CIMMYT

SIMLESA
Sustainable Intensification of Maize and Legume Systems for Food Security in Eastern and Southern Africa

TARI
Transforming Agriculture

Australian Government
Australian Centre for International Agricultural Research

COUNTRY POLICY BRIEF ENHANCING AGRICULTURAL RESILIENCE AND SUSTAINABILITY IN TANZANIA

Simple, affordable and impactful: Two wheel tractors drive sustainable intensification in Tanzania

Summary and key facts

One reason for the low crop production and adoption of Conservation Agriculture-based Sustainable Intensification (CASI) in Tanzania is the lack of access to small-scale mechanization

Research shows that power tiller - 2 wheel tractor - operated direct seeders, single row planters reduces the time it takes for planting from 8 hours using human labor to 3 hours per ha

Based on the findings, investments and promotion of these planters accelerated adoption of CASI, thereby increasing yields of both maize and pigeon pea

What is the problem?

Muscle power alone is insufficient

In Tanzania, more than half (62%) of farmers still use hand hoes and human muscle-power to run all farm operations. Just under a quarter (24%) use animal traction and only a small 14% use mechanical power such as tractors, power tillers, and weeders. Farmers spend many weeks in undertaking grueling physical farming activities that could be done in a matter of days or less with appropriate machinery. In rain-fed agriculture systems, timeliness and efficiency are critical to optimize farm operations and production. Failure to start farming operations on time and slow operations limit farmers' capacities, farm productivity and profitability.

Most maize cultivars were observed to lose up to

43%

of expected yields for a 20 day dry spell which can be avoided with timely planting

What solutions were identified from research?

Multi-sector approach can help promote appropriate farm mechanization

The Sustainable Intensification of Maize-Legume Cropping Systems for Food Security in Eastern and Southern Africa (SIMLESA) project in Tanzania supported a paradigm shift towards Conservation Agriculture-based Sustainable Intensification (CASI). This involved promoting practices that emphasized minimizing tillage, crop rotations and intercrops, and maintaining soil cover using crop residues. While validating and doing adaptive research on these practices, the research team realized that, lack of locally-adapted appropriate small-scale machinery was an impediment to the adoption and use of these technologies.

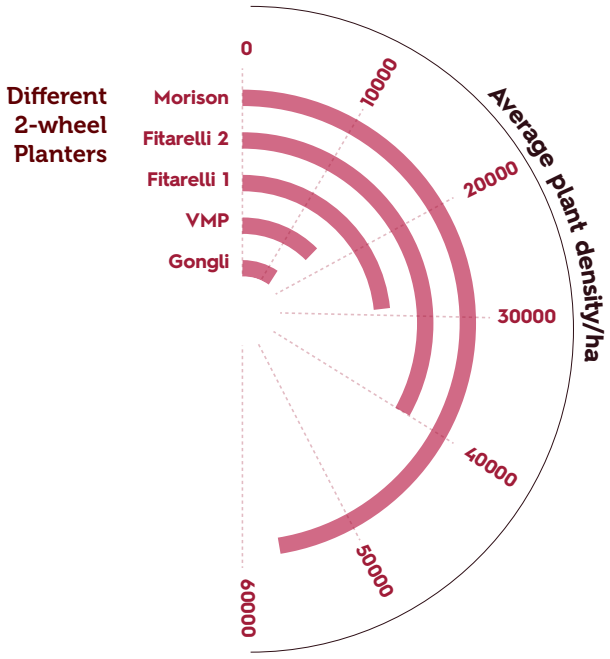
To address this need for mechanization to implement CASI, SIMLESA researchers joined forces with the Farm Mechanization and Conservation Agriculture for Sustainable Intensification (FACASI) project and the Center for Agricultural Machinery Testing for Rural Technology (CARMATECH). The three teams conducted on farm trials with the aim of testing various conservation agriculture planters, which are driven by a power tiller (two-wheel tractor).
Key among the findings was that with manual labor, it took 160 man hours for planting one hectare of a maize field but three machine hours to plant one hectare using the validated planters mounted on a small engine two wheel tractor. Crucially, the costs of hand labor for planting one ha of maize was estimated to costs a farmer about TSh.120, 000 ($60) while using Morison and Fitarelli (two models validated by the research teams), it costs about TSh.10, 400 ($5).

Beyond Tillage: Emphasizing Multifunctionality

Mechanization covers all levels of farming and processing technologies, from simple basic hand tools to more sophisticated and motorized equipment. Benefits include:

- Eases and reduces hard labor
- Relieves labor shortages
- Increased control over row planting, precise fertilizer application, timely planting
- Enhances market access
- Contributes to mitigating climate related hazards

Average maize plant population per hectare for four seasons across 3 different locations



Source: FACASI annual report 2017

Average time, seed and fertilizer rate, fuel, Planting depth, and plant population for different 2WT direct seeders for maize and beans

Seeder	Average hr/ ha	Average seed kg/ha	Average fert (kg DAP)/ha	Average fuel (L)/ha	P lant depth cm	Average % moist. @ sowing	Soil type Arumeru and SARI	Soil type Mbulu
Gongli	3	22	100	3.6	2.50	28	Clay loam	Sandy loam
Fitarelli 1	5	20	59.1	3	3.33			
Fitarelli 2	2	18	125.7	2	2.67			
Morison	4.5	23	90	2	3.0			

Recommended seed rate is 20kg/ha, and fertilizer 90kg DAP/ha.
Source: FACASI annual report 2017

Opportunities for policy action

Increase networks on machine testing and adaptation for multifunctionality

Scale up multidisciplinary demonstrations and continued validation of two wheel tractors

The potential demonstrated here was the result of multidisciplinary teams of engineers, agronomists, business development and policy experts. Developing a national network of multidisciplinary teams to promote appropriate mechanization across the country is needed. Government should continue to invest in strengthening district mechanization units. This will require investments of human and financial resources by government and private sector. To scale up the testing and scaling of validated machine, such as the Morison and Fitarelli planters and power tillers (small engine tractors) for accelerating adoption of CASI. One way is to provide enabling taxation environment for importation of planting implements.

Promote multifunctional mechanization

Mechanization covers all levels of farming and processing technologies, from simple and basic hand tools to more sophisticated and motorized equipment. In line with the suggestion to invest in R&D for appropriate machinery, emphasis is required on a system of machinery that provides flexibility and multi-functionality. This way the returns on investment on new machinery is improved by elimination of "idle capacity" since machines will be useful all year round.

Invest in the incubation of new business opportunities including demand creation

Research has shown that one way to overcome the high costs of equipment is through mechanization custom hire services. This is because ownership of machines is likely to be a relatively high capital expenditure and so many farmers will find it more cost effective to hire instead. Training in the use of mechanization and business operations provides new rural business opportunities in providing services to farmers who lack capital. A framework for market demand creation must be developed. For example, funding for free trials can be organized on a large scale. This kind of market creation activity is beyond the ability of small agribusinesses and requires private-public sector collaboration.

Why act now?

Modernization of agriculture isn't possible without appropriate mechanisation along the value chains

Without smallholder-adapted mechanization, low productivity will persist. Opportunities for labor savings and economic diversification will be lost. This will undermine efforts aimed at agricultural modernization, economic diversification and income growth. Investing in research, adaptation and scaling of smallholder-adapted mechanization using readily available power sources (or small tractors) can help achieve these aims.

References and sources

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