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**Directorate of Training, Documentation, and  
Technology Transfer**

**Working Paper Series**

**Prioritizing Actions for Conservation Agriculture in  
Mozambique**

by

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# **DIRECTORATE OF TRAINING, DOCUMENTATION, AND TECHNOLOGY TRANSFER**

## Working Paper Series

The Directorate of Training, Documentation, and Technology Transfer of the Agricultural Research Institute of Mozambique in collaboration with Michigan State University produces several publication series concerning socio-economics applied research and technology transfer in Mozambique. Publications under the Research Summary series are short (3 - 4 pages), carefully focused reports designated to provide timely research results on issues of great interest. Publications under the Research Report Series and the Working Paper Series seek to provide longer, more in depth treatment of agricultural research issues. It is hoped that these publication series and their dissemination will contribute to the design and implementation of programs and policies in Mozambique. Their publication is all seen as an important step in the Directorate's mission to analyze relevant agricultural policies and agricultural research in Mozambique.

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# Prioritizing Actions for Conservation Agriculture in Mozambique

## EXECUTIVE SUMMARY

Conservation agriculture has been promoted in Mozambique since 1996 but wide-scale adoption of the three principles (minimum soil disturbance, rotation/intercropping with legumes and permanent soil cover) has remained elusive. In order to prioritize the activities that may facilitate wide-scale adoption of CA a multiple round survey of 43 CA “experts” working in Mozambique was carried out. Of the 43 experts, 35 responded to at least one round of the on-line survey. The results show that the majority agree that CA is useful for most smallholders in Mozambique but needs to be adapted to local conditions through research that is closely linked with farmers’ reality. Manual forms of CA are seen as the most immediately relevant to smallholders. There is less agreement among these experts about the role of inputs in CA.

The following actions were chosen as the most important for facilitating widespread CA adoption in Mozambique:

- For research, the participants highlighted the need for adoption/disadoption studies in different agroecological zones, as well as long term agronomic and soil science research and socio-economic studies looking at incentives and motivation.
- For development activities, the participants prioritized training for extension workers (both public and private), establishment of more demonstration plots, establishment of more farmer-led initiatives as well as investments with a longer term approach (> 5 years).
- Finally, for policy, there is a priority to ensure that both input and output markets work better for smallholder farmers, that CA should be introduced into agricultural training curriculum, and that agents need to work together and learn from each other to avoid conflicting messages.

These results were presented to a group of CA stakeholders in November, 2012 who identified the following common themes:

1. Widespread adoption of CA can best be fostered by providing farmers with a set of options for CA practices that best fit their farming situation.
2. The farmer should be in the center of the innovation process so that development agencies, researchers and the private sector are more aware of the constraints smallholders face.
3. Because of the existing experience in each agro-ecological zone it would be beneficial to document the constraints and what is working best in each zone.

The group decided that national level coordination would be necessary to foster the development of teams or platforms at the agro-ecological zone level where experiences can be shared and approaches harmonized. Based on this, the participants suggested that a small team of people dedicated to CA should champion this process including representatives from IIAM soil scientists, IIAM social scientists, national extension, CGIAR research centers and NGOs.

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# **Prioritizing Actions for Conservation Agriculture in Mozambique**

by

Philip Grabowski and Bordalo Mouzinho

## **1. INTRODUCTION**

Conservation agriculture (CA) is being promoted by a wide range of development agencies and research organizations in Mozambique since 1996 but wide-scale adoption of the three principles (minimum soil disturbance, rotation/intercropping with legumes and permanent soil cover) has remained elusive. Lists of activities to improve the wide-scale adoption of CA in Mozambique were developed in February 2012 at the IIAM workshop “The Future of CA in Mozambique.”

In order to better understand the level of agreement on these activities and in order to prioritize them, IIAM’s CA working group asked Michigan State University (MSU) to use a multiple round survey of CA “experts” working in Mozambique. A list of 43 individuals was developed based on their experience with CA in Mozambique. Most these individuals were researchers or development agency project managers, though a few were also from the private sector and educational organizations. Thirty-five of the 43 experts responded to at least one round of the on-line survey (30 in round 1 and 25 in round 2).

The survey was developed based on Delphi methodology (Turoff, 2002) where respondents express their opinions about a topic and explain their reasons for that opinion in the first round. These results are then summarized and returned to them so that they can see the opinions and arguments of others. In the second round questionnaire they can then adjust their opinions or clarify their arguments. In theory the rounds can continue until the results have stabilized either in consensus or entrenched disagreement. In this case only two rounds were possible in the given time frame but this was sufficient to reach relative agreement on the priority activities. The results are summarized below by the main topics included in the surveys. On 6 November the results of this process were presented by MSU to the CA working group in Maputo with participation from a variety of other CA stakeholders. At this meeting the group discussed what actions to take based on the results and this discussion is summarized at the end of this document.

