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NUTRIENT PROFILE OF HONEY HARVESTED ACROSS TWO DIFFERENT SEASONS AT ISAN-EKITI

Oyeniyi, F. G. and Afolabi, O. L.
[1] Department of Agricultural Technology, Ekiti State Polytechnic, Isan-Ekiti.
Corresponding author: femigabriel382@gmail.com

ABSTRACT
Honey is a nutrient-dense edible product whose composition varies significantly due to a variety of factors such as floral sources, climate and seasonality. This study was carried out at the apiary unit of the Teaching and Research Farm, Ekiti State Polytechnic. Harvesting of honey was done during two different periods in the year viz late dry season (first quarter of the year) and early raining season (second quarter of the year). Weather parameters such as average rainfall, relative humidity, wind speed, solar radiation and relative pressure were obtained during both seasons in addition to the proximate compositions of honey samples. Rainfall in late dry season (March) was 1.53mm compared to 26.64mm in early raining season (May). Solar radiation was 202.28w/m^2 in late dry season and 183.95w/m^2 in early raining season. Proximate composition of honey harvested in late dry season showed that crude protein in late dry season was 2.64% and 0.69% in early raining season. The ether was 0.23% in late dry season 0.19% in early raining season. The result showed significant variation in content of protein and some minerals as well as total volume of honey harvested across both seasons. This study reveals that it may be beneficial to schedule the harvesting of honey to the period when nutrients laden in it may be higher, typically before the raining season This also has implications on welfare of bees as harvesting honey at certain periods of the year would amount to considerable stress on the colony.

Keywords: Honey, Bee, Season, Nutrient, Welfare

Description of Problem

Beekeeping is recognized as a viable agricultural activity in Nigeria, with the country producing honey, beeswax and other products. According to Nigeria's Federal Government official records, the country's honey production is estimated at around 15,000 metric tonnes per year (2). The country is still far from meeting her domestic demand for honey and this has resulted in reliance on imports to meet the demand of 440, 000 metric tonnes (1). A report by the Nigerian Government indicates that the country's production potential is in the neighbourhood of 800, 000 metric tonnes annually, which thus shows that there is a significant opportunity for growth (2). Weather and climate exert a big influence on honey production. Temperature is a key variable as bees prefer a range of temperatures for foraging which in turn increases hive activity. Very high temperatures make bees less active and thus reduces honey supplies while low temperatures decrease foraging and hive activity (3(3). The impact of rainfall on honey production is also notable as sufficient precipitation encourages flowering of plants and yielding of nectar. While minimal rainfall lowers nectar availability and honey production on one hand, heavy rainfall can dilute nectar and make it less available to honeybees on the other (7). Long term drought conditions can also have a negative effect on the floral sources that are essential for the production of nectar. Production of honey is greatly aided by plants with high nectar contents and advantageous flowering patterns (8). Also, honey yields are often higher in regions with a variety and abundance of nectar sources than in those with less floral sources (6). While it is important to ensure proper hive management so as to foster welfare of bees, reduced honey yields and decreased honey quality can result from wrong timing of harvest, over-harvesting or incorrect management (4). Hence, the study was carried out to cover two different seasons in a state in Southern Nigeria so as to establish the better period during which the harvest has better yield and constitutes less stress to the colony.

Materials and Methods

The study was conducted at the apiary unit of the Teaching and Research farm, Ekiti State

Polytechnic, Isan-Ekiti. The location is roughly between latitudes 15° 39′ 15′ and 15° 36′ 19″ N and longitudes 70° 12′ 33″ and 70° 10′ 40″ E at a height of around 544 metres above mean sea level as obtained from the weather station at Ekiti State Polytechnic. It is situated in the rainforest agroecological zone, Southwestern district of Nigeria. Honey was harvested from four out of the six top-bar hives at the apiary in March and May of the same year. Harvesting was done in the morning (8:00-10: 00 a.m.) with the product retained in buckets. A manual hand press was subsequently done in the biology laboratory of the Polytechnic. The product was then gradually emptied into previously unused (new) 33cl bottles. Two samples of each of these (across the various seasons) were then taken to the laboratory for proximate analysis and mineral content determination. Results obtained were subjected to T-test.

