

# Introduction of Decker Type Maize Sheller to Selected Areas of Eastern Tigray and Its Socioeconomic Impact Assessment

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## Abstract

Maize production has increased in the last few years in the region and country. Despite the increase, there are still many problems that are not solved in the production system, among them shelling system or operation is the first. The traditional methods of shelling; i.e. rubbing the cob together, fringe by hand finger, beating the cobs using sick, or by pestle and animal tramping are labor intensive, time consuming, cause damage, and cause loss of grains. In order to solve problem the Mekelle Agricultural Mechanization and Rural Energy center manufactures decker type maize Sheller to small holder farmers. And this paper evaluates the socioeconomic impact of this decker in comparing with rubbing the cob of corn together, fraying by hand finger, beating the cobs by using stick, and using decker type maize Sheller. This paper overcome through two approaches these are technical and socioeconomic evaluation.

**Keywords:** Sheller; Decker type; maize cob; maize increase production, post-harvest loss

## Background and Justification

**Maize**, the American Indian word for corn, means literally that which sustains life. It is, after wheat and rice, the most important cereal grain in the world, providing nutrients for humans and animals and serving as a basic raw material for the production of starch, oil and protein, alcoholic beverages, food sweeteners and, more recently, fuel (FAO, 1992). The major steps involved in the processing of maize are harvesting, drying, de-husking, shelling, storing, and milling. For the rural farmers to maximize profit from their maize, appropriate technology that suites their needs must be used.

The threshing floor usually made smearing the ground with cow dung and left to dry for some time or leveling the ground and trampling according the type of crop which is going to be threshed. During threshing the loose crop is laid on the floor and several oxen tread on it. The oxen go round on the threshing floor over the crop for some time and are taken out to turn the un-threshed crop from the bottom up and spread it laying the heads up for efficient treading.

Food dehydration is a method of preserving food that fits today's lifestyles. Drying food offers one of the most economical and energy-efficient ways of preserving a variety of foods. It is estimated that drying costs less than canning and one-quarter as much as freezing. Drying not only preserves foods but also offers new and different nutritious snacks such as dried fruits, fruit rolls, and meat sauces.

The existing method does not encourage high output and often result in low quality products. But there is a growing need to provide the farmers with appropriate technologies. To overcome such shortcoming this project is necessitate to introducing and demonstrating in our mandate areas.

Traditionally farmers have experienced some methods of shelling maize, which includes rubbing the cob of corn together, fraying by hand finger, and beating the cobs by using stick. Those methods do not support large-scale shelling of maize and quality maize, especially for seeds and commercial purposes. In order to overcome the above mentioned problems this project coming with this easy, efficient and affordable maize Sheller's

The main Objective of this paper is to enhance knowledge and skill of smallholder farmers for better utilization of efficient and low cost maize Sheller in the future productivity of farmers through efficient and low cost maize Sheller. And cross checking socio economic impact of these maize sellers.

## Methods and data collection technique

Two methods have been used to identify and understand the socio economic impact of decker type maize Sheller. The first method was farmer perception after some of the farmers who had adopted the maize Sheller. The second method was technical performance of the Sheller after measure the capacity directly in Mekelle Agricultural mechanization and Rural Energy Research Center (MAMRERC) work shop

## Study area and Sample size

This research was testing in two Woreda's of Tigray regional state (Wikro Kilde Awilalo Tabia Laelay Agulae which was selected 30 farmers and 3DAs and Atsbi Wenberta tabia Hayelom which also selected 30 farmers and 3DAs). Training was given to farmers and DAs on how to use this decker type maize Sheller in comparing three common practicing techniques in the study area.

This research has conducted using four treatments. These are;

1. rubbing the cob of corn together,
2. fraying by hand finger,
3. beating the cobs by using stick, and
4. Using decker type maize Sheller using the most popular maize variety in the region which is ‘Mekelle 1’.

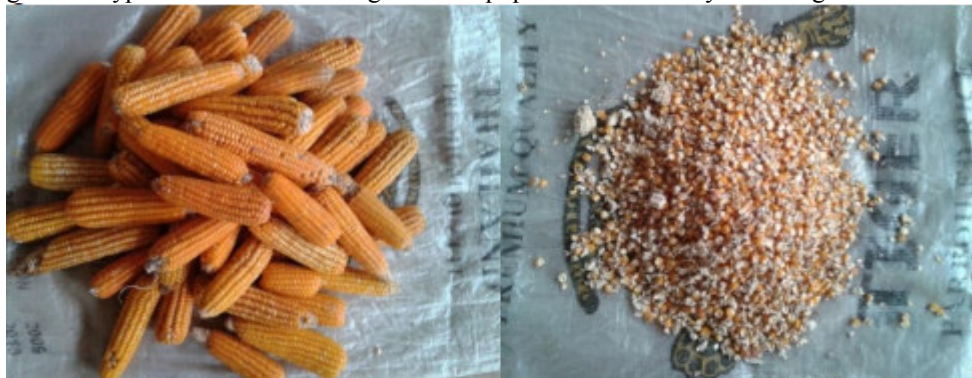


FIGURE 1: KNOWN VARIETY MAIZE MEKELLE 1

THE MOISTURE CONTENT OF THE GRAIN WAS DETERMINED ON DRY WEIGHT BASIS USING THE OVEN METHOD AT 103°C FOR 24 HRS TAKING A SAMPLE OF 100GMS. FOR EACH TEST RUN, 50 KG OF UNSHELLED MAIZE WAS FEED AT A TIME. USING THIS DRY BASE MOISTURE CONTENT WAS;

$$\begin{aligned} \text{Moisture content (\%MC)} &= \frac{\text{weight before (Wd)} - \text{weight after (Wa)}}{\text{weight before}} * 100 \\ &= \frac{100 - 85.4}{100} = 85.4, \text{ this was for all the four treatments} \end{aligned}$$