## **2. RESULTS FROM CA PRIORITIZATION SURVEY**

### **A. Importance of CA and conditions for its use**

In round 1, 76% of respondents said that CA is very important for agricultural development in Mozambique. Those who saw it as less important warned that it is not a silver bullet and some of the benefits take a long time to appear. Forty-five percent said that CA is useful for all agro-ecological zones and another 48% said that it is useful in “most” or “some” agro-ecological zones of the

country, specifying that its performance depends on soil and climatic conditions.

The respondents were also asked an open ended question in round 1 about the conditions under which CA can benefit smallholder farmers in Mozambique. Multiple responses were provided by many of the responses. Among the respondents, 31% said it can benefit them under all conditions. Others said CA only benefits smallholders where rainfall is low (24%) and soils are poor (14%). Others said that CA can only benefit smallholders where it saves labor (17%) or is supported by adequate training (10%). All respondents were then asked to agree or disagree with each of these conditions in round 2. Most agreed with the statement that CA will benefit smallholder farmers if there is good technical support (87.5%) and that it can be useful under all or most conditions (62.5%). There was some contention whether or not CA is primarily useful for poor soils and low rainfall or for high agricultural potential areas with high input use, but this seems to be only because of how the question was interpreted. Many of those who disagreed felt that it was useful under the conditions described, but not only for those conditions. Most disagreed with the statement that CA only benefits smallholders if it saves on labor or inputs and they explained that the real concern is the profitability of those inputs.

### **B. Three Components of CA**

Respondents were asked in round 1 if a profitable form of CA that can lead to wide-scale farmer adoption has been identified. The most common response (67%) was “No” and that more research is needed. Another 22% said they were not sure, one of whom argued that it is not possible to develop one form of CA for the diverse agro-ecological zones and that local forms should be developed. In the second round the question was adjusted by adding a response category about the need for local adaptation. With this clarification there was consensus among respondents that local adaptation is necessary for CA to be adopted. Many comments stated that more research is required in order to locally adapt CA.

Dry Season minimum tillage. Manual zero tillage was ranked as the most important form of minimum tillage while tractor based forms ranked the lowest in both rounds. The average rating of importance in round 1 correlated with the average ranking of the technologies in round 2. There were mixed opinions about the importance of basins and animal based minimum tillage for the Mozambique context in round 1. Basins were seen by some as too labor intensive and inappropriate for sandy soils. Manual forms of CA predominate in Mozambique and are likely to be the ones that can lead to widespread adoption in the short term. Nevertheless many respondents felt that context specificity is important and in certain areas animal traction and even tractor power can be useful for CA in Mozambique. The different forms of CA will have unique costs and benefits for different categories of farmers in each agro-ecological context and the particular niche of each form should be analyzed as CA promotion strategies are being developed.

**Table 1: Arguments for and against the various types of minimum tillage and the average rating from the round 1 questionnaire and the final ranking (1-6) from the round 2 questionnaire.**

	<b>Arguments for</b>	<b>Arguments against</b>	<b>Average rating *</b>	<b>Ranking (round 2)**</b>
Manual Zero Tillage (jab-planter, dibble stick, or single cut of hoe)	Affordable Saves time compared to basins Water harvesting	Herbicide prices high Adoption levels low Low labor productivity compared to animal or tractor powered	4.32	1.89
Basins	Affordable, adoption can be gradual Saves time Water harvesting Focused soil improvement	Not appropriate for sandy soils Takes too much time Can be waterlogged Adoption levels low	3.58	2.47
Animal drawn ripper and direct seeder	Low labor, efficient use of animal power Animal traction being promoted in Moz. and this would make it more sustainable Avoids compacting the soil Less repairs than tractors Precise fertilizer application	Few tools, few animals, little experience Only where no TseTse fly Only for medium resource farmers Ripper causes too much disturbance of soil structure	Ripper - 3.46 Direct seeder - 3.32	Ripper - 3.00 Direct seeder - 3.58
Tractor ripper or seeder	Large areas with low labor cost Rippers can be used to remove hardpan	Expensive, unavailable, difficult to maintain Only for commercial farmers or on contract	Ripper - 2.48 Direct seeder - 2.50	Ripper - 4.68 Direct seeder - 5.37

\*(5=important, 1=not important)

\*\* (These methods were ranked from 1 to 6 where 1 is the most desirable for wide-scale adoption)

Legume rotations. Nearly all respondents agreed in round 1 that rotations and intercrops with legumes were very important but there was less agreement about the importance of leguminous cover crops.

