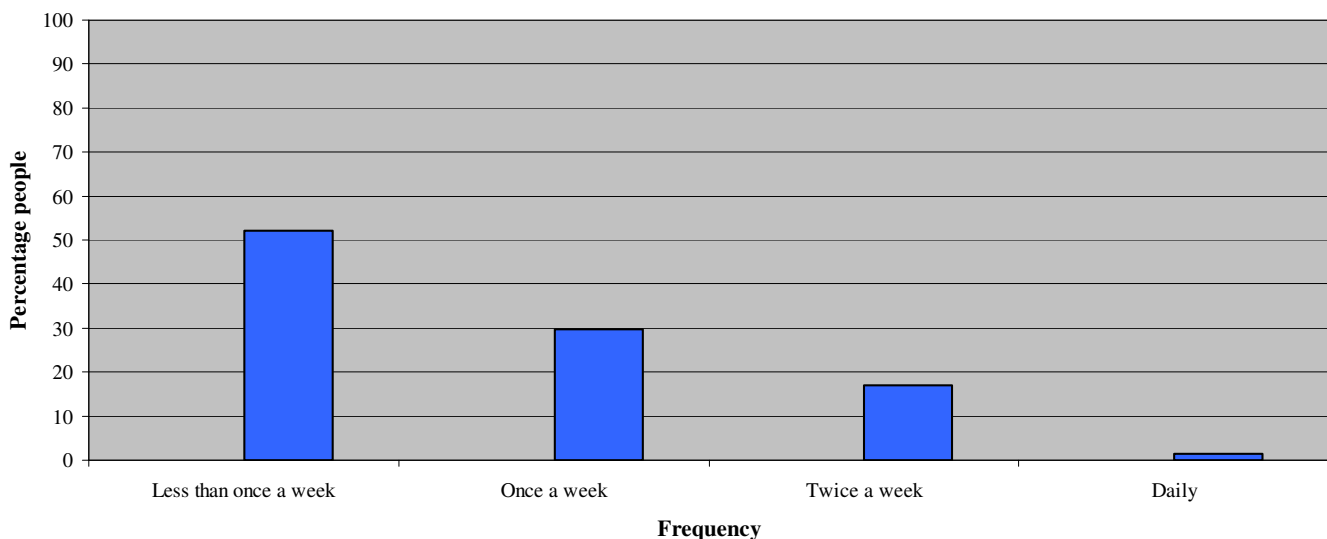


Figure 3.5. Frequency of cowpea consumption by people in Mpumalanga

The main source of cowpea for consumption was from the farmers' own produce (83.6%). Other places where cowpeas were obtained included hawkers and local markets (10.9%) and other shops (5.6%). The people that consumed cowpea preferred whole cooked seeds (88.7%). This same preference was also found amongst people in India (Kachare *et al.* 1988). Many people used the crop as an ingredient in dishes (69.0%). Responses indicated that it could be used as an ingredient in soups and could be added to samp (*Zea mays*). The leaves were used as a vegetable (26.8%), the seeds were ground to make a porridge (4.2%) and could be used as a baking product (1.4%). Seven percent of the people interviewed ate the fresh pods.

This study showed that a preference for seed colour existed amongst the people interviewed. Just over a half of the people preferred the light seed (50.7%), 33.8% preferred darker-coloured seeds whilst the remaining 15.5% did not seem to have any preference to seed colour. A respondent remarked that the plants that came from the dark seeds grew straight upwards, whilst another respondent did not know that seeds other than dark coloured ones even existed. Langyintuo *et al.* (2004) investigated the consumer preferences for cowpea in Cameroon and Ghana and found that the seed with a white seed coat was popular in only one market in Ghana. Black eyes were found to be premium in Ghana but not in Cameroon. On the other hand, grain size was found to be the most important characteristic in both countries as most consumers preferred large grain (Langyintuo *et al.* 2004). During another survey, 84.2% of Ghanaian mothers preferred cowpea varieties with light coloured seed coats for infant food preparation (Phillips *et al.* 2003).

