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Technical Skill needs of Senior Secondary School Graduates for Employment in Apiculture Industry in Rural Area of Ebonyi State, Nigeria

[1]Idenyi Edwin O.; [2]Nwankwo Clara U; [2]Onwe Bernard I .
[1]Department of Vocational and Technical Education