On Farm Evaluation and Demonstration of Lever and Screw Honey Presses

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Abstract

Honey is an important product of beekeeping with high nutritional and medicinal values. The other important product as well is wax. It is a valuable commodity, used by the beekeeper to form the foundation, but it also has high commercial value on the open market, both domestically and internationally. These two important products need to be properly handled and prepared for market. Among different ways of proper utilization of these products using of honey presses, like screw and lever types are some of them. During the experiment, screw and lever presses were evaluated. These honey presses were provided to farmers around Debre Worek wereda. Farmers and werada development agents were gathered to a training during which they were demonstrated the two honey extraction methods. Participants evaluated the methods using various parameters, such as, convenience of operation, knowledge, power requirement, extracting efficiencies, extracting rate, honey loss and maintenance condition.. The Farmers opinions and test results showed that the honey extracted by the screw press was better than honey extracted by the lever one. The average extracting rate, efficiency, and honey loses of screw honey press was 53.9kg/h, 96.8%, and 0.28kg whereas the lever type was 36.5kg/h., 90.6% and 0.42kg respectively. The statistical analysis of the data at 0.05level of confidence showed that significant difference between the two press regarding honey loss. Beyond technical capability, most farmers prefered the screw one because of less energy requirement and higher extracting capability. The overall observation showed that the honey extracted with the mechanical presses had acceptable qualities such as honey color, flavor odor, removing impurities as compared to traditional method using boiled water, cloth, and sun heat methods. Therefore, it is possible to recommend that the screw type honey press can be used by as additional income generating opportunity.

Key words: aluminium box, honey comb, steel box

Introduction

Beekeeping is one of the agricultural activities that farmers in the region are engaged in to produce the sweet food, honey. It is a useful sideline activity

for many farm families in most parts of the region. Being a natural food collected by bees from nectar of flowers and processed by them, honey contains several vital constituents having nutritional and medicinal values. Viscous supersaturated sugar in honey is easily assimilated in the blood stream, deposited in liver as glycogen, and provides energy to our body. The calorific value of 1 kg of honey is very high as compared to other products.

Farmers in the Amhara region used fixed comb beehives, which is traditionally made from locally available materials such as woven reeds or grass. Estimates show that there are more than 0.6 million beehives in the region in which nearly 99% of them are traditional hives. The annual estimated honey production in the region is 334.243 tones with an average honey production of 5 Kg /annum from the traditional hives (CSA, 1994). This is a very low figure mainly attributed to lack of appropriate beekeeping equipment. Honey is usually squeezed out of the cut combs by hand, roughly filtered through cotton cloth, mosquito net, and stored in locally made containers. Mostly this method make the product get mixed with wax, pollen, dead bees and other foreign matter.

Beeswax is a product of the honeybee. It is produced from the bee's own body during the warm period of the day. The bee uses wax to build the comb cells in which its brood reared, and the cells in which honey and pollen are stored (Adjare, 1990**)**.Wax is a valuable commodity. It used by the beekeeper to form the foundation, but it also has high commercial value on the open market, both domestically and internationally (Draper and Duggan, 2001). The price paid to the beekeepers for unprocessed wax ranges from 10-15 birr per kilogram, while after processing it costs from three to four times in local markets. Most farmers do not sell beeswax since they do not have proper honey and it's by product processing equipments.

In recent years, the introduction of improved Kenya model beehives with movable frames in some areas of the region increased the total honey production five folds when compared with the traditional beehives. Beside the honey production increments, there was also an increase of interest by farmers in participating on beekeeping activities and wax trade for additional income generation. Therefore, these facts forced the need of suitable honey pressing equipment.