3.3.3.2. Source of income

Just more than 40% of the respondents claimed that cowpea contributed in some way to their household income. The most stated that the contribution was small (less than 25%) whereas one person regarded cowpea as an important contribution (more than 50%) to the household income (Figure 3.6.). On average, a cup (\pm 250 ml) of seed was sold for three Rand. The price for one kilogram of seed varied between two and three Rand. Larger quantities reached prices of R 10 per 5 kg and R 20 per 10 kg. The excess produce was sold mainly to neighbours on a door-to-door basis or at pension pay points (84.9%) whereas a small percentage of the farmers sold the seed at the local markets (9.7%).

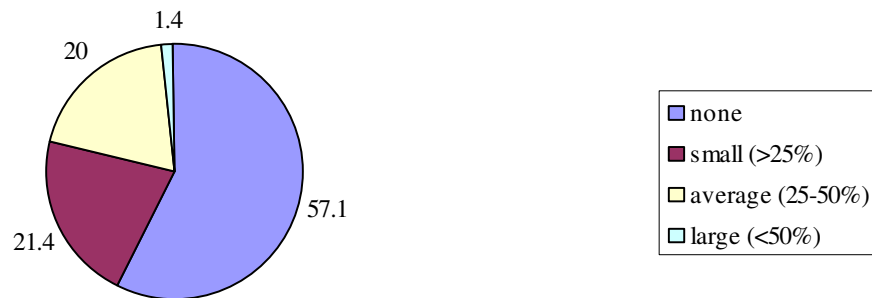


Figure 3.6. Percentage contribution of cowpea to household income in Mpumalanga

3.3.3.3. Feed for livestock

Cowpea was generally not used as feed for livestock. However, those that did use it preferred to use the fodder rather than the seed (Figure 3.7.). One respondent reported that she fed her pigs on a daily basis with cowpea fodder. The use of cowpea as fodder is most advanced in India, regarded primarily as a fodder crop in Australia since the late 1950's, and plays a major role in drier areas in West Africa (Tarawali *et al.* 1997). Cowpea haulms compare very well with other forage legumes, mostly with higher crude protein, digestibility and mineral content but has lower fibre (Tarawali *et al.* 1997).