THEN, THE SHELLING TIME WAS RECORDED BY USING A STOPWATCH WHICH IS USED TO FIND FIELD CAPACITY AND EFFICIENCY OF THE SHELLER ACCORDING;

$$\begin{aligned} \text{field capacity (FC)} &= \frac{\text{total shelled}}{\text{recording time}} \\ \text{Efficiency (\%)} &= \left( \frac{\text{total shelled in a given time (Kg)} - \text{breakage (kg)} - \text{unshelled (Kg)}}{\text{total sample of maize (Kg)}} \right) * 100 \end{aligned}$$

After identified technical performance of the maize Sheller 40 farmers of Atsbi wenberta and Kilt-Awlae’lo weredas was selected. Then training was given to the farmers and distributed the Sheller. Finally farmers perception also organized by using group discussion and individual interviews.

#### Nature and source of data

Both primary and secondary sources of information have been exploited to conduct the study. The major data variables considered in this research area field capacity, efficiency of the decker and percentage of breakage from the in-house test results. And labor saving, time saving, cost, breakage, uniformity, safety and comfort, simplicity of design and technology, versatility for use, affordability was also collected from the participants perception using individual and group discussions.

#### Decker type Maize Sheller

This Sheller was adopted from national exhibition held in Tigray, Mekelle in 2011 and made little modification by MAMREREC. The Sheller is very effective and easy to movable and manufactures for small holder farmers specially women’s and children’s.

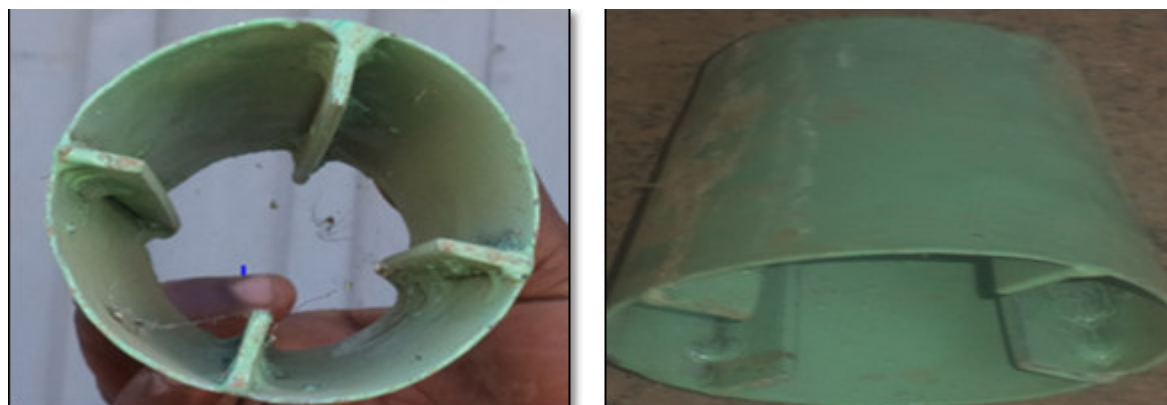


FIGURE 2: PICTURE OF DECKER TYPE MAIZE SHELLER CAPTURED IN APRIL 2013

### Data analysis

The decker type of maize seller was tested in work shop in comparing with four treatments. And the collected technical and farmers perception data was analyzed using simple descriptive method using excels statistical software.

### Result and discussion

#### Comparison of decker type

Decker type maize Sheller shown in figure 2 is simply modified Sheller technology which constructed simply. This decker type was tested in MAMREREC workshop with respect the four treatments are (decker type maize Sheller (1), beating the cobs by using stick (2), rubbing the cob of corn together (3), and firing by hand finger (4), and the result is as shown in the table below.

TABLE 9: RESULT ANALYSIS OF DECKER TYPE WITH RESPECT THE FOUR TREATMENTS

treatments	SUB(kg)	SB(kg)	FC(kg/hr)	Eff(%)	Brakeage (%)
1	20.425	0.2425	22.775	98.8	2.975
2	20	0.4525	23.35	95.8	6.76
3	20	0.4675	15.765	97.7	5.825
4	20.875	0	9.175	100	0
MES	20.3225	0.29	17.76752	98.59	3.6
CV	4.07315	143.18	69.5	1.9	143.3

Where:- SUB,=Shelled Unbroken; SB,=Shelled Broken; FC, Field capacity, and Eff,= Efficiency

The shelled unbroken have no significant difference. But the other parameters shelled broken, field capacity, efficiency and damage have significant difference among the treatments on Decker with hand, Decker rotary type, firing and rubbing.

