

# Introduction and Evaluation of Low Cost Horizontal Beehive on Two District of Tigray Ethiopia

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## Abstract

The study was conducted to evaluate and introduce of low cost horizontal hive at low land and high land part of Tigray Ethiopia. The diverse climatic and latitudinal changes do not affect the overall performance of the introduced hive and has statistically insignificant ( $p=0.065$ ) and type of hive at both locations did not affect yield significantly but the effect of hive type in honey yield production is highly significant ( $p<0.001$ ). This  $p$  value indicates that application of different types of hives can vary honey yield production at a significant level.

This paper evaluates that with local material and indigenous knowledge the problem of input cost can be solved by an integrated research approach like what Mekele agricultural mechanization and rural energy research centre did and practical technical support is important for poor farmers to enhance their productivity.

## Background and Justification

Ethiopia having the best natural and favorable agro climatic condition, the country owned the highest bee density in Africa (Ayalew, 2001). Moreover, beekeeping is practiced for a long time by farmers, producing around 23.6% and 2.1% of the total African and world's honey, respectively. This honey production capacity enables the nation to be one of the top 10 producers of honey in the world, and it is the largest one in Africa (USAID, AGP-AMD, 2012).

In Ethiopia, traditional beekeeping is the oldest and the richest practice, which has been carried out by the people for thousands of years. Several million bee colonies are managed with the same old traditional beekeeping methods in almost all parts of the country (Fichtl, R and Admasu, 1994). Based on locally available materials used for construction of hives, environmental conditions and positions used to keep bees, the following variants of basic design are found throughout the country: hollowed logs, bark hive, bamboo or reed grass hive, mud (clay) hive, animal dung (mixed with ash) hive, woven straw hive, gourd hive, earthen pot hive and so on. The beekeepers that are experienced and skilful in using these hives could do many operations with less facility. Gezahegne (2001) reported that under Ethiopian farmers' management condition, the average amount of crude honey produced from traditional hives is estimated to be 5 kg / hive / year.

Extensive scaling out of Langstroth beehive carried out by Tigray Bureau of Agriculture and Rural Development in past years has tremendously raised its consumption level throughout the region and promising results have been recorded in improving livelihood of farmers.

According to data collected from Tigray Bureau of Agriculture and Rural Development (2010), total number of beehive colonies available in the region is estimated to be 220-250 thousands, whereas the total number of Langstroth beehive so far distributed to farmers is 74 thousands (which is 36%). This indicates that adoption rate of Langstroth beehive is very low, regardless of its higher yield and quality. This is mainly attributed to its high cost and low purchasing power of farmers.

At the initial stage of its promotion by (1995), the total cost of one set Langstroth beehive (with 3 supers) was 230.00. Within 20 years of time this cost has risen incrementally to about 2000 birr excluding excluder and other accessories.

The main reason for its high cost is that the type of timber used and level of technology and techniques related to its manufacturing process. Hence it is essential to look for other options by which the cost can be minimized.

While carrying out extensive scaling up of modern beehive (Langstroth) of our region, there have been tremendous attempts of farmers in manufacturing its horizontal version using local materials. But none of them has yet been verified for their effectiveness.

Recently Jimma Mechanization Research Center (JMRC) has carried out an evaluation research on a horizontal bee hive. According to the result honey bee production of low cost hive is less by 1.1% than that of Langstroth type. Moreover, the absconding rate (the running away of transferred bee from their hives because of different reasons) of honey bee colony in low cost horizontal hive is 8.3% and 33.3% in Langstroth which is a significant result.

For this reason Mekelle agricultural mechanization and rural energy research center has been made an effort on implementing of problem based research agenda on reduction cost of honey bee production especially on hive cost reduction by introducing low cost horizontal hives.

## Materials and Methods

### Method and data collection technique

#### Study area ascription

This study was conducted in two districts of tigray regional state, having two different agro ecological zones of kola and dega. Dega(High land ) of atsebi wenberta and Kola( low land) temben was selected to evaluate the comparative yield performance and cost reduction of hive construction of different type of hives for their potential of honey bee production and divers effect of altitude.

#### Sample size

A sample of 10 low Cost horizontal bee hives was constructed from timber & shembko(bamboo) with hard cover of galvanized sheet on agricultural mechanization and rural energy research center and distributed to 10 farmers on high lands of atsbi and low lands of tembien, who had already possessed traditional & langstroth (modern) beehives. Farmers' selection was purposely for those who have traditional and modern hive.

#### Treatment and their description

	treatments	Description	No hive
1	T1	modern hive	10
2	T2	LCH hive /low cost horizontal hive/	10
3	T3	Traditional hive	10
4	replication	10	30

LCH hive /low cost horizontal hive/

The hive has one base and two horizontal supers having queen excluder with 30 frames.

Farmers sealed the hive with mud & animal dung. All its' internal sizes of each supper is equal to that of modern bee hive and the only difference is the position of the supper and the material the hive made from.



Unsealed hive with mud & animal dung



The first type L.C.H. on bee farmer

## Result and discussion

The research was conducted to see the effect (advantage) of the newly introduced low cost horizontal hive and it was important to see whether it is area limited or not and the collected data was analyzed based on the following statistics.