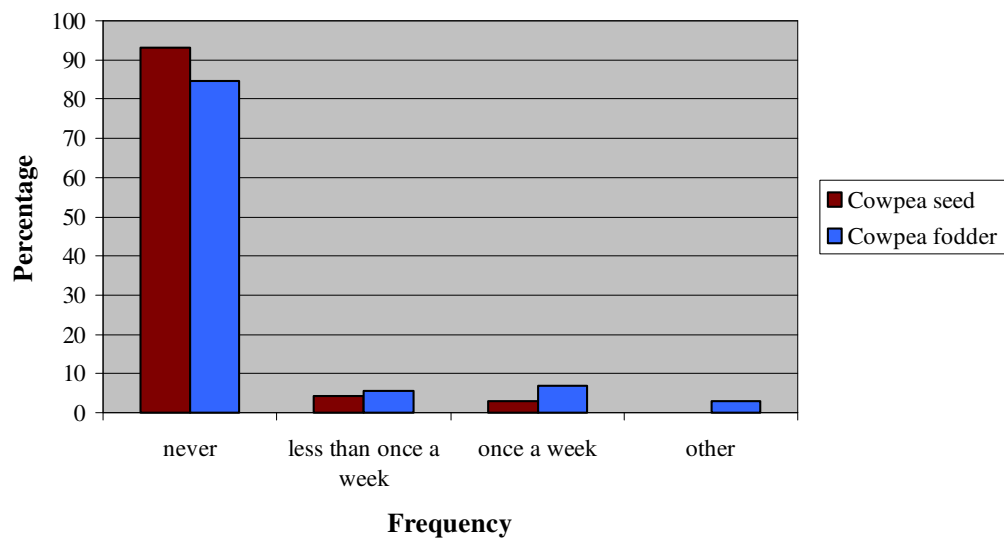


Figure 3.7. Frequency of cowpea consumption by animals in Mpumalanga

3.3.3.4. Medicinal uses

Due to the current interest in investigating plants for sources of new medicines, an aspect of particular interest of this survey was the use of cowpea for medicinal purposes. In this study, of the 10% of people who said that they use cowpea medicinally, the majority stated that they used the seeds. The seeds were used to make a paste and applied to open wounds, abscesses and tumours and the paste presumably healed the sores. Other researchers have identified the seeds to have diuretic and anthelmintic properties (Noorwala *et al.* 1995). One respondent indicated that she cooked the roots for medicinal purposes. A previous report indicated that decoctions of roots were used for treating painful menstruation, epilepsy and chest pain (van Wyk & Gericke 2000).

3.3.4. Cultivation practices

Less than half the people interviewed have been producing cowpea actively for less than five years (Figure 3.8.). However, 21.2% have been growing cowpea for more than 20 years where some farmers said they were continuing the tradition started by their forefathers.

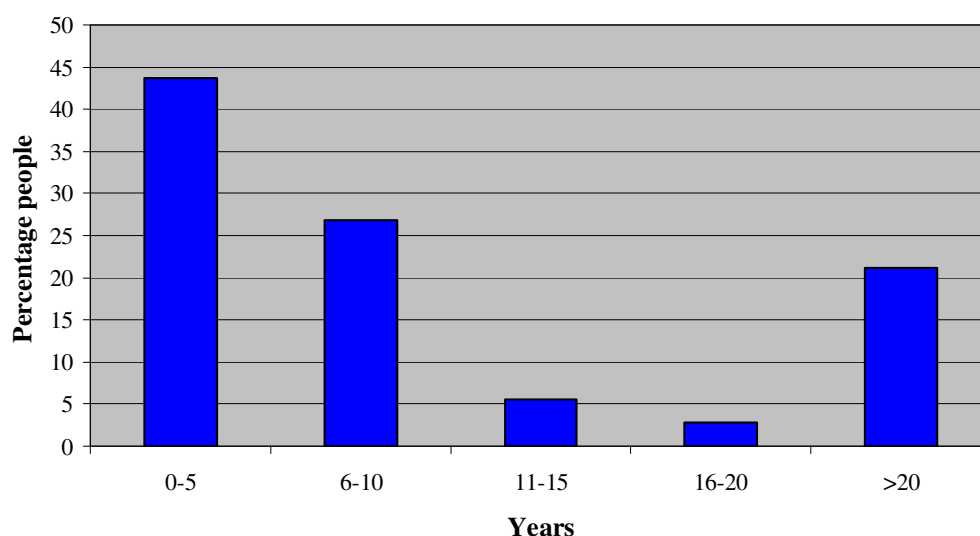


Figure 3.8. Number of years that the respondents have been producing cowpea in Mpumalanga

Most farmers received training with respect to the cultivation of cowpea (60.6%) and were mainly trained through the Department of Agriculture. This was done, for example, in the form of farmers' days where the farmers learnt more about the crop and cultivation procedures from scientists. A small percentage of the training was provided by a company known as Ecolink. Plant protection was not actively practiced by the people (65.7%). Those that did practice it (34.3%), used pesticides and ash to

rid insects whereas some used the harmful chemical, dichloro diphenyl trichloroethane (DDT) to treat their crops in the field. A total of 53.5% of the farmers practiced intercropping, predominantly with maize and groundnuts, and to a lesser extent with Bambara groundnuts/jugo beans (*Vigna subterranea* (L) Verdc.). This is similar to intercropping practices followed in Benin (Kossou *et al.* 2001). More farmers should be encouraged to practice intercropping as cowpea actively fixates atmospheric nitrogen, thus increasing soil nitrogen levels for other crops. Almost 60% of the people interviewed did not practice crop rotation. In the Ouémé Valley in Benin, farmers practice various types of crop rotation. Cowpea is often sown second or third after maize as it improves soil fertility and is less labour intensive (Kossou *et al.* 2001).

