POLICY BRIEF

October 2020
The WRC operates in terms of the Water Research Act (Act 34 of 1971) and its mandate is to support water research and development as well as the building of a sustainable water research capacity in South Africa.

Improving food security by enhancing the productivity of grain legumes – Limpopo study

A recently completed Water Research Commission (WRC) project investigated ways of enhancing food security, nutrition, and production efficiency of high-yielding grain legumes in selected rural communities of Limpopo Province, South Africa.

Background

Under-nutrition can be divided into protein energy-malnutrition and micronutrient deficiencies. Globally, the most important micronutrient deficiencies are iron, vitamin A, iodine and zinc. Reports have shown that children living on commercial farms are severely affected, and the prevalence of malnutrition is higher in the rural areas than in the urban areas.

Malnutrition usually results in severely stunting and underweight in children, especially children at the ages of 1-2 years and children under six. It is internationally recognised that malnutrition must be addressed heading through a multi-sectorial response and a multi- or interdisciplinary research approach.

Water use for food production, improved nutrition and health can be achieved by better diversity of foods and more nutritive diets. Furthermore, it is unclear in most instances as to what extent the various and changing environments influence food choices, nutrient intake and the contribution of home-garden production to food and nutrition security.

This hinders the development of appropriate, sustainable and integrated agricultural, nutritional and social programmes that will improve the nutritional health of rural communities. It is proposed that participatory action research be adopted as an overarching method of understanding the nutrition related needs of the rural poor.

Cowpea production in South Africa

To enhance and sustain the production of cowpea in South Africa, the production of cowpea must be matched with consumption or utilisation. Although, cowpea is believed to have originated from South Africa, production, consumption and diversification of its products is generally poor.

This study focused on one of the ways to enhance sustainable food production and nutrition in the drought prone communities of Limpopo province through the introduction and cultivation of high yielding, disease and insect pest resistant, early maturing and water use efficient grain legumes (cowpea and pigeonpea).

This project's main objectives were to:

- introduce and promote high yielding, pest resistant, early maturing and water use efficient grain legumes (cowpea and pigeonpea)
- promote transformation of existing cropping practices through the introduction of modern production practices (strip intercropping of legumes with maize),
- improve nutritional dietary intake of the communities through the introduction of cowpea-based food products (***Akara*** and ***Moin-moin***) and fortification of their maize sole diets with cowpea products,
- identify stakeholders in the cowpea value chain (cowpea production and food processing value addition) and enhance human capital development in value chain through training and farmers' school.
- stimulate sustainable development through the improvement of traditional agronomic production practices, preparation of cowpea diets and cultivation of

resource use efficient legumes.
- to train farmers on agronomic and entrepreneurial skills to empower them to produce these crops

Strip intercropping of cowpea and maize.

Main results of the study

The results of the study showed that significant interactions were obtained between the varieties and the cropping system and location which implied that these factors influenced the performance of the varieties differently. The result of the water use efficiency (WUE) showed significant ($P<0.05$) variations among the varieties. The top three varieties for this variable were 001101-2 (2.37 kg mm ha^{-1}), ICEAP 001284 (2.16 kg mm ha^{-1}) and ICEAP 00604 (1.84 kg mm ha^{-1}).

The results also showed that cropping system had significant variation in the water use efficiency (WUE). Strip-intercropping performed better than monocropping and mixed intercropping with WUE values of 2.93, 2.40 and 0.60 kg mm /ha, respectively.

Among the five cowpea varieties evaluated, three of them (ICEAP 001101-2, ICEAP 001284 and ICEAP 00604) were promising top yielders with good maturity indices (early to flower and maturity), grain yield, land equivalent ratio (LER) and water use efficiency. These varieties were then selected by farmers for adoption and cultivation.

Economic efficiency, marketing efficiency and cowpea value chain

Cowpea is a drought-tolerant legume serving as a staple food for the majority of Africans alongside maize and other cereals consumed by most Africans. The crop is regarded as a good protein source, and plays an important role as a cash crop in some climes.

