Using TICs in the evaluation of prototypes of hives for Apis mellifera adapted to high temperatures in Latin America and Caribbean.

Emanuel CALUVA[1], Ezequiel CECOTTI[2], Juan DUKART[3], Andrés MOLTONI[4], Javier CAPORGNO[5], Cecilia DINI[6] Emilio FIGINI[7],

1 INTA - EEA Concepción del Uruguay -Apicultura de Precisión -. caluva.emanuel@inta.gob.ar
2 Cambio Rural - Ceres
3 Programa Apícola de la Asociación para el Desarrollo Regional de Ceres y Hersilia.
4 INTA - Instituto de Ingeniería Rural - Castelar -Laboratorio de Electrónica
5 INTA – PROAPI - Proyecto EQUIDAD
6 INTA – PROAPI - Proyecto REDLAC
7 EEA-INTA BALCARCE-Buenos Aires-Argentina-PROAPI

APIMONDIA 2015 Daejeon, Korea

Ministerio de Agricultura, Ganadería y Pesca
Presidencia de la Nación

INTA Instituto Nacional de Tecnología Agropecuaria

PRO API

FONTAGRO

INTRODUCTION

One of the consequences of climate change (CC) in Latin America and Caribbean (LAC) is the increase in the occurrence of extreme events. In recent years, extremely high temperatures have caused absconding of colonies and melting of thousands of hives in this region, where Langstroth´s hive, developed for temperate climates in 1852, is mostly used.

In Argentina there are precedents of honeycombs melting in the 1950s, and in the province of La Pampa in 1996. Since 2009 these phenomena have become more frequent. That year, in northern Santa Fe a loss of over 8500 hives was reported, with an economic loss of approximately U$S 620,000. In 2013 losses of hives by melting in Chaco, Buenos Aires and Santiago del Estero were reported.

OBJECTIVES

Evaluation of different designs of hives for Apis mellifera, for better performance in hot climates, by using temperature and humidity sensors.

MATERIALS & METHODS

Seven beehive models were evaluated as an alternative to the standard Langstroth hive in this first stage of the research.

The evaluation was performed in an apiary located 4 km south of Ceres, Santa Fe, Argentina, coordinates 29°54'52.17“ S 61°54'40.81“ W.

The evaluated models were:

1. Ventilated floor, mesh 4 mm.
2. Honey super with anterior and posterior mesh.
3. Langstroth hive (with central reduced entrance of 17 cm x 0,9 cm).
4. Langstroth hive (without entrance reducer).
5. Hardboard (HDF) outer cover and glass wool.
6. Hardboard outer cover and cement-bonded polystyrene beads.
7. Outer cover with lateral vents.
8. Honey super with anterior vent.

Each model was evaluated with and without honeybees inside to observe the contrasts between full and empty beehives (FB and EB).

Temperature sensors were used in the EB, while temperature and relative humidity (RH) sensors were used in the FB.

Also, every two weeks during the experiment, the comfort conditions in the colonies were recorded in the FB. This conditions included amount of brood (open/capped) and status thereof, and the presence of diseases.

The observation period was 3 months, after that the most promising prototypes were chosen for the next stage.

The sensors used were:

- SHT11: for temperature and humidity measurements in the brood chamber.
  - Absolute RH accuracy: +/- 3.5% RH
  - Temp. accuracy: +/- 0.5 °C
- TMP36: for temperature measurement in the honey super.
  - Temp. accuracy: +/- 1 °C

Humidity sensors were put in Benton cages.

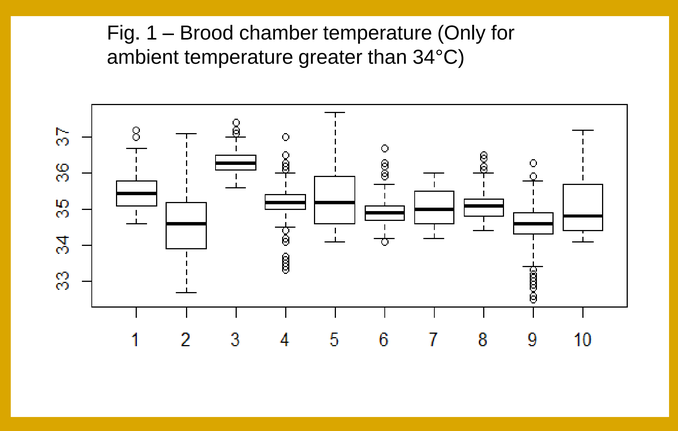

Fig. 1 – Brood chamber temperature (Only for ambient temperature greater than 34°C)