#### Location

The effect of location on the honey yield is indicated in Table 1. Statistically insignificant ( $p=0.065$ ) and type of hive at both location did not affect yield at significance even if some numerical difference was observed in honey yield due to research location. Modern, LCh and traditional hives score 27.8, 20.8 & 9.2 kg mean yield respectively in temben but 19.2, 26.4 & 7.2 kg was harvested in atsbi location.

Table yield 1 of honey on K.G

Grand mean 18.43				
	Type_of	L.H.H	modern	Tdational
		20	27.1	8.2
	location	Atsbi	Tembien	
		17.6	19.27	
	Type_of	location	Atsbi	Tembien
	L.H.H		19.2	20.8
	modern		26.4	27.8
	Tdational		7.2	9.2

**Hive type**

The effect of hive type in honey yield production is highly significant ( $p < .001$ ). this p value indicate that application of different type of hive can be vary honey yield at significant level.

Table 2 of Yield of honey per hive

Type of hive	Mean	Cost hive /year
Modern	27.1a	
L.H.H	20b	
Traditional	8.2c	

**Economic gain**

All costs were calculated and the given profit considers the net outcome of honey producers at one year per given production season.

The effect of hive on profit is stile significant ( $p < 0.001$ ). grand mean of profit is 1636 and the profit obtained from each type hive is quite different but the effect of location on profit is insignificant ( $p = 0.097$ )

**Profit**

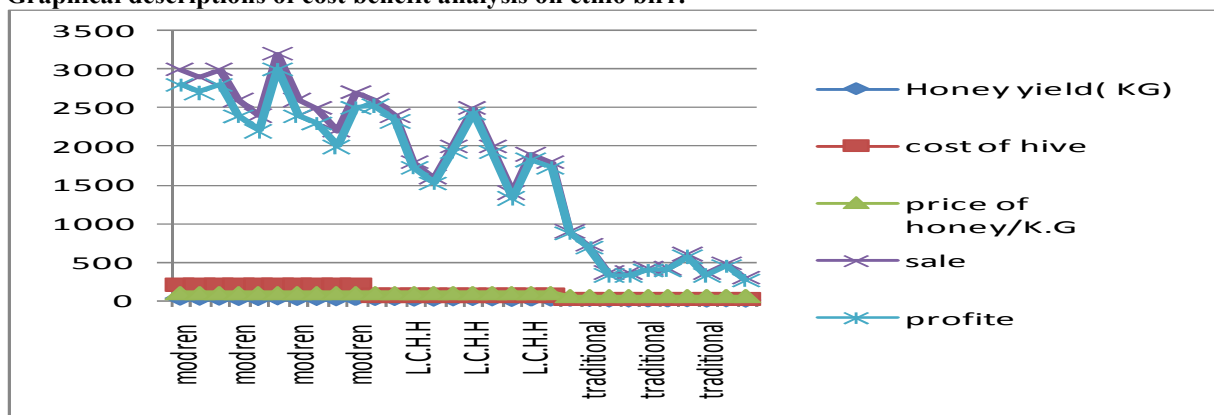
Grand mean profit 1636 Birr/hive /1harvest

Grand mean profit	By Types of hive	L.H.H	modern	Traditional
		1930.00 Birr	2510.00 Birr	467.00 Birr
Grand mean profit	by location	Atsbi	Tembien	
		1566. Birr	1706. Birr	

Grand mean profit	by Type of hive location	Atsbi	Tembien
	L.H.H	1850.00 Birr	2010.00 Birr
	Modern	2440.00 Birr	2580.00 Birr
	Traditional	407.00 Birr	527.00 Birr

**\*\*Birr =local Ethiopian currency**

**Graphical descriptions of cost benefit analysis on ethio birr.**



**Farmers' perception**

From the research analysis farmers perception was indicted that type of hive is significant ( $p < 0.001$ ) but location is insignificant ( $p = 0.078$ ).

Farmers can explain their perception by what magnitude they need a type of hive and they perceive modern hive by giving 4.8 point out of 5, 3.90 to LHH and 2.6 point to traditional hive.

**Tables of means**

**Variant:** perception of beekeeping farmers to the local material made hive with other type of hives based on cost, productivity and manageability, and other factors of production and beekeepers rank the three hives accordingly.

**Grand mean 3.77**

Type of hive	L.H.H	modern	Traditional
	2.60	3.90	4.80
Location	Atsbi	Tembien	
	3.60	3.93	

Type of hive	location	
	Atsbi	Tembien
L.H.H	3.80	4.00
Modern	4.60	5.00
Traditional hive	2.40	2.80

**Training**

After evaluating the low cost horizontal hive farmers demand to have a training to produce by their own skill and what they have local row material.



**Farmers at training**



**A hive made by farmers**

**Conclusion**

This type of hive has a big advantage (at significant level) to that of traditional hive but it is lower yield than modern hive, so it would be advantageous to recommend that this type of hive shall be introduced and popularized among poor beekeepers and other incapable members of society.

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