*Mulching and residue retention.* Regarding crop residues most agreed in round 1 that maintaining it on top of the soil was important. When asked about incorporating residues the responses were polarized with nearly 1/3 of responses saying it was very important and explaining that it is much better for the soil than burning the residues. Another 1/3 said it was not important and argued that it is incompatible with minimal soil disturbance and should not be practiced.

*Interactions among the three components.* Based on some of these comments from round 1 and from the inventory of CA projects being carried out simultaneously by MSU, it was decided to ask respondents in round 2 about the potential benefits and challenges of promoting CA without emphasizing minimum soil disturbance. Regarding benefits, the responses indicated that these practices may be more easily adopted because farmers can continue doing what they are used to - digging up their fields and intercropping, but with the benefit of mulch, which controls weeds and retains moisture. Respondents also pointed out that intercropping reduces risks (weather and market) and tilling controls weeds and increases the decomposition of residues. Regarding the challenges that would be faced by not emphasizing minimum tillage, many respondents stated that the benefits of mulching and intercropping will be less than if soil disturbance were minimized. One pointed out that the farmer still has the arduous work of digging up the soil and the added work of mulching. Many also argued that there is also still a high risk of erosion and soil degradation because of the soil disturbance and that the soil will lose carbon and nitrogen and possibly develop hard pan. Some respondents felt that there will be no improvement in soil structure if it is tilled. Many respondents did not consider it to be “real” conservation agriculture. In the words of one respondent, “CA is a system that allows the farmer to mimic a condition of fallow while using the land at the same time. It is about renewing and maintaining the soil structure. Minimal soil disturbance is key to this.”

### **C. CA and input use**

In relation to other complementary practices, most stated in round 1 that fertilizer and manure based compost is important for CA but there was less agreement on the importance of herbicides and hybrid seed. In round 2, fertilizer, herbicide and hybrid seed were all seen as “somewhat important” by most respondents with some saying they were very important and others saying they were not important at all. Arguments against these inputs were that they are expensive and unavailable and there is some risk in not seeing the benefit on a bad rainfall year. Arguments for these inputs emphasized how they work together with CA to show greater benefits (yields) for all the effort the farmer has put in to improving soil quality. Specific arguments against herbicides included the need for training and the fear of health and environmental problems. Hybrid seeds were seen by some as irrelevant because of the good quality of OPVs and by others because it is not relevant to crops like cassava, though they did point out that improved varieties are needed there too.

In round 2 the respondents were asked about the feasibility of low input CA. About 1/3 said it was feasible, 1/3 said it was not feasible and 1/3 said they were unsure. Arguments for the feasibility of low input CA were that farmers do not have access to inputs so this is the only option available for most smallholders in Mozambique. Other respondents emphasized that they have observed CA benefits even without purchased inputs. Arguments against the feasibility of low input CA included that it would require much greater training and synergy between components in order for the benefits to be demonstrable. One stated that without inputs “yields will remain low, or will even go down and farmers will soon revert back to conventional tillage which controls weeds and improves decomposition of crop residues and release of nutrients leading to higher yield.” Others emphasized

that inputs like fertilizer and herbicide are especially important when farmers first start using CA.

#### **D. Actions for widespread CA adoption**

In round 1 there was general agreement that the research and development activities listed, which were based on what has been proposed in other forums, are important with no respondents saying any of the activities were “not important” except regarding developing a strategy for carbon payments. The policy interventions on the other hand had higher levels of disagreement with one or more respondent seeing each intervention as not important in many cases.

The research, development and policy activities that were ranked as most important in round 1 also received the most votes in round 2. This agreement suggests general consensus on these actions but the concerns of those who see them as less important should also be considered. Table 2 presents the most voted for activities under each category, the importance ranking from round 1 and the concerns and conditions described in round 1.

**Table 2: The research, development and policy activities that received the most votes in the round 2 questionnaire regarding their ability to facilitate widespread adoption of CA.**

<b>Research</b>	<b>Votes</b>	<b>Percent</b>	<b>Importance (from round 1)</b>	<b>Concerns and conditions (a selection of comments from round 1)</b>
Research the advantages and disadvantages of CA in the different agro-ecological zones	14	64%	4.46	Not a priority Can be inferred from other studies Should be combined with socio-economic studies to see how different regions are benefiting
Long term agronomic and soil science research (on station and on farm)	13	59%	4.04	Low capacity for this type of work Must be linked to on-farm research to stay on target Must consider market conditions and input availability
Adoption and disadoption studies (numbers using different practices and characteristics of those using each, positive deviance studies characterizing adopters)	9	41%	4.56	Adoption seen around the world - not in doubt
Social and economic studies (gender impacts, labor issues, cost/benefit analysis, explore what is motivating behaviors)	8	36%	4.58	Not a priority
<b>Development</b>	<b>Votes</b>	<b>Percent</b>	<b>Importance</b>	<b>Concerns and conditions</b>
Carry out regular trainings for extension workers, producers and local authorities on CA	12	55%	4.73	More than training, extension needs better supervision for correct implementation Not all who are trained can provide quality extension