3.3.5. Storage practices

Drying the seed prior to storage was followed by 98.5% of the people interviewed and this was done mainly by spreading the seeds onto a surface and letting them dry in the sun. Storage containers used by most farmers included calabashes and tins. Other storage mediums included cribs made from plant material, plastic buckets, glass bottles, cement rooms, sacks and wooden rooms (Figure 3.9.). This complements storage practices in Benin, where closed containers like casks and big jars are used to store dry grain (Kossou *et al.* 2001).

A low percentage of respondents encountered problems with mouldiness (19.7%), less had problems with insects (16.9%) and even less reported problems with both insects and mould (14.1%) during storage. Many of the farmers (47.9%) stated that they had no problems during seed storage. This was apparent since many of the farmers adequately dried their seeds prior to storage and many of them (67.1%) treated the seeds with different substances to deter pests.



Figure 3.9. Various storage containers observed during the survey in Mpumalanga; a. plastic bucket, b. cement room, c. wooden room and d. metal box

These substances included ash, pesticides and 8.5 % of the people treated the seeds with DDT during storage. In Benin, local plant-based preparations are used to protect the grains during storage (Kossou *et al.* 2001). In the results of a survey by Kossou *et al.* (2001), it was shown that the insects *Callosobruchus maculatus* Fab. and *Bruchidius atrolineatus* Fab. caused up to 100% loss to cowpea seeds within a few months of storage. The survey indicated that white coloured mould and black coloured mould were predominantly found on the seeds that were stored. Some people stated that green and pink coloured moulds were also growing on the seeds. From these observations, fungi like *Fusarium* spp. and *Aspergillus flavus* Link ex Fries could be present on the seeds. The majority of the farmers (85.9%) did not encounter any problems with the germination of the seeds after storage.

3.3.6. Health aspects

Cowpeas and beans are known to contain antinutritional factors that limit their consumption (Phillips *et al.* 2003). Indigestible oligosaccharides, such as raffinose and stachyose cannot be utilised by humans and monogastric animals since they lack the specific specific α -galactosidase enzyme needed to digest

them (Phillips *et al.* 2003). In Ibadan, Nigeria mothers were interviewed concerning the problems encountered by children consuming cowpeas. The majority of the mothers (90%) reported no problems attributed to the consumption, but 9.9% of the mothers reported discomfort in their children including diarrhoea, vomiting, offensive stool, abdominal pains, bad breath, abdominal distension and flatulence. Apparently, these problems disappeared later in the lives of the children (Hussain *et al.* 1992). During the present survey, only one person complained of constipation after consuming cowpea. In the case of the livestock, one person noted that his livestock were bloated after eating the fodder.

A plausible explanation why not many problems were reported could be because cowpea was not consumed on a regular basis. It does not seem that there are any ill effects due to mycotoxin ingestion amongst the people and animals. This could also be due to the small intake of seeds and good storage practices. However, chronic effects due to mycotoxin ingestion can only be established by monitoring the people and animals on a long term basis.

3.3.7. Major constraints associated with cowpea production

About 36.6% of the people stated that they experienced no major constraints when it came to the production of cowpea (Figure 3.10.). The constraints identified were largely due to external factors. Thirty-five percent saw drought as a major constraint. Insects including black lice and aphids were also a cause for concern (22.5%) whereas lesser constraints included lack of irrigation water, loss of plants due to cattle grazing and wild animals, deep ploughing and poor flowering of the crop. In the Ouémé Valley, Benin amongst 129 farmers interviewed, the primary constraints to cowpea production were insects (bruchids during storage), birds and rodents (Kossou *et al.* 2001). Similarly, vertebrate and insect pests were identified by farmers in Sierra Leone as limiting cowpea grain production (Alghali & Pratt 1995).