The highest shelling field capacity is 23.775 kilogram per hour in beating the cobs by using stick and highest efficiency of 100 % in hand firing using hand was obtained from the test. On the other hand, the lowest mean FC 9.175kilogram per hour from firing and efficiency of 95.8% from beating the cobs by using stick was obtained test.

Also in terms of brakeage the highest brakeage was in in beating the cobs by using stick which is 6.76% or 0.27Killogram and the lowest brakeage was in firing using hand 0% or 0kg of the four treatments.

#### Socioeconomic impact of decker

To conduct socioeconomic impact 40 farmers 50% of them are female house holders due to most of shelling practices are done by female using hand fringe. Theoretical and practical Training was given to the farmers as shown in figure 3. Hand fringe is tedious and time taking process as well as it harms fingers of the women's. Therefore the farmers like this Sheller and practicing for one month as shown in figure 3. After this their perception was collected using structured questioner and group discussion.



FIGURE 3: TRAINING TO PARTICIPANTS (FARMERS AND DAS) IN THE STUDY AREA

The questioners focusing on suitability to small farms, simplicity of the technology on design and manufacturing, safety and comfort, Versatility for use, uniformity, Safety and comfort, Safety and comfort with respect to the traditional methods.

**Suitability to small farm:** all of the participant farmers say this Decker type maize Sheller is very suitable in use when comparing with traditional methods. Due to the traditional methods are causing to harm our health and quality of the grain itself.

**Simplicity of design and technology:** 85% of the participant farmers say it is easy in term of design and technology but difficult when comparing to traditional methods or hand fringe.

**Safety and comfort:** 100 % of the participant farmers say it have better in term of safety and comfort comparing with traditional hand fringe. As the traditional hand effects on hand/finger/ brushing, fell tiredness on their arm, and scratching of their bottom hand and this helping to avoid such injuries.

**Versatility for use:** the decker have only used for Shelling of maize for small scale farmers who have small amount maize production due to the capacity is not more than 20 up to 30 kilogram per hour.

**Uniformity:** the machine has uniform shelling ability with breakage is very low in comparing with traditional methods having high breakage

**Safety and comfort:** this decker is safe in use and has comfort in use when comparing with traditional methods. Firing with hand harm our finger, beating the cobs by using stick harm also our hand and arm; and break the grain, and rubbing the cob of corn together also harm our hand and break the grains.

**Labor saving:** when comparing with traditional methods 19 of the total 21 participants or 95 percent says the Decker type saves labor; due to it is easy in use and it need not more power than hand fringe. This is checked also in the technical analysis.

**Time saving:** of the total participants 21 of the 21 or 100% participant farmers says it takes less time than traditional hand fringe

**Brakeage:** all of the participants agree on the machine is zero breakage when comparing with hand fringe almost the same

**Cost:** when comparing with traditional methods it have high initial cost ; due to the initial cost of the Decker type is around 500 Ethiopian birr says all farmers or 100% Hence the initial cost of hand fringe is zero

#### Cost benefit analysis and cost effectiveness

The benefits of the additional flights (F2– F1) are given by the summation of the total amount that each new trip maker would be willing to pay to make the flight. the cost benefit analysis (CBE) and cost effectiveness analysis here was computed based on cost including individual cost (wedge) and time taking to shelled the maize. The initial cost of decker is high which 85 Ethiopian birr (4USD) and daily worker per hour in the study area is 70 Ethiopian birr (3.67USD). The computed time and cost of the four treatments was as shown in the table 2.

TABLE 10: INDIVIDUAL COST AND TIME TAKING TO COMPUTE 25 KILOGRAM MAIZE

treatments	time taking in Hr	Initial cost USD	Cost of Wedge in USD/8Hr	cost of wedge for 25Kg maize with cob	Net cost in USD in n Hrs
1	1.098	4	3.67	0.5036	4.5036
2	1.071	0	3.67	0.491	0.491
3	1.586	0	3.67	0.727	0.727
4	2.725	0	3.67	1.25	1.25

The net cost benefit analysis of the Sheller was high initial but after n hours the cost will be computed

using (initial cost plus cost of wedge for 25Kg maize with cob) times n hours. And the net cost of decker was initially high but after eight hours the cost becomes low.

### **Conclusion and recommendation**

#### **Conclusion**

Therefore four conclusions were drawn from this paper: first conclusion is that Decker type maize Sheller is best technology when compared with hand Fringe and beating with stick in term of field capacity about 20 up to 30 kilogram per hour. Second conclusion was decker type have 98.6%, Efficiency and breakage about 1.2 percent which is high. Third conclusion was it is also easily manageable, transportable, and maintains locally, it hasn't any complicated system in use it also comfortable for women's.

#### **Recommendation**

Other technologies better capacity and efficiency than this Decker type; such as Engine type maize Sheller may be introduced and demonstrate to the farmers. to additional modification more than this if necessary. Extension works and other development works must do to introduce new technologies and increase perception of farmers and other users.

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