#7442 AFFORDABILITY OF MECHANISATION SERVICES FOR SMALLHOLDERS IN ZAMBIA BY AGRODEALER DEVELOPMENT

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ABSTRACT

The objective of this work was to assess the affordability of mechanisation systems along with conservation agriculture for smallholders in Zambia by agrodealer development. Two smallholder communities (60 km east of Lusaka, and 150 km southwest of Lusaka) with a conservation farming extension service and a suitable agrodealer available were the focus of the trial. Each agrodealer received a mechanisation package to operate and offer the service to local smallholder farms. The performance of agrodealers was monitored by a variety of methods and showed agrodealers as mechanisation contractors can be profitable given sufficient business pump-priming and training. Conservation farming practices undertaken by trained agrodealers were also shown to improve yields and the resilience of smallholder farms in difficult growing season.

INTRODUCTION

In Zambia, there are 1.46 million small and medium-scale farmers (Sitko et al. 2015) of which only 17.9% (261,590) are medium-scale farmers farming 5–100 ha. 81.1% (1,196,720) are either subsistence farmers farming 2 ha or less by hand and typically with a family of five to six members, or slightly larger farms farming 2–5 ha. Smallholders have a restricted purchasing power and cannot afford to invest in agricultural machinery.

The challenges hampering agricultural mechanization in sub-Saharan Africa (SSA) are affordability, availability, lack of farmer skills and constraints within the private sector (Sims et al., 2016). Low capacity and lack of support for mechanisation contractors (agrodealers) to succeed is therefore holding back the development.

There are activities to stimulate private investment in agriculture (Musika) and promote conservation farming practices (Conservation Farming Unit) in Zambia. Thierfelder et al. (2015) found that in 80% of cases studied, regardless of soil type or conservation system employed, conservation management increased maize yield. They also suggested that the continuing improvements seen over time under conservation management were due both to recovery in soil health and the skills of the producers themselves

There is a business opportunity for mechanisation service providers to be in the vanguard of conservation agriculture for African countries (Sims et al. 2014, Adu-Baffour et al 2019). This is a key strategy needed to improve farm resilience and improve crop yields and incomes for smallholder farmers in Sub-Saharan Africa (SSA) (Rockström et al., 2009).

The objective of this work was to assess the affordability of mechanisation systems along with conservation agriculture for smallholders in Zambia by agrodealer development.

MATERIALS AND METHODS

Two smallholder communities (60 km east of Lusaka, and 150 km southwest of Lusaka) with a conservation farming extension service and a suitable agrodealer available were the focus of the trial in Zambia (Peets et al 2019). Two agrodealers, one on each site, received

mechanisation packages to operate and offer the service to local smallholder community. The mechanisation package consisted of: 82HP 2WD tractor, 3 tine ripper, off-set disc harrow, 3 row planter, 3 tonne trailer, 12m boom sprayer, and a maize sheller (Table 1). Resale values and years owned were estimated based on local knowledge of resale values and applying a straight-line depreciation model. The performance of agrodealers was monitored by telemetry data (standard reports such as daily engine hours, and advanced GPS tracking analysis to detect boundaries of worked areas), agrodealer sales invoices, agrodealer accounting data, and site visits during the period of June 2018 to August 2019.

Table 1. Mechanisation package items and cost (USD).

Item	Purchase Price ($)	Resale ($)	Years owned
Tractor	33538	16000	6
Ripper	2250	500	10
Disc Harrow	4200	2500	10
Boom Sprayer	2800	500	5
Planter	4650	1000	10
Sheller	7000	2000	5
Trailer	4000	2000	10
Total	58438	24500	–

The data obtained was modelled in Microsoft Excel using standard costing methodology (Landers, 2000). Multiple spreadsheets were produced which costed the individual machines on a per hectare basis using theoretical work rates. The model accumulated hectares worked as more jobs were undertaken with the aim of spreading the fixed costs of ownership over the total hectares. This allowed judgements and model adjustments to be made which reflected the actual workrates achieved by the machinery according to the telemetry data. Maize yields were assessed in adjacent fields for a range of customers where mechanisation was done on one field and standard local practice applied to the other.

