



Conservation Farming Unit

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Small and Medium Scale Agriculture and Mechanisation

1. Mission Impossible?

The idea of mechanisation and small-scale agriculture sounds like a contradiction in terms and one can almost hear sceptics raising the alarm.

'Smallholders and machinery don't mix, tractors and other mechanised equipment is too expensive, farms are too small, maintenance too complicated and if this isn't enough what about the availability of spare parts, back up and servicing? And how about the lessons of the past, the history of Government sponsored schemes, the rusting carcasses of tractors and equipment scattered across the country or being hauled to Kafue to be transformed into malata or rebar?'



An all too familiar scene!

Small-scale agriculture, they remind us, is about the familiar and tranquil spectacle of farmers tilling their land with hoes and ox ploughs.

In reality, as this article will demonstrate, the opportunities for mechanisation in the small and medium scale sector in Zambia are enormous but only if we are prepared to learn from the mistakes of the past, progress cautiously, apply common sense and insist on the application of sound business principles. The sceptics have a point, the past informs the future, and we should take heed of Albert Einstein's famous quote which reminds us that the definition of insanity is *'doing the same thing over and over again and expecting different results'*.

2. The Kenya Example

In 2007/8 the CFU made several visits to Kenya to investigate opportunities to introduce Conservation Farming. Of interest to us was how farmers prepare their land for planting because the foundation of CF as it evolved from the disastrous experience of the 1930's American Dust Bowl requires the *reduction of soil disturbance to the extent possible, in other words the application of Minimum Tillage or the more advanced form of Zero Tillage*. What emerged from these visits was firstly that Min-Till was more or less unheard of at the grass roots and that in terms of Hoe and ADP (oxen) Min-Till practice, Zambia was way ahead.

Of particular interest however was the revelation that in Kenya, tens of thousands of small farmers have their fields ploughed and harrowed by many hundreds of private tractor operators who migrate across the country before the onset of the rains raising clouds of dust, pulverising and compacting soils and burning enormous quantities of fuel. In Tanzania on a smaller scale, the picture is no different.

The objective in Kenya - where the CFU is involved with a local organisation as part of a regional COMESA initiative sponsored by Norway to promote CF/CA - is to get rid of ploughs and harrows and convert the Tillage Service Providers (TSP's) to Min-Till ripping. The immediate benefits which have already been noticed by converts are self evident and include; *reduced fuel consumption and costs; elimination of compact layers and less crop stress during dry periods*, not to mention the medium term soil benefits.

▪ **No Government Intervention**

A key feature of the TSP industry in Kenya is that there is no Government involvement whatsoever. Furthermore, many of the operators are not farmers at all but merely service providers much like the mini-bus operators in Zambia who without question provide a far more efficient, competitive and widespread service than the Government owned UBZ service of yesteryear. The same might be said of the pickup and truck operators who ply their trade throughout rural areas.



Diesel use 13 to 15 litres/ha. Time 3.5 to 4.5 hours/ha



Diesel use 5 to 7 litres/ha. Time 1.0 to 1.25 hours/ha

3 Could Mechanised MT Tillage Service Provision Work in Zambia?

The Kenya example showed that opportunities should exist to develop privately owned Min-Till Service Provision in Zambia where relatively few private tractors operating outside of large scale commercial agriculture are used for ploughing and haulage. The rule of thumb formula for estimating an economically viable price for delivering mechanised tillage services to small and scattered customers is arrived at by multiplying the amount of fuel used to till the client's field by a factor of 6. In the examples shown above, the current economic price for ploughing 1 hectare in Zambia is **ZMK 640,000** and for MT ripping is **ZMK 274,000**.

In Zambia the custom of hiring in services is traditional and about 30% to 40% of smallholders hire oxen or labour to prepare their land for planting and later for weeding. Costing these services is tricky as payment is made in many forms including cash and barter and expenditure varies substantially depending whether itinerant labour, distant relatives or members of the extended family are engaged. The idea of developing mechanised Min-Till service provision was exciting but would this service be able to compete with the alternative choices available to smallholders? As the results of our investigations showed, (refer to the following table), the answer appeared positive.