In the Region, most farmers do not have the practice of extracting of pure honey and wax, rather they crushes honey with wax for market purpose. However, research output indicates that, traditionally the comb is collected and stacked on a wire mesh and container is put underneath the pile of combs. The heat from fire or sun begins to melt the honey, and honey and wax trickle down in to the container, the material collected is left untouched until the next morning. The bee wax, which will be hardened at the top of the honey, is removed and the honey is poured in to container.
The disadvantage here is that the honey looses nutritional value and quality when exposed to high temperatures. In addition, the smoky fire employed is full of ashes, charcoal and dust which contaminate the honey. Such honey tastes bitter and smoky (Adjare, 1990**)**. Therefore, using of heat for honey processing is not recommended (Gentry, 1982).

The conventional methods of extracting honey and beeswax are unsuitable and unhygienic. Extraction of honey by squeezing with the hand seems to be the quickest method for the average honey-taper who cannot afford a honey extractor or solar wax-melt. However, the hand contaminates the honey, and unripe honey ferments within a few days after extraction (Adjare, 1990**)**. Honey with high moisture content or "unripe" honey can deteriorate from the various yeast and bacteria that will thrive on the moisture available. Fermentation reduces the keeping quality and thus the life of the honey (Draper and Duggan, 2001).

There are different models of honey presses are in markets. The screw, lever, and hydraulic methods are some of them. All types of honey presses are not used by farmers due to equipment un availability and poor awareness. Preliminary observations show that these technologies need further studies on farmers' management for their suitable operation to extract better honey in both quality and quantity. Therefore, the objective of this study was to verify the performance of improved honey presses under farmers' local conditions and to increase awareness and access to improved honey presses among farmers, and extension/development workers.

Materials and methods

Description of Honey Presses

Honey is separated from the honeycomb under simple mechanical pressure applied by the use of a lever or a screw handle. Equipment of this kind is inexpensive and relatively easy to make. It is ideal for the small-scale honey processor, except the sieve and threaded screw, which are available and purchased from the market.

Honeycomb presses material should be made of aluminum (for those honey-contacted areas) and steel metal (for other parts). The pressing pad is made of wood and laminated by non-corrosive material. The press has a drilled chamber into which the combs are placed and squeezed. The honey is forced out through the round hole leaving the wax and any debris behind and collected in a draining tray. The mixture of wax and debris is subsequently separated and good quantities of high quality wax obtained. The models of honey presses used for testing purpose have the difference in driving mechanism and are described as follow.

Lever type honey press is modified at Bahir Dar Agricultural Mechanization Research Center. It is made of metals and wood. Cylindrical in shape and has cylindrical pressing pad located at the center of the basket. The pressing pad is derived by a hand-using long lever (Figure 1). It is easy to assemble and disassemble all components very quickly from the frame.

The screw honey press was purchase from the local market. It was copied from the original one that was made in Germany. It is made of metals and wood, cylindrical in shape and has cylindrical pressing pad located at the center of the basket. The pressing pad is derived by fine metric threaded screw lever (Figure 2). In the center, some parts like the base, the leg and the screw supports modified at bahir Dar Agricultural Mechanization Research Center.

For testing purpose both models were manufactured as a single unit with different driving mechanism. The base (leg) and the aluminum cylindrical basket are common for both honey presses. The honey pressing processes for each model are done by changing the driving unit alternatively.

Figure1

Figure 2

Evaluation Procedures

Screw and lever driven honey presses were the two-selected mechanical model, for the study. For both models except the perforated cylindrical containers and the screw parts, the other different parts of the models of manual operating honey presses were carefully design and manufactured at Bahar Dar Agricultural Mechanization Research center.

After checking of proper functioning of both honey presses in the center, criteria were set for selection of participant farmers and trail site. Numbers of farmers using local beehives, awareness about the improved technology among farmers, and area that is potential in honey production were some of the criteria. Site selection was made through discussion on the objective and merits of study with respective wereda Agriculture and Rural Development Office experts, development agents and farmers. Based on the criteria's and discussion, the trial site and participant farmers were selected. The selected sits were from E*ast* Gojjam zone, Debreworke wereda in three different kebeles.