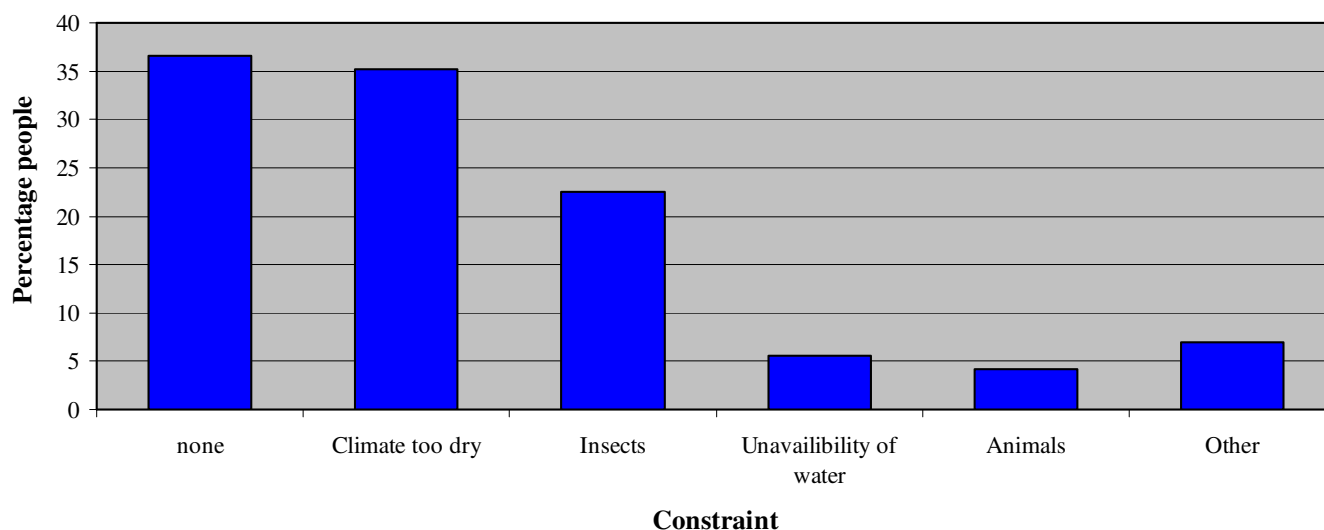


Figure 3.10. Major constraints associated with cowpea cultivation in Mpumalanga

3.4. CONCLUSION

Although cowpea is not considered as an important crop to cultivate, it is evident from this study that the rural communities do rely on it in many ways, mainly as a source of food and, to a lesser extent, as a commodity to trade with. The information gathered from this survey revealed that most of the farmers had a good understanding of the cultivation and benefits of cowpea. Although the majority of the farmers received formal training with respect to cowpea production a concern exists with the continuing use of DDT both in the field and during storage. The evidence of mould on the seeds led to the investigation of storage fungi and possible mycotoxin contamination associated with the seed (Chapter 4). A possible health risk could exist due to the consumption of contaminated feed. Interesting information regarding the medicinal uses of the crop confirms previous reports by other sources. This study prompted the investigation into the antimicrobial activity of cowpea extracts (Chapter 6), providing a good starting point into the scientific validation of the medicinal properties of cowpea.

The potential benefits from the cultivation of cowpea by small-scale farmers in South Africa are numerous. As a good source of protein, it can contribute positively towards food security. Although the farmers have established adequate cultivation and storage practices the input from researchers to rural communities to disseminate knowledge will play an integral part in the increased and sustainable use of cowpea in South Africa.

3.5. ACKNOWLEDGEMENTS

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3.6. LITERATURE CITED

Alghali AM, Pratt DE (1995) Utilisation of farmers' practices and perceptions in the formulation of pest management strategies for cowpea production in southern Sierra Leone. *Insect Science and its Application* **16**: 103-108

Appert J (1987) *The storage of food grains and seeds*. Macmillan Publishers Ltd., London. p. 5. ISBN 0-333-44827-8

Emechebe AM, Lagoke STO (2002) Recent advances in research on cowpea diseases. In: Fatokun CA, Tarawali SA, Singh BB, Kormawa PM, Tamò M (eds) *Challenges and opportunities for enhancing sustainable cowpea production*. Proceedings of the World Cowpea Conference III held at the International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria, 4-8 September 2000. IITA: Ibadan, Nigeria. pp. 94-123. ISBN 978-131-190-8