RESULTS AND DISCUSSION

The results of mechanisation contractor (agrodealer) performance analysis demonstrate the following: fieldwork was conducted on 142 days out of available 393 calendar days; tractor worked 980 engine hours during this period; a total of 219 jobs were done; invoiced area was 364 ha (258 ha of conservation farming); average worked area was 2.3 ha; seasonal work rate was 3.8 ha/day (0.5 ha/hr); revenue generated 43 USD/ha (18.63 USD/hr).

The actual quantity of work achieved fell short of the projected values for a variety of reasons ranging from the timing of machine delivery missing a large part of the season (Table 2.) to delayed advertisement of tractor service. This is highlighted by the planter, sprayer and shelling machines in particular. However, once working, the operators produced better workrates than projected.

Table 2. Actual and projected work in a season (year).

	Quantity of work		Time to complete (hr)		Work rate ha/hr	
Type of work	Actual	Projected	Actual	Projected	Actual	Projected
Ripping (ha)	258	300	512	595	0.50	0.50
Discing (ha)	35	70	63	50	0.56	1.40
Planting (ha)	25	100	46	124	0.54	0.81
Spraying (ha)	46	100	24	46	1.92	2.16
Shelling (bags)	11036	33000	221	165	50	200
Trailer (hrs)	65	200	65	200	–	–
Total	364 ha	570 ha	931	1180	–	–

Table 3 shows the projected financial statement for the Agrodealer business which could have made a gross profit of over $15,000 with the enterprise breaking even in just under 4 years. This is based on favourable and timely working conditions with minimal breakdowns but in no way unrealistic rates of work.

Table 3. Projected Agrodealer mechanisation services financial statement (USD).

Task	Cost($/hr)	Cost ($/ha)	Retail ($/ha)	Gross profit ($)
Ripping	19.47	38.64	50.00	3407.86
Spraying	30.35	14.05	46.15	3210.37
Discing	34.41	24.58	46.15	1510.17
Planting	21.05	25.99	46.15	2016.44
Shelling	17.49	0.09	0.19	3460.47
Trailer	19.74		30.00	2051.20
Total ($/yr)	24,151.18		39,807.69	15,331.51
Opex ($/yr)	13,397.16		Breakeven (yr)	3.81
Capex ($/yr)	10,754.03			

The actual financial statement shown in Table 4 shows a loss of just over $1,500. Two tasks were profitable, and it is envisaged that given a better season and a longer work window with full machine availability that planting and shelling operations will also contribute to the enterprise profitability. Indeed, spraying which only became available part way through the season still turned a profit.

The farm trial results demonstrated that maize crop established by ox ploughing wilted mostly and performed poorly (mean yield 0.3 t/ha), crop established by tractor ripping demonstrated more vigorous root development and better yield (mean yield 5.5 t/ha) (number of farms in comparison trial 21). The rainfall in the period of November 2018 to April 2019 was 277 mm as measured at five locations in the trial area.

Table 4. Actual Agro dealer mechanisation services financial statement (USD).

Task	Cost ($/hr)	Cost ($/ha)	Retail ($/ha)	Gross profit ($)
Ripping	22.51	44.66	50.00	1378.31
Spraying	48.42	25.22	46.15	963.01
Discing	33.20	59.29	46.15	-459.59
Planting	35.61	65.94	46.15	-494.61
Shelling	18.37	0.37	0.15	-2356.90
Trailer	29.92		26.70	-209.15
Total ($/yr)	22,404.58		21,225.65	-1,503.93
Opex ($/yr)	11,650.55		Breakeven (yr)	-38.86
Capex ($/yr)	10,754.03			

CONCLUSIONS

Contracting business (agrodealer) can be profitable, however, in early stages needs support such as set up with financial aid, time to build customer base, and training. The actual financial statement for the mechanisation contractor business showed a loss of just over $1,500. Ripping and spraying were profitable. The projected financial statement for the agrodealer mechanisation contractor business shows a potential to make a gross profit of over $15,000 with the enterprise breaking even in just under 4 years. This is based on favourable and timely working conditions with minimal breakdowns but in no way unrealistic rates of work.

Conservation farming practices undertaken by trained agrodealers were also shown to improve yields and the resilience of smallholder farms: a yield improvement of mechanised ripping for maize establishment versus ox driven techniques of 5.2 t/ha (mean yield 5.5 t/ha and 0.3 t/ha respectively) during difficult season was shown.

Further work is required to improve the efficiency of tractor field work by better planning, scheduling and training.

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