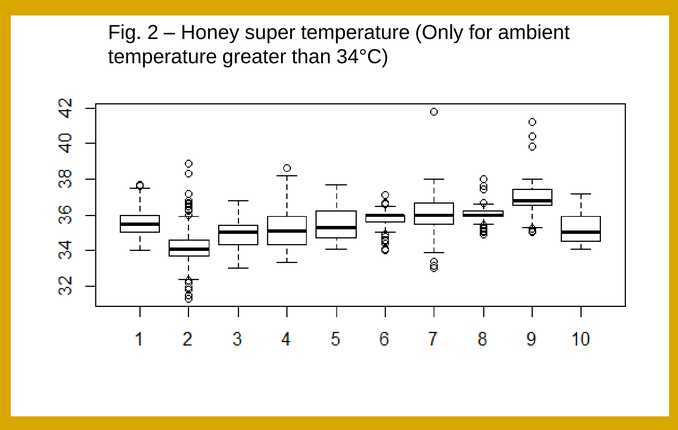

Fig. 2 – Honey super temperature (Only for ambient temperature greater than 34°C)

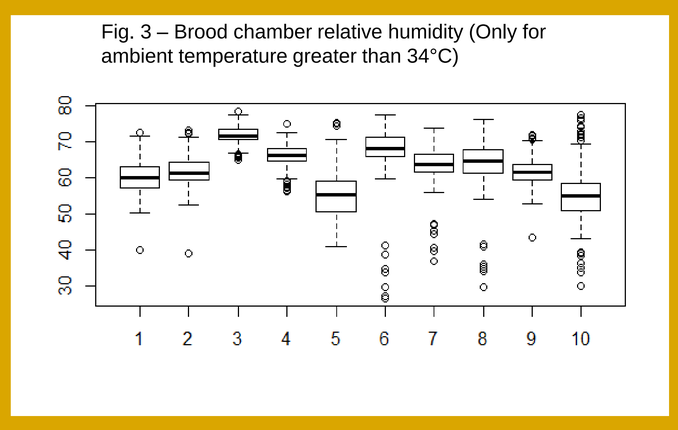

Fig. 3 – Brood chamber relative humidity (Only for ambient temperature greater than 34°C)

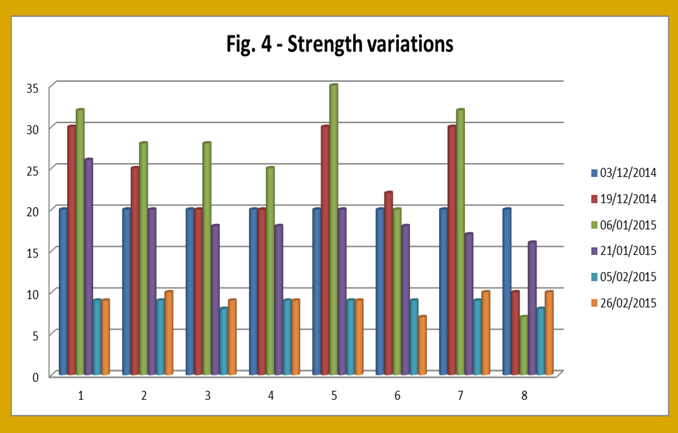

Fig. 4 - Strength variations

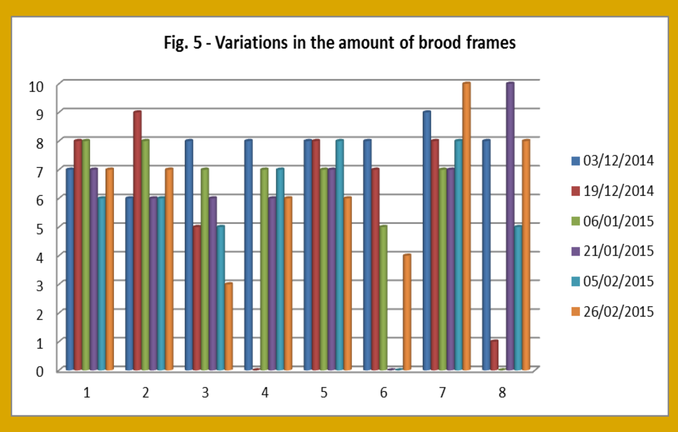

Fig. 5 - Variations in the amount of brood frames

RESULTS

The test was performed with an "exploratory" nature. No repetitions for each prototype were applied.

The purpose of this stage was to reduce the number of prototypes to evaluate in the next stage by performing a ***non-statistical*** inference, and thus be able to make a future statistically and economically viable test.

Fig. 1, Fig. 2 and Fig. 3 show the results obtained in the 7 prototypes and the standard model during the trial from 11 December 2014 to 18 March 2015.

Temperature variations on the EB were analyzed and no significant differences among the prototypes were found, reason of discarding EB in future tests.

It was considered that the “comfort zone” for the colonies was within 34 to 35,5 °C and close to 80% on RH, and was also considered that a low RH (<40 %) and high ambient temperature (>34 °C) increase the risk of honeycomb melting.

The variations of the strength of each colony during the observation period is reported. It is expressed in frames covered by bees, Fig. 4; and brood frames, Fig. 5. Treatment number 8 (Honey super with anterior vent): the colony was replaced for a new one after 28 days since it was queenless.

The data analysis concluded that the best three prototypes, which controls temperature and humidity, are Langstroth hive (with central reduced entrance of 17 cm x 0,9 cm), Langstroth hive (without entrance reducer) and hive with Hardboard outer cover and glass wool.