In each kebele, three participants were selected. The selected farmers were practically trained on operation and handling of manual operating honey presses. The performances of mechanical and traditional honey extracting implements were discussed. Since the study was based on farmers' evaluation, discussion was made on the objective of the study and expectation form the participant farmers.

The presses were tested in two honey harvesting times, in November and June. Honey pressing time was recorded using stopwatch, crude, and pure honey measured by spring balance. During test time, farmers up to 80 Kg weight were used to operate the press. This helped to validate the selected materials strength**.** The net pressing time includes from the moment starting pressing and ends when it is necessary to turn over the pressed honey and clean the clogged holes. The losses of honey were determined by dissolving the remaining pressed honey in to water and separating it mechanically.

Both honey presses practically demonstrated in two ways for the farmers. The first method provided theoretical explanation of the use and benefit of the machines for over 250 farmers, and secondly practical demonstration was done. All participants forwarded their opinion regarding the presses, performance and other to be improved. Finally, in all trail site discussion was held among farmers, development agents and wereda expert on merit and demerit of honey presses relative to local honey extraction practices and their performance. Information was collected and recorded on required improvements, effectiveness, and suitability of the supplied honey presses. The data were analysed by SPSS statistical package using T-test.

Results and Discussion

The two improved models of manual operated honey presses were evaluated with respect to their technical performance and farmers view. The technical performance result obtained from Debre-work *wereda* trials site is shown on Table 1. It is the summary of the mean for crude honey used for experiment (kg), pure honey extracted (kg), time required to extract pure honey (min.), machine efficiency (%) and capacity (kg/h).

The data in Table 1 shows that the average amount of mixed honeycomb used for each trail for both model of honey press were equal. On the average from 10.7kg of crud honey, 8.5 and 7.3 kg of pure honey were obtained by screw and lever type honey presses, respectively.

Table 1. Summary of the average data obtained during honey presses testing

Machine Model	Trail's	Crude Oney (kg)	Pure Honey (kg)	Pressing time, (min.)	Efficiency, (%)	Extracting rate (kg/h)	Honey Losses (kg)
Screw Type Honey Presses	*Test-1*	9	6.5	9.6	95.6	40.6	0.30
	Test -2	11	9.3	6.8	97.9	82.0	0.27
	Test -3	12.2	9.7	14.9	97.0	39.0	0.28
	Average	**10.7**	**8.5**	**10.4**	**96.8**	**53.9**	**0.28**
Lever Type Honey Presses	*Test -1*	9	6.7	13	95.7	30.9	0.30
	Testy-2	11	6.2	7.7	80.5	48.3	0.54
	Test -3	12.2	8.9	17.7	95.7	30.2	0.42
	Average	**10.7**	**7.3**	**12.8**	**90.6**	**36.5**	**0.42**

The average extracting time for pressing of 8.5 kg of pure honey, were 10.4minute for screw type and for pressing 7.3 kg of pure honey were 12.8 minute for lever type honey presser. The average out-put and efficiency for screw type honey press was 53.9 kg/h and 96.8% whereas, for the lever, one was 36.5 kg/h and 90.6 % in that order

The screw type of honey press has the capacity of extracting honey a little more than the lever type. However, there was broken wax seen in the pure honey that increase cleaning time and decrease the quantity of the wax. It saves from 0.25 – 0.5kg honey that can be lost by the lever type, this condition make the screw honey press get preferred by farmer and indicates that the screw one shows less losses of honey. As table 1 shows the average amount of honey loses by the lever one is greater by one and half times than that of the screw one. However, even though the lever type honey press was not able to extract fully as the screw one, it does not break wax. . Since all parameters were equal for both presses i.e. volume of honey pressing chamber, strainer hole diameter, weather condition and type and condition of crude honey, the difference in out-put, loses, and efficiency was due to the variation of driving mechanism. The screw driving mechanism has an advantage on constant pressing and holding ability on crude honey. This action makes the honeycomb under steady and continuous pressure and facilitates to be extracted very fast whereas, for the lever one, it is not easy to maintain fully this condition.

