Pod Borer Resistant COWPEA

Potentials and Constraints
Cowpea for Food and Poverty Alleviation

About The *Maruca* - Resistant Cowpea Project

The Maruca Resistant Cowpea project is a public-private partnership coordinated by AATF to develop transgenic cowpea varieties with resistance to *Maruca* pod borer.

About IAR

The Institute for Agricultural research (IAR), Samaru was established in 1924 with mandate for crop research and improvement in the savanna region of Nigeria.

About AATF

The African Agricultural Technology Foundation (AATF) is a not-for-profit organisation that facilitates and promotes public-private partnerships for the access and delivery of appropriate agricultural technologies for use by resource-poor smallholder farmers in Sub-Saharan Africa (www.aatf-africa.org).

Introduction

Cowpea is a popular leguminous crop in Africa which is known as 'beans' in Nigeria and 'niebe' in the Francophone countries. The largest production is in the moist and dry Savannas of Sub-Saharan Africa (SSA), where it is intensively grown as an intercrop with other cereal crops like millet, sorghum and maize as well as rice fallows (Ishiyaku et al, 2010). Though it is grown in other parts of the world, Nigeria remains the largest producer and consumer of cowpea in the world. According to FAO data (2001-2010) Nigeria produces an average of 2.58 +/- 0.31 million metric tonnes. Nigeria's cowpea demand deficit is met by imports from neighboring countries like Niger and Burkina Faso.

In line with the aforementioned, the African Agricultural Technology Foundation (AATF) is coordinating a public private partnership to develop improved varieties of cowpea that can withstand the pod borer (*Maruca Vitrata*) and enhance farmers' grain and fodder production. The project, which started in 2008 is accessing and inserting the cry1Ab gene (Bt gene) into selected cowpea varieties to protect the crop against the *Maruca* pod borer. Confined field trials are currently in their fourth year at the Institute for Agricultural Research, Ahmadu Bello University, Samaru, Zaria. The developers expect to have the first *Maruca*-resistant cowpea (Bt cowpea) seed available to farmers around 2017 subject to approvals from regulatory agencies; the identification of effective and stable *Maruca*-resistant lines; and efficient transfer of the resistance to traditional varieties through conventional breeding. Similarly, this approach can be exploited to increase the

A cowpea trader in Abuja

nutritional composition of cowpea such as protein, micronutrients and vitamins. This will definitely lay the foundation for developing novel value added cowpea products.

The Nutritional Value of Cowpea

The nutritional value of cowpea is in the composition of its grain. The grain is rich in protein up to around 30 percent in some varieties. In addition, the grain contains micronutrients such as iron and zinc which are necessary for healthy living (Boukar et al., 2010). It is for these reasons that, societies endowed with cowpea have evolved different ways of utilising the grain for food. Perhaps the coinage of *naman talaka* (poor man's meat) by the Hausas of *w*est and central Africa points to the perception about the nutritional attributes of cowpea grains. All parts of the cowpea are used for food. The leaves, green pods, green peas and the dry grains are consumed as different dishes. These parts are nutritious, providing proteins, vitamins and minerals especially micronutrients. The grains are rich in the amino acids lysine and tryptophan making it better than cereals. This makes cowpea a good supplement for cereal and root-and-tuber-based diets characteristic of many coastal and forest communities. It is the food value of the grain and cowpea pod that gives the economic value of the crop. The cowpea hay on the other hand provides good fodder that significantly supports the livestock industry especially that of dry savannas of West and Central Africa. The combination of food and fodder potential of cowpea has resulted in a stable food security drive in many parts of the globe.

Economic Importance

The cowpea value chain involves many people contributing to the development of the commodity in many countries in SSA. These range from transporters of the commodity to traders and those working in the local value addition enterprises. Many farmers solely survive

Prof. Stephen Misari - the Cowpea Project Entomologist

on cowpea farming as a business. Sales from their cowpea harvests enables them to not only buy supplementary cereal grains such as rice (for domestic consumption), which does not grow in their localities but also fertiliser and other inputs for the coming season thereby safeguarding their food security through cowpea production.