FAOSTAT (2004) (Food and Agriculture Organisation Statistical Database).
<http://apps.fao.org/faostat/collections>

Hussain MA, Akinyele IO, Omololu A (1992) Maternal perceptions of gastro-intestinal problems in the feeding of cowpeas (*Vigna unguiculata*) to young children in rural Ibadan, Nigeria. *Food and Nutrition Bulletin* **14**: 55-58

Kachare DP, Chavan JK, Kadam SS (1988) Nutritional quality of some improved cultivars of cowpea. *Plant Foods for Human Nutrition* **38**: 155-162

- Kossou DK, Gbehounou G, Ahanchede A, Ahohuendo B, Bouraima Y, van Huis A (2001) Indigenous cowpea production and protection practices in Benin. *Insect Science and its Application* **21**: 123-132
- Langyintuo AS, Ntougam G, Murdock L, Lowenberg-DeBoer JL, Miller DJ (2004) Consumer preferences for cowpea in Cameroon and Ghana. *Agricultural Economics* **30**: 203-213
- McWatters KH, Resurreccion AVA, Fletcher SM (1990) Response to American consumers to akara, a traditional West African food made from cowpea paste. *International Journal of Food Science and Technology* **25**: 551-557
- Moss MO (1996) Mycotoxins. *Mycological Research* **100**: 513-523
- Noorwala M, Mohammad FV, Ahmad VU (1995) A new monodesmosidic triterpenoid saponin from the seeds of *Vigna unguiculata* subsp. *unguiculata*. *Journal of Natural Products* **58**: 1070-1074
- Nyazema NZ (1987) Medicinal plants of wide use in Zimbabwe. In: Leewenberg AJM (ed) *Medicinal and poisonous plants of the tropics. Proceedings of Symposium of the 14th International Botanical Congress, Berlin*. Pudoc, Wageningen. pp. 36-43. ISBN 902-200-921-1
- Phillips RD, McWatters KH, Chinnan MS, Hung Y-C, Beuchat LR, Sefa-Dedeh S, Sakyi-Dawson E, Ngoddy P, Nnanyelugo D, Enwere J, Komey NS, Liu K, Mensa-Wilmot Y, Nnanna IA, Okeke C, Prinyawiwatkul W, Saalia FK (2003) Utilization of cowpeas for human food. *Field Crops Research* **82**: 193-213
- Quin FM (1997) Introduction. In: Singh BB, Mohan Raj DR, Dashiell KE, Jackai LEN (eds) *Advances in cowpea research*. Co-publication of International Institute of Tropical Agriculture (IITA) and Japan International Research Center for Agricultural Sciences (JIRCAS), IITA, Ibadan, Nigeria. pp. x-xi. ISBN 978-131-110-X

- Singh BB, Ehlers JD, Sharma B, Freire Filho FR (2002) Recent progress in cowpea breeding. In: Fatokun CA, Tarawali SA, Singh BB, Kormawa PM, Tamò M (eds) Challenges and opportunities for enhancing sustainable cowpea production. Proceedings of the World Cowpea Conference III held at the International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria, 4-8 September 2000. IITA, Ibadan, Nigeria. pp. 22-40. ISBN 978-131-190-8
- Tarawali SA, Singh BB, Peters M, Blade SF (1997) Cowpea haulms as fodder. In: Singh BB, Mohan Raj DR, Dashiell KE, Jackai LEN (eds) Advances in cowpea research. Co-publication of International Institute of Tropical Agriculture (IITA) and Japan International Research Center for Agricultural Sciences (JIRCAS), IITA, Ibadan, Nigeria. pp. 313-325. ISBN 978-131-110-X
- Van Wyk B-E, Gericke N (2000) People's plants: A guide to useful plants in southern Africa. Briza Publications, Pretoria. p. 192. ISBN 187-509-319-2