Results and Discussion

Tables 1 and 2 respectively show that the average rainfall volume in early raining season (26.64mm) was significantly ($P<0.05$) higher than that in late dry season (1.53mm). Wind direction in the latter (205.77^o) was however significantly ($P<0.05$) higher than the former (187.39^o). Also, solar radiation in the late dry season was significantly ($P<0.05$) higher than the early raining season (183.95^o).

Table 3 shows that the crude protein content of the honey sample harvested in late dry season (2.64%) was significantly ($P<0.05$) higher than that in early raining season (0.69%). In like manner, the Potassium content of honey harvested in late dry season (101.00mg/kg) was significantly higher ($P<0.05$) than that in early raining season (19.35mg/kg). This was the case for other minerals such as Calcium, Magnesium, Manganese, Iron, Zinc, Copper and Phosphorus respectively. The higher proportion of nutrients and mineral elements in the honey sample harvested during the late dry season appears to bear correlation to the relatively low rainfall during this period as adduced by (5). This is most likely due to the high moisture content of the sample during rainy season which is less during the dry season, thus making the material more nutrient-dense. Interaction with beekeepers in Ekiti revealed that swarming of bee colonies occur between March to June with the latter month, being the peak period. This may thus also account for reduced quantity of honey harvested in May (close to the peak of swarming).

Table 1: Average weather condition for late dry season (March 2024)

S/N	Parameter	Value
1	Rainfall (mm)	1.53
2	Relative Humidity	77.05
3	Wind speed(m/s)	7.30
4	Wind direction (^{o})	205.77
5	Solar Radiation (w/m^2)	202.28
6	Relative Pressure (Pa)	949.10

mm – Millimetre, % - Percentage, m/s – Metres per second, ^{o} – Degrees, w/m^2 – Watts per second, Pa – Paschal

Table 2: Average weather condition for early raining season (May 2024)

S/N	Parameter	Value
1	Rainfall (mm)	26.64
2	Relative Humidity	75.95
3	Wind speed(m/s)	14.25
4	Wind direction (^{o})	187.39
5	Solar Radiation (w/m^2)	183.95
6	Relative Pressure (Pa)	949.87

mm – Millimetre, % - Percentage, m/s – Metres per second, ^{o} – Degrees, w/m^2 – Watts per second, Pa – Paschal

Conclusion and Application

The findings reveal that in order to optimize quality of honey and its by products, it may be advisable to schedule harvest towards the late dry season (especially in Southern Nigeria where rainfall begins in April, peaks in July and resumes from September to October). There is however a need to validate this finding in order for the recommendation to be valid since this was carried out in a location in Ekiti (a state located in Southern Nigeria). In addition, harvest of honey across other months in the year should be done so as to compare production and quality characteristics.

Table 3: Proximate composition and Mineral content of Honey samples harvested across the different seasons at Isan-Ekiti

S/No.	Parameters	Late Dry Season	Early Rainy Season
1	Moisture (%)	17.61	19.67
2	Ether extract (%)	0.23	0.19
3	Ash (%)	0.31	0.21
4	Crude Protein (%)	2.64[a]	0.69[b]
5	Crude Fibre (%)	0.10	0.08
6	NFE (%)	79.11	79.16
7	Vitamin C (mg/100g)	18.35	10.57
8	Na (mg/100g)	81.50	64.20
9	K (mg/100g)	101.00[a]	19.35[b]
10	Ca (mg/100g)	222.65[a]	98.75[b]
11	Mg (mg/100g)	20.75[a]	11.10[b]
12	Mn (mg/100g)	0.67[a]	0.32[b]
13	Fe (mg/100g)	5.16[a]	1.45[b]
14	Zn (mg/100g)	0.83[a]	0.41[b]
15	Cu (mg/100g)	0.25[a]	0.11[b]
16	P (mg/100g)	51.67[a]	22.25[b]
17	Pb	ND	ND
18	Total volume	45 Litres	33 Litres

[a,b] : Means along the same row with different superscripts differ significantly (P<0.05), % - Percentage, Na – Sodium, K – Potassium, Ca – Calcium, Mg – Magnesium, Mn – Manganese, Fe – Iron, Zn – Zinc, Cu – Copper, P – Phosphorus, Pb – Lead, ND – Not Detected.

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