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ORIGINAL ARTICLE

# Comparative analysis of profitability of honey production using traditional and box hives

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**Abstract** Information on the profitability and productivity of box hives is important to encourage beekeepers to adopt the technology. However, comparative analysis of profitability and productivity of box and traditional hives is not adequately available. The study was carried out on 182 beekeepers using cross sectional survey and employing a random sampling technique. The data were analyzed using descriptive statistics, analysis of variance (ANOVA), the Cobb-Douglas (CD) production function and partial budgeting. The CD production function revealed that supplementary bee feeds, labor and medication were statistically significant for both box and traditional hives. Generally, labor for bee management, supplementary feeding, and medication led to productivity differences of approximately 42.83%, 7.52%, and 5.34%, respectively, between box and traditional hives. The study indicated that productivity of box hives were 72% higher than traditional hives. The average net incomes of beekeepers using box and traditional hives were 33,699.7 SR/annum and 16,461.4 SR/annum respectively. The incremental net benefit of box hives over traditional hives was nearly double. Our study results clearly showed the importance of adoption of box hives for better productivity of the beekeeping subsector.


## 1. Introduction

Beekeeping has been practiced in Saudi Arabia for many centuries. At present, approximately 5000 household beekeepers engage in beekeeping practices in the country (Al-Ghamdi, 2010). Beekeeping is a viable business that significantly contributes in increasing and diversifying the incomes of many rural households in Saudi Arabia (Al-Ghamdi and Nuru, 2013a; Nuru et al., 2014). Beekeeping provides various benefits, such as income from the sale of bee products, self-employment opportunities, pollination and conservation of

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biodiversity. For instance, honeybee pollination service, have been reported to increase the yields and quality of many important cultivated crops, such as *Citrus sinensis* (by 30%), watermelon (by 100%) and tomatoes (by 25%) (Crane, 1990).

Although there has been a strong effort to promote improved beekeeping technologies through widespread demonstration of the technology, 70% of beekeepers in Saudi Arabia still practice traditional beekeeping methods (Al-Ghamdi, 2010). The low adoption of new technologies could be due to lack of tangible information on the profitability and productivity of beekeeping using different types of hives.

Productivity of beekeeping is a measure of honey yield per colony/beehive. Honey yield per beehive is a major factor affecting the profitability of beekeeping enterprises (Jones, 2004). There are variations in yield within the same locality among honeybee colonies. Queen quality, ecological conditions, floral composition, types of technology and resource management are among the major factors affecting the profitability of beekeeping enterprises (Tucak et al., 2004). Moreover, colony strength, types of hives used, age of the queen, swarming of colonies and honeybee management practices are also major factors influencing the profitability of beekeeping businesses.

Profit in beekeeping is defined as profit per colony, which is calculated by subtracting total apiary product sales from total costs and dividing by the number of colonies (Urbisci, 2011). In addition, profitability is defined as the difference between income earned from the sale of products and the cost incurred during production. In Uganda, regardless of profitability, a 50% higher honey yield was recorded for improved (top-bar) hives than traditional hives (Dathine, 2012), indicating the importance of improved beekeeping technologies in enhancing honey yield.

A study by Workneh (2011) concluded that beekeepers can increase their profit more than double by using box hives instead of traditional hives. Similarly, in his study using partial budgeting analysis, Melaku (2005) also reached a similar conclusion that both homemade and commercially made top-bar hives were beneficial and led to a higher net return per colony compared with traditional hives.

Beekeeping is practiced in the different regions of the Kingdom using different types of hives and honeybee races. However, to date, no adequate comparative study has been conducted on the profitability and productivity of traditional and box hives. Thus, the objective of this study was to analyze and compare the profitability and productivity of traditional and box hives considering annual operational costs and returns.

## 2. Materials and methods

### 2.1. Location of the study area and sampling techniques

The study was carried out in Saudi Arabia taking sample respondents from five regions. The regions were selected based on their potential for beekeeping and availability of information in line with the specific objective of the study. Accordingly, Madinah, Haiel, Taif, Jazan and Al-Baha regions were chosen and 30, 30, 31, 45 and 46 respondents respectively were selected from these regions, through random sampling techniques. Thus, the total sample size of the study was 182 beekeepers. According to Storck et al. (1991), the sample size should depend on the funds and time available as well as other factors but not necessarily on the total population. Both traditional and box hive owners were included in the sample respondents to analyze and compare the productivity and profitability of the two hive types.

### 2.2. Method of data collection

Mixed methods, such as surveys, key informant interviews and observations, were used for data collection to capture all of the relevant information. Besides beekeepers a support data were collected from extension workers and traders. The questionnaire was prepared in line with the specific objective of the study and was pre-tested on a small number of respondents. Using the feedback obtained during the pre-test, the questionnaire was customized in a way that was comprehensible to enumerators and respondents.

Information that was generated from the questionnaire includes: the demographic characteristics and socio-economic profiles of the beekeepers, education level, honeybee colonies holding size, and average honey yield per each type of hive per annum. Moreover, data on the major expenditures for producing honey, quantity of inputs (e.g., labor, feeds, medicine) and the average prices of honey and costs and returns from both hive types were used for analysis and comparison. Trained enumerators were employed to collect the data under close supervision of the researchers.

### 2.3. Data analysis

The data were analyzed using descriptive statistics and analysis of variance (ANOVA). Moreover, the Cobb-Douglas (CD) production function was used to measure the profitability and productivity of beekeeping. Partial budgeting was employed to analyze the profitability of box and traditional hives. Partial budgeting is a technique for assessing the benefits and costs of a practice relative to not using the practice. This method only accounts for those changes in costs and returns that directly result from using different production practices. According to Upton (1987), partial budgeting is useful for evaluating such changes as adopting a new technology, expanding an enterprise, alternative enterprises, different production practices, hiring a custom operation rather than purchasing equipment and making a capital improvement. Partial budgeting is based on the principle that a change in the organization of a farm or ranch business will have one or more of the following effects: eliminating or reducing some costs; eliminating or reducing some returns; causing additional costs to be incurred; and causing additional returns to be gained.

### 2.4. Model specification

The CD production function was used to analyze the difference in beekeeping productivity between using the traditional and box hives. Following Gujarati (1995), the generalized form of the CD production function can be specified as:

$$Y = AX_1^{B1}X_2^{B2}X_3^{B3}\cdots X_n^{Bn}e_1^u$$