

Key Success Factors in Integrated Crop Management Systems in Africa

By

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Introduction

While the title of my paper refers to crop management systems throughout Africa, I shall be focusing on the management systems of small-scale cotton producers in central and Southern Africa. A region I have been involved with for many years.

Africa has the highest population growth rate in the world and this has placed tremendous pressure on the land and on traditional crop management systems. Political, social and economic upheavals have also led to a decline in the level of research and extension services provided to small-scale farmers. These obstacles have made it very difficult for individual small-scale farmers to change their management systems. However there are four interesting developments that could make a difference. They are; 1) Establishment of Independent Commodity Research; 2) Conservation Farming; 3) Improved Pest management and 4) Working in Groups.

1) Commodity Research Development

An independent Cotton Research Trust, directed by a Board of Trustees, has recently been established in Zambia. The Trust is now responsible for all the functions previously carried out by the Government. This has only been made possible by a change in the Government policy and a commitment from the major stakeholders to support the Trust financially, through levies on cotton production. The Government has also transferred Magoye Research Station to the trust and has seconded key staff, as an interim measure, until the Trust can recruit suitable professionals to run the research programmes.

Cotton Research Station at Magoye has now been transformed and looks neat, tidy and efficient with new trials under the breeding, entomology and agronomy sections. A detailed cotton handbook has already been completed, which will be available to all cotton producers. The Trust is also providing commercial research facilities to other organisations, as an additional source of income.

The primary objective of the trust is to provide appropriate and sustainable research for cotton producers. Once the research programme is up and running the Trust will turn its attention to training and extension services to cotton producers.

The resuscitation of an effective cotton research programme in Zambia, controlled by the stakeholders, augers well for the future of the industry in Zambia. Other governments in the region should consider what this change in policy has achieved. And emulate it.

2) Conservation Farming

Brian Oldreive, a pioneer of conservation tillage in Zimbabwe, developed a farming system to suit smallholder farmers that was efficient, more productive and environmentally sustainable. This system, called “Conservation Farming” is now being adopted in several countries in the region, including Zambia where its development will be discussed in more detail.

The Zambia National Farmers Union, supported by several agencies, has established a Conservation Farming Unit, to research and demonstrate practical and sustainable methods of conservation farming throughout the country. Dunavant, one of the main ginners in the country, is also encouraging its growers to introduce this system into cotton production.

The technologies are simple to adopt, do not need expensive equipment and have an immediate and dramatic impact on productivity, in addition to restoring the natural fertility of the land. It is also suited to both food and cash crop farming.

The technologies involve adopting five husbandry practices, which together comprise a complete farming system, these are: -

1. **The Retention of crop residues:** Soil and water loss is reduced and water infiltration improved by retaining residues on the surface. Trials in South Africa on a 4% slope showed 90% water run off and a loss of 28-tones/ha soil under conventional bare soil tillage. There was a 90 % improvement under Conservation Farming methods.
2. **Restricting tillage of the land to the precise area where the crop is to be sown:** Labour requirement per ha is then reduced and better spread throughout the year.
3. **The completion of land preparation before the rains:** This makes it easier to plant the crops early, which results in higher yields.
4. **The establishment of a precise and permanent grid of planting stations:** Successive crops are planted in the same holes each year. This facilitates land preparation, improves the soil structure and the residual uptake of fertilizer. In Zambia planting holes are dug 70 cm apart in 90 cm rows across the slope. Cotton is planted at both ends of the hole, with fertilizer applied in the center. Weed populations also reduce over time, as only 15 % of the ground is prepared.
5. **Rotations with nitrogen fixing legumes:** These should occupy a minimum of 30% of the cultivated area. This reduces the requirement for artificial fertilizer. Deep-rooted crops in the rotation also improve root penetration. New research is showing a significant yield improvement from the symbiotic effects of strip planting 2 rows of cotton and two rows of early maturing varieties of pigeon pea. The pigeon pea roots provide nitrogen for the cotton. And the pigeon pea benefits from the insecticides sprayed over the cotton. The pigeon pea is also harvested early, leaving room for the cotton to grow out later in the season.

The principle aim of this system is to restore and maintain the fertility of the land only in the cultivated area occupied by the planted crop. The intervening inter-row zone can remain infertile, as only competition weeds occupy this area. This system also opens doors to a number of associated technologies, which can reduce costs and labour inputs.

For example, conservation tillage enables the farmer to look after more land with the same manpower. The crop uses applied nutrients more efficiently, as they are placed only in the planting zone.

Additional technologies are also advocated for specific situations.