Farmers being trained on insecticide spraying techniques at Ga-Thaba.

Despite the several nutritional benefits of this crop, its economic importance and welfare enhancing potential, farmers still do not have sufficient information about the value that can be added to cowpea in order to get best possible value for money in its production. The study thus examined the economic efficiency, marketing efficiency and mapped the cowpea value chain in the Capricorn and Waterberg districts of Limpopo province, South Africa.

For the economic efficiency part, data were collected purposively from 60 smallholder cowpea farmers while for the value chain mapping and marketing efficiency, data were collected from 80 smallholder cowpea farmers. Analytical tools employed include descriptive statistics, Data Envelopment Analysis (DEA), Tobit regression model, value chain mapping and binary logistic model.

Matured cowpea pods.

For the economic efficiency part, the DEA results showed that the Technical Efficiency (TE) scores of cowpea farmers had a mean of 0,9588 with a minimum of 0,7500 and maximum of 1,000. This means that 95% of the farmers were technically efficient. The allocative

Efficiency score ranges from a minimum of 0,41 and a maximum of 1,000 with a mean of 0,65. The Allocative

Efficiency (AE) scores imply that farmers are not utilizing inputs efficiently. The Economic Efficiency scores ranges from a minimum of 0,38 to 1,000 with a mean score of 0,62. The implications are that cowpea smallholder farmers were economically inefficient on average and that the cost of cowpea production for each farm could be decreased on average by approximately 38.2% to obtain the same level of output. The result of the Tobit regression models employed ascertain determinants of economic efficiency revealed age, educational level, primary income source, farm size, method of intercropping, purpose of growing cowpea and source of labour to be significant.

In identifying and defining the participants along the cowpea value chain, a value chain map was constructed to show the different stages cowpea goes through before reaching the final consumer. The results of the marketing efficiency measure revealed that 66% of smallholder cowpea farmers were efficient. Notable determinants of marketing efficiency from the logistic regression model showed that age, household size, years in schooling, years in farming cowpea, income generated from selling cowpea, quantities of cowpea sold and occupation of the farmers were significant in determining marketing efficiency.

Major constraints faced by the farmers were pests, lack of access to formal markets and lack of information on how to process cowpea.

Recommendations and conclusions

From the foregoing, the study recommends that investment in capacity building of farmers through education is very important to enhance both economic and marketing efficiency in terms of resource utilisation. Also, the different actors or players in the cowpea value chain should collaborate for improved linkage along the value chain. Training should also be given to farmers on adopting new technologies as this can potentially assist in making their production to be more efficient.

In conclusion, this study achieved the overall objectives of providing relevant information about the response of introduced cowpea and pigeonpea varieties to cropping systems, different location, comparative advantage of strip-intercropping over the mixed intercropping as well as the training of farmers and students. The specific key indicators of innovative end-products achieved by the project were:

1. Three high-yielding pest resistant and WUE cowpea varieties were introduced and adopted by the farmers. These varieties were selected by farmers because they performed better than the local check (Glenda).
2. Three high-yielding pest resistant and WUE pigeonpea varieties were introduced. These varieties were selected by farmers because they performed well in terms of water use efficiency, LER, early maturity and grain yield.
3. New intercropping system-strip intercropping was introduced and adopted by farmers because it performed better than the commonly used traditional mixed intercropping.
4. In the human area of capital development, four MSc students, six Technicians and 125 farmers were trained on cowpea and pigeonpea improved production practices.
5. A total of 125 farmers, four MSc students, six Technicians were trained on different cowpea/pigeonpea menus and recipes to enhance utilisation, dietary intake and diversity.
6. The famers were trained on record-keeping and other farm management techniques for profit making and tracking of resources used for sufficient production.

Related reports:
Enhancing food security, nutrition and production efficiency of high-yielding grain legumes in selected rural communities in Limpopo Province, South Africa (Volumes 1 and 2) (**WRC Report No. TT 829/1/20** and **TT 829/2/20**). For more information, contact WRC Executive Manager, Dr Sylvester Mpandeli, Email: sylvesterm@wrc.org.za