The monetary values of cowpea products are of major concern to farmers. However, cowpea's contribution to ecological stability is usually underemphasized. Cowpea, through its symbiotic association with beneficial bacteria, fixes nitrogen from the atmosphere to the soil and hence enhances soil fertility which also benefits other crops succeeding it. The broadleaf nature of cowpea and soil covering effect ameliorates soil erosion.

The full economic potential of cowpea will only be realised if other value added products especially those targeted at the ever growing urban population, are introduced. For example, converting cowpea into baby food might bring about a rise in the price of the commodity which will also bring higher returns to the producer. Cowpea is already an important weaning food in many communities in Africa and Asia. Demand for cowpea is particularly high in Nigeria.

Enhancing Cowpea's Contribution to Economic Development

It is estimated that total annual cowpea grain production in the world is valued at approximately USD 1.13 - 2.81 billion. Raising the average yield per hectare of the crop will therefore increase the annual global production and hence the revenue. Sources from field research have indicated that the potential yield of cowpea can go up to 3,000kg/ha if most of the constraints to cowpea production are addressed. These constraints include: i) lack of seeds of potentially high yielding varieties; ii) insect pests in the field; iii) storage insect pests; iv) diseases; v) parasitic flowering weeds; vi) drought and vii) low soil fertility.

Apart from the constraints mentioned above that affect the contribution of cowpea to the gross domestic product many specialists are of the opinion that the potential economic impact of cowpea is yet to be fully exploited even at the current level of production. This is mainly due to the slow rate of expanding the list of cowpea value added products. The lists, especially of commercial products, have for long remained unchanged and include beans pudding (*moi-moi*), bean cake (*akara*), although research efforts into the development of new products is beginning to yield positive results. The introduction of new value added cowpea products into the market would significantly raise the revenues from cowpea .

Prof Mohammed Ishiyaku at the cowpea research farm in IAR Zaria

Photo showing Pod Borer damage on cowpea flowers

Raising Cowpea Productivity

In order to raise the productivity of cowpea, the strategy should focus on tackling the production constraints and diversification of value added products. With respect to the constraints mentioned above the cowpea germplasm can be manipulated to develop varieties with resistance and tolerance to diseases through conventional breeding methods. Significant progress has been recorded in this regard (Singh et al., 2010). However, conventional breeding has not succeeded in providing solutions to the problem of insect pests affecting cowpea both in the field and in storage. Specifically, no success has so far been recorded in developing cowpea varieties resistant to such destructive insects as the sucking bugs and the pod borer (*Maruca*). This is because all the cowpeas in the world lack the natural defense against these insects. To contain these insects the option has been to use expensive and unsafe chemicals. which after use on the crop can get released into the environment thereby contaminating it. Moreover, the use of insecticides significantly raises the cost of production.

Ever since the commercial benefit of the application of biotechnology in agriculture was realized in the early 1990s, cowpea scientists have concurred on the need to exploit this modern scientific tool to develop insect

Dr. Prince Addae, Cowpea Project Manager, AATF

resistant cowpea. Through modern genetic improvement procedures, genes responsible for conferring resistance to insects such as *Maruca* can be transferred from other species into cowpea. The resultant genetically improved cowpea can then be improved further through conventional breeding.

Conclusion

Cowpea is a precious crop especially to those living in marginal ecologies. Its resilience in withstanding poor ecological conditions and its high food and fodder value makes it a commodity that can turn around the fortunes of smallholder farmers. However, there is a need for investment in science and agricultural technologies to develop cowpea varieties that can address the production constraints facing smallholder farmers and thereby contribute to sustainable economic development. Hybridization of the conventional and modern crop improvement approaches such as biotechnology is inevitable if livelihoods are to be sustained in resource poor communities.

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