Journal of Experimental Research

June 2016, Vol 4 No 1
www.er-journal.com
Email: editor-in-cheif@er-journal.com

Received: February 2015
Accepted for Publication: March 2016

Effects Of Season On Weight Gain By Honeybee Hive (*apis Mellifera*)

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Abstract

Five honeybee hives already colonized by honeybee were used in the study aimed at evaluating the effect of seasons of the year on weight gain by honeybee hive.The weight of these hives were reduced (by partial harvesting) to an average initial weight of 2.76kg the night preceding the experiment (30th of April, 2007) for seasons "A". On the night of the last day of October the hives were weighed with the average weight gain for the hives standing at 6.27kg. This represents the initial weight of the hives for season “B”. Season “C” initial average weight was 13.13kg. The average weight of the beehives at the end of the season was 17.26kg. The average daily weight gain for each season was determined by dividing the weight gain for each season by the number of days (the observation lasted for). That is 184 days for season “A”, 92 days for season “B” and 89 days for “C”. The wet and dry bulbs thermometers were used in determining the micro-temperature and relative humidity. The micro-climatic readings were taken three times daily (6am, 12pm and 6pm) during the observation. The number of honeybees leaving and returning to the hives were observed and recorded.The study showed a significant difference ($p<0.05$) in terms of final weight gain and average daily weight gain in favour of “B”. The study also demonstrated that temperature and relative humidity affect honeybee foraging. Honeybee foraging affects weight gain.

Key words: Honeybee hives, season, weight gain, temperature, humidity.

INTRODUCTION

Honeybee (*Apis mellifera*) produces many products such honey, beeswax, royal jelly, propolis, pollen, bee venom and others. However, from global perspective, the greatest value of honeybee lies in their potential to pollinate arable and permanent crops (Williams, 1996;Costanza et al. 1997; klein et al. 2007; Johnson, 2007; Abrol, 2009). However, tropical subspecies of *Apis mellifera* exhibit changes in behavioural pattterns associated with the duration and predictability of forage abundance in their contracting environments (Winston et al. 1981; Needham et al. 1988; UNFCCC, 2007).

Among the environmental factors that may impact the delivery of provisioning services by honeybee is climate change. Climate change directly influences honeybee of behavior given the strong dependency on bee foraging activity's and flight intensity on temperature, solar radiation, wind speed and direction. Indirect effects of climate on honeybee are changes in flowering pattern, pathogens and predator as well as increase in temperature and changes in rainfall pattern (Souza, 1980; Riches and Harry, 2007; Stokstad, 2007; Reddy et al. 2012). Climate change has been associated with observed variation in honeybee abundance and honey yield (Grane, 1990; Le conte and Navajas, 2008; Engelsdorp et al. 2008). The purpose of the research work is to evaluate the impact of climate change in seasonal yield of honey and proffers solution to ameliorate such condition(s).

MATERIALS AND METHODS

The experiment was conducted at Adani village Ukana, in Udi local Government area of Enugu State. Five (5) Kenya top-bar hives were used in this experiment. The Kenya top-bar hive is a long hive normally made of hardwood and designed to take twenty eight (28) top bars, each measuring 48cm long. The ends are vertical but the long sides of the hives slope inwards at an angle of about 60 degrees. The flight entrance was made with a drill (consisting of seven

pencil sized holes) the length of each hive measures 120cm. The beehives were kept on tree top (oil bean).

Seasons of the Year. For this research purpose the year was divided into the Wet season or Rainy season (May to October) Cool dry season (November to January) and the hot dry season (February to April). The seasons were designated as

"A" Rainy/wet season
"B" cool dry season and
"C" Hot dry season

The experiment was conducted from May to April of the following year.

Measurements:

Data was collected on weight gain which was determined on the last day of each season. This was used to determine the average daily weight gain. Weight gain was measured using a bathroom scale. Data were also collected on temperature and relative humidity at 6 am, 12 pm and 6 pm using the wet and dry bulb thermometers; data on flight intensity was collected three times daily at 7 am, 12 pm and 5 pm respectively.

Five honeybee hives, already populated by honeybee were used for the study. The weight of these hives were reduced (by partial harvesting) to an average initial weight of 2.76kg the night preceding the experiment (30th of April, 2007) for seasons "A". On the night of the last day of October the hives were weighed with the average weight gain for the hives standing at 6.27kg. This represents the initial weight of the hives for season “B”. Season “C” initial average weight was 13.13kg. The average weight of the beehives at the end of the season was 17.26kg. The average daily weight for each season was determined by dividing the weight gain for each season by the number of days (the observation lasted for). That is 184 days for season “A”, 92 days for season “B” and 89 days for “C”.

Data generated were subjected to analysis of variance (ANOVA) using (SPSS,2007). Where significant differences were found Duncan 'snewmultiple range tests were used to separate the means (Obi, 1990).

RESULTS AND DISCUSSION

Table I: Effects Of Season On Weight Gain By Honey Bee.