Equally important was the evidence that customers could bear the economic cost of mechanised Min-Till services provision and that no subsidies or incentives would be necessary.

Alternative Costs of Service Provision for Land Prep

System	Season	Max Effective Window	Time Required per/ha	Cost to Client ZMK/ha Hired Services
Hoe Tillage				
Ridge Splitting	Dry	3 months	30-35 man days	200,000 to 300,000
Overall Digging	Wet	3 weeks	50-60 man days	300,000 to 500,000
CF MT Basins	Dry	3 months	25-30 man days	175,000 to 250,000
Ox Tillage				
Ploughing Hired	Wet	3 weeks	14 hours	200,000 to 300,000
Ridging Hired	Wet	3 weeks	7 hours	150,000 to 225,000
CF MT Ripping Hired	Dry	3 months	4 hours	150,000 to 200,000
Mechanised Tillage				
Ploughing	Wet	3 weeks	3.5 hours	500,000 to 700,000
CF MT Ripping	dry	3 months	1 hour	250,000 to 300,000

4 Getting the Equipment Right

As we know in farming, the devil lies in the detail and while mechanised rippers are generally referred to collectively they come in many shapes and forms, some more or less suited to Zambian conditions and others totally unsuited. After much practical experimentation in 2009, it became evident that no ex-factory models furnished all the requirements. In short, these are:

- Width of ripper tines and points no more than 4cm to 5cm to minimise draft, fuel consumption and soil disturbance.
- Minimum clearance of ripper frame above ground in operational mode 0.6m.
- Coulters of 18cm diameter set well in front of ripper points to cut through trash and avoid clogging.
- Operational ripping depth 25cms to shatter compact layers caused by previous shallow ploughing and hoe tillage.
- Adjustable land wheel or crumblers to set ripping depth and avoid wear and tear on hydraulics.
- Effective trip mechanism to avoid breakages caused by roots and rocks.
- Power requirement matched to the equipment– 2 tine ripper 60hp, 3 tine ripper 80hp



The modified 2 tine rippers in the photos above show some of the features required, but are yet to be perfected. The operating clearance of the ripper on the left is too low the coulters are set too close to the tines and the tines are too broad, whereas the ripper on the right is missing an adjustable depth wheel.

On the assumption that 1 unit can rip a maximum of 250 to 300 hectares between July and November for about 100 customers it is important that TSP's augment their income through the provision of additional

services. If unavailable, the inclusion of a trailer for haulage in the loan package is considered essential and the inclusion of a stationary Maize sheller a worthwhile option.

What must be avoided is overburdening TSP's with unnecessary equipment unless they happen to be large farmers in their own right; boom sprayers, zero till planters and combines are not suited for service provision aimed at smallholders.

5. MT Mechanised Tillage Service Provision - the Current Situation

Three pilot schemes are presently operational in Zambia, one promoted by Dunavant Cotton, the second by AFGRI with the support of CFU/Musika and the third by MACO/FAO with a total of 58 TSP's operating in the field.

Although these schemes are still in their infancy the demand for MT-TSP services by small farmers has proved to be overwhelming with substantial untapped potential for expansion. However several challenges and threats exist and stakeholders need to get together to iron out some crucial ground rules if we are not to experience distorted competition, burnt out loan schemes and a future spectacle of underutilised and broken equipment. History should not repeat itself. As we see it, the key ground rules must include the following:

- Schemes to be based on sound business principles.
- Careful and thorough screening of potential loanees.
- Effective practical and business training.
- Equipment package tailored to small and medium scale service provision.
- Timely delivery of new equipment - by July at the latest.
- Back up services for maintenance and spares.
- TSP customers trained and familiar with the use of herbicides.

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