Most of participated farmers during testing and demonstrating time gave there view that the screw one is better than the lever one due to its ability of high extracting rate, less power requirement and honey losses. They also assumed that, the lever one also has the advantage over the screw one by its easy for operation and less damage of wax particles. Among farmers, evaluation parameters given above some of them were supported by figures and found acceptable as indicated on the test results. The other thing observed during testing time was that the perforated basket hole were clogged and it was difficult to extract the honey as to be, so that it requires re-inverting of the crude honey and cleaning of holes once or twice during the processing time. Finally, participants gave their opinion that the machines require improvements. Increasing of holding capacity of the pan and volume of perforated basket, minimizing selling cost, and weight of the machines were some of the comments that need to be addressed.

From participants' comments and observation, we realize that the existence of delaying of pressing time due to waiting of honey until reduced the over flow of honey over the bottom pan and less volume of the basket makes the presses to have reduced performance. Therefore, this condition indicates that, the requirements of upgrading both honey pan and perforated basket holding capacity, thereby, increasing the rate of out-put and decreasing time taken through avoiding idling time

Traditionally when honey exposed to high temperature, honey loses in nutritional value and quality. In addition, the smoky fire employed is full of ashes, charcoal, dust and gravel which contaminate the honey. Such honey tastes bitter and smoky (Adjare, 1990**)**. That is why extracting honey using mechanical honey presses is very advantages since it keeps the honey quality (color, odor, purity and test).

On the other hand, the statistical analysis using t-test shows significant difference at 0.05 level of confidence. As shown in Table 2, the honey losses and machine efficiency between the two models have significant difference where as the amount of extracting of pure honey and extracting rate was found statistically not significant. That means the screw honey press has an advantage over the lever one regarding honey losses and efficiency.

Table 2. Independent Samples Test

Observation		t-test for Equality of Means		
		t	Sig. (2-tailed)	Mean Difference
Pure honey	Equal variances assumed	1.038	.315	1.2000
	Equal variances not assumed	1.038	.315	1.2000
honey loss	Equal variances assumed	-2.948	.009	-.1378
	Equal variances not assumed	-2.948	.013	-.1378
Machine efficiency	Equal variances assumed	2.818	.012	2.4444
	Equal variances not assumed	2.818	.016	2.4444
Pressing time	Equal variances assumed	-1.108	.284	-2.3778
	Equal variances not assumed	-1.108	.284	-2.3778
extracting rate	Equal variances assumed	1.885	.078	20.0000
	Equal variances not assumed	1.885	.083	20.0000

Conclusion and Recommendation

Screw and lever model honey press were capable of extracting mixed honey. These presses can be manufactured by small workshops with exception to the strainer and threaded lever, which require special machine. The total cost for manufacturing theses presses will be acceptable by farmers particularly for those who engaged partially or fully on honey processing activities. In addition, farmers are benefited by using these presses in two ways, selling pure honey and wax. Therefore, the return of machine cost will be in short time. Moreover, they have very less maintenance cost; they are simple in construction, and operation...

Even though both honey presses were abele to extract pure honey, farmer comments and technical test result shows that the screw honey press has better performance regarding the honey out put, losses, and efficiency. So that, in the Region, development of apiculture technologies is needed to enhance the income generation potential of small holders. Therefore, the screw type honey press can be recommended for farmers' use.

However, it is also necessary to focus on increasing of out put in order to maximize the performance of the machine by further improving driving mechanism attachments, perforated basket, and pane assembly. For proper exploitation of the machine, it is also necessary to consider the following points while extracting honey.

1. The crude honey should not be highly crushed so that it will not be difficult to separate the mix;
2. The pressing process should be carry out immediately after harvesting;
3. During pressing time, the pressed comb should be re-inverted and the container hole cleaned;

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