- **Vetiver** (*Vetiver zizanioides*) grass strips planted on the contour are the most effective way of controlling erosion. This grass forms a living barrier, which arrests soil movement. In Malawi, where farmers have begun to recognize the value of vetiver, groups of farmers, with access to water, have cultivated small nurseries to provide tillers to their neighbors.
- **Tephrosia vogellii** is a legume that can be used to effectively rehabilitate degraded soils. It is not palatable to livestock and has a lifespan of 3–4 years. In Zimbabwe 27% of communal farming land is totally degraded because of inappropriate farming methods. In Malawi the situation is even worse. Degraded soils will not respond to good management and in drought years total crop losses can occur. Planting *Tephrosia* has helped to rehabilitate these soils after 2–3 seasons.
- **Faidherbia alba** is a deciduous tree that grows to a height of 25 meters. Unlike most trees it sheds its leaves during the rains. The leaves are nutrient rich and improve soil fertility, allowing cultivation on degraded soil beneath the branch canopy with significant benefits to crop yields.

Conservation farming is a dynamic farming system that can be adapted to the needs of the farmer and the environment. It is a sustainable and profitable system that should be actively encouraged by all extension agencies throughout the region.

3) Pest Management

Zimbabwe has been recognized as the leader in cotton pest management strategies in Africa that are still valid today. These are the scouting method, based on searching 24 plants per field of 20 ha and the resistant management strategy that was recommended for pyrethroid use, right from the start. There is still no instance of bollworms developing resistance to pyrethroids in Zimbabwe. These two aspects form the basic recommendations for pest management in the region.

The commercial cotton growers in Zimbabwe were also instrumental in developing the Cotton Training Centre in Kadoma in the early 1980's. Organisations in Zambia, Malawi and Mozambique have also sent staff and farmers to the CTC where they have gained valuable knowledge in pest and predator recognition and control management strategies. Although these courses have helped large numbers of farmers, to recognize pests and predators, only a few small-scale producers use the recommended methods of interpreting

scouting results on bollworm egg numbers. Surveys have shown that over 75% of the small-scale farmers find it easier to locate the larvae than the eggs and they find the recommended strategies too complicated to understand. The standard recommended system is therefore inappropriate for the majority of these farmers because of the low standard of education and farming.

A simplified system is now being developed for use in the Dunavant distributor-training programme in Zambia. This system combines calendar spraying with a simplified scouting method (using a pegboard for recording the major pests and predators). The system is simple to understand and helps the farmer to assess damage thresholds through scouting. It also introduces the participant to the role predator's play in integrated pest management. The calendar schedule reduces the chance of the farmer making a mistake, one of the problems found during the survey. Pyrethroids for bollworm control are only recommended after first flowers. This is in line with the Zimbabwe recommendations for resistance management.

A training and check scouting system is also being developed in South Africa by Danced, a Danish aid organisation concerned with producing 'cleaner cotton'. It is hoped that this scheme will establish a pest management system for small-scale farmers similar to the one that has been so successful in the commercial sector in Zimbabwe. The programme will also include pest management strategies relevant to genetically modified (Bt) cotton.

The small-scale farmers in South Africa have grown Bt genetically modified cotton commercially for 2 years now and yields on some farms have been improved by over 30% by using Bt varieties. The number of sprays has also been reduced significantly. This has had a major impact on profitability. It is considered that Bt cotton will prove to be of greater benefit to small-scale cotton producers than it has been to large-scale commercial operators.

Resistance management for Bt cotton is being enforced in South Africa and under this strategy farmers growing Bt cotton must also maintain a refuge consisting of non-Bt varieties of the same crop. Scouting will continue to play an essential role in resistance management strategies in Bt cotton.

Working in Groups

Over the last 20 years small scale farmers have found it increasingly difficult to successfully operate on their own. The logistical problems for suppliers and creditors and the introduction of privatized marketing services have often resulted in many potentially successful farmers unable to take advantage of services taken for granted by large-scale commercial operators.

There are however organisations in Malawi, Zambia and Mozambique who have been assisting farmers to work in groups, or associations, in order to take advantage of the economics of scale. Small-scale farmers, working as individuals, have also established a reputation of poor financial discipline and repayment of credit. The group imposes financial discipline and everyone benefits.

The National Smallholder Farmers Association of Malawi (NASFAM) was established to develop and build a commercially viable network for smallholder directed business associations to improve returns for farmers who participate.

NASFAM is now assisting 4000 clubs in 31 commodity-orientated associations. The organisation also encourages improved land use management. And there are now over 100 model farms established in 17 associations.

A Board of Directors, elected by the members, runs the associations. Farmers pay an annual fee to join the association and this covers association expenditure. NASFAM provide assistance in obtaining markets and training in business development and credit discipline. The cotton associations were only formed 2 years ago, but a special marketing contract has already been negotiated and prices have risen by 15 %.

In Zambia the Dunavant distributor system is also based on a group structure with an elected representative acting as an agent for the gin company. The agent works on a commission basis that is dependent on the results of the group. Results have improved significantly since this system was introduced.

Conclusions

The basic ingredients for crop development have been identified. It is now up to the stakeholders, particularly the farmers and the governments, to work together and implement the appropriate key success factors throughout the region. Let us hope this becomes one of the realities of the New Africa Renaissance.

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