	Seasons of the year		
Parameter	**A**	**B**	**C**
Initial wgt of beehive (kg)	2.76	6.27	13.13
Final wgt of beehives (kg)	6.27	13.13	17.26
Total wgt gain	3.51^{b}	6.86^{a}	4.13^{b}
Avg daily wgt gain (g)	19.08^{c}	74.56^{a}	46.40^{b}

a,b,c Mean with different superscripts are significantly different ($p<0.05$).

Weight Gain

Average final weight gain and average daily weight gain (ADWG) were evaluated for the various season. Season 'A' had an average daily weight gain of 19.0 8g and average final weight gain of 3.51kg. It was also observed that the average final weight gain as well as average daily weight gain for season 'B' was 6.86kg and 74.56g respectively while the average final weight gain and the average daily weight gain of season “C” was 4.13kg and 46.40g. This result showed a significant difference ($P<0.05$) between the treatment groups for the parameters evaluated. This result agrees with the findings of Center for Tropical Agriculture (CTA, 1996) which reported that foraging honeybee avoids the heat of the sun. Researchers have all agreed that season and temperature have a substantial effect on the flight intensity which varied over the months.

Researchers have also observed that bee activity varied significantly during different ch

hours of the day as well different season of the year. This is in relation to maximum temperature and relative humidity which affect weight gain (Junior et al. 2010; Khavrus and shelevytshy, 2010; Reddy et al. 2012; Diana et al. 2012). Research has also linked the number of honey bee existing a hive to be positively influenced by mean air temperature and sunshine; while negative tendency was observed with very high relative humidity and cloudiness (CTA, 1996; Paterson, 2006; Hafton et al. 2013).Climate Change influences flower development and nectar production which are directly linked with foraging actively and colony development (Winston, 1987). The major effect of climate change on honey bee, stems from changes in the production of flowers on which honey bee depend on for food (Thuiller et al. 2005). The cool dry season (season 'B') which made the highest weight gain was not only due to the abundance of pollen and nectar but the prevailing of favourable weather condition (temperature and relative humidity) which encouraged foraging.

Table 2: Interaction effect of weather condition on flight intensity of honey bees

Seasons	Temp (0C)	Relative Humidity (%)	Honeybee leaving per minute	Honeybee returning per minute
Rainy/wet season	21	87.6	62b	49^{b}
Cool dry Season	23.3	58	120^{a}	106^{a}
Hot Dry Season	30	75	83^{ab}	70^{ab}

a,b,ab Means on the same row bearing different superscript differ (P<0.05) significantly

Table 2; showed that the highest flight intensity was observed with season “B” with a mean temperature of 23.3^{0}C and a relative humidity of 58%. The number of honey bee leaving and returning to the hives during this period was 106 and 120 respectively. The number of honeybee leaving and returning to the hives for “B” differed significantly (P<0.05) from “A' and “C” respectively. The (hot dry) season “C” has a mean temperature of 30^{0}C and a relative humidity of 75%. However, the “A” (Rainy/wet season) has a mean temperature of 21^{0}C and a high relative humidity of 87.6%.

Differences in flight activity of honeybee due to weather condition have been reported by various researchers (Souza, 1980; Burrill, 1981;Sihag and Abrol, 1986). It has also been observed that increasing air temperature resulted in an increase in flight intensity of honey bees, while decreasing temperature result in a decreasing number, of flight activities (Winston,1987). However, Sihag and Abrol (1986) showed that relative humidity directly influenced flight activity of honeybee. It has also been observed that climatic factors influence flower development and pollen and nectar production which are directly linked to foraging and weight gain (Winston, 1987; Paterson, 2006). Apiculturists believed that a major effect of climatic change on honey bees stems from changes in the distribution of the flower species on which the bees depend for food (Thuiller et al. 2005). Observations have shown that an excessively dry climate reduces pollen production and impoverishesthe nutritional quality, which would adversely affect bees of that habitat (Thuiller *et al*., 2005; Tripathi, 2011; Nascimento and Nascimento, 2012).

RECOMMENDATION

1. Honeybee farmers are encouraged to provide enough space in their beehives by total or partial harvesting especially in the brood chamber on or before November. This is because honeybees foraging as well as weight gain were high within the period.

2. Honeybee farmers are also encouraged not to engage in total honey harvesting between May and October. This is important in preserving honeybee as weight gain is very low due to poor weather condition

3. Inspection should be intensified between November and January; farmers are encouraged to destroy swarm cells. This will help to avoid swarming and make for a stronger colony.

4 Honeybee hives should be protected with shade materials which can be natural or artificial to conserve and maintain the brood temperature.

CONCLUSION

1. The study most importantly indicates that weight gain is not only dependent on the abundance of nectar and pollen but on the existence of favourable weather condition which encourages honeybee foraging.

2. The study showed that high temperature and relative humidity do not support honeybee foraging. High relative humidity and low temperature also has a negative effect on honeybee foraging and consequently on honey weight gain.

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