Establish more CA demonstration plots with active producers	11	50%	4.46	When project ends all goes back to conventional Work with current adopters instead
Farmer-led initiatives with a broader focus – such as Farmer Field Schools on Integrated Soil Fertility Management	11	50%	4.42	Expensive Must be based on current research and combined with on-station trials Need to coordinate curriculum for each zone so as not to waste effort Should be optional, not a rule
Invest in long term development projects (longer than 5 years)	11	50%	4.68	Horticulture can see benefits in shorter term
<b>Policy</b>	<b>Votes</b>	<b>Percent</b>	<b>Importance</b>	<b>Concerns and conditions</b>
Getting input and output markets working better for smallholders	15	68%	4.44	Markets don't cause adoption but should result from increased demand and surplus supply Markets strangle farmers Input prices are too high and herbicides are not available in rural areas
Introduce the topic of CA into agricultural training curricula (technical school, primary level, etc.)	14	64%	4.44	Just as another subject it will not bring about change Should be focused on rural schools
Harmonize CA research and CA project efforts to learn from each other and avoid conflicting messages	13	59%	4.31	Synchronize would be a better word Not conflicting now

In round 2 the respondents were also asked about the relative importance of the three sets of activities by asking them to hypothetically suggest how a donor should divide funds among them in order to best achieve widespread adoption of CA. The average allocations were as follows: 40% for research

43.6% for development and 16.4% for policy activities. One person summarized this allocation as follows “We still have more to learn on adaptations to Mozambique contexts, thus research is important to point the way. But we already have technology available for dissemination and so investing in development activities with the aspects for which a consensus exists [is also important]. As long as policy constrains resource use, policy work must be done.”

### 3. CONCLUSIONS AND IMPLICATIONS

On November 6, 2012 MSU presented results from its inventory of CA projects in Mozambique, meta-analysis of CA literature in Mozambique and the above results from the prioritization process to a variety of CA stakeholders in Maputo. The common themes from these results are as follows:

1. Widespread adoption of CA can best be fostered by providing farmers with a set of options for CA practices (such as for weed control, fertility enhancement, seeding, etc.). This will allow them to choose what best fits their farming situation which will vary in bio-physical and socio-economic conditions even in each agro-ecological zone (and even within some communities).
2. The farmer should be in the center of the innovation process so that development agencies, researchers and the private sector are more aware of the constraints that smallholders face, thereby avoiding the pitfalls of promoting a technology that farmers do not find useful. The focus should be on applied action research that links researchers with development agencies and private sector organizations in order to make CA research more immediately relevant to farmers and to make CA promotional efforts more informed.
3. Because of the existing level of experience in each agro-ecological zone there is real potential to see immediate benefits from documenting what is working best in each zone and the constraints that are being faced in each CA project. Communication between organizations working on CA at the agro-ecological level is one first step. Small socio-economic research projects coordinated at this level could help identify the constraints to adoption of the technologies being promoted. The aim of this coordinated effort would be to enable the selection and development of technologies that are working best in each agro-ecological zone in a way that is closely linked with education and promotion of these technologies.

The participants at the meeting on 6 November, 2012 proposed that some sort of national level coordination is necessary to foster this effort by facilitating the development of teams or platforms at the agro-ecological zone level where experiences can be shared and approaches harmonized. This national level coordination would also facilitate learning between zones and addressing nation-wide issues such as the concern about making markets work for smallholders and the need for greater CA information in agricultural training curricula among others.

Based on this, the participants suggested that a small team of people dedicated to CA should champion this process and determine how to continue from this point on. From IIAM there should be a representative of the biophysical research on CA and a representative of the socio-economic research (from CESE). In addition the national extension efforts, CGIAR research centers and NGOs must be represented. The current CAWG would continue to meet and do its work but this smaller group would be encouraged to move the CA development forward in a more focused way. How this will be worked out is yet to be discussed.

Several practical suggestions emerging from these discussions may be useful in guiding the next phases of this work. Instead of tackling all zones at once, they should choose a few areas first where benefits of coordination seem most promising. The Manica maize systems and Nampula cassava systems were identified as areas worth considering focusing on first. It was also suggested that the CAWG should meet in different parts of the country when possible and spend time seeing what is happening on the ground, hearing presentations from project managers and researchers and interacting directly with farmers in their fields. Cross learning between regions may provide opportunities for innovation despite different contexts.

As of this writing the above mentioned technical team has met a few times to develop these ideas further. They are in the process of developing a concept note for a project implementing these ideas. The team also identified the potential to learn from the experiences in Zimbabwe where national CA efforts have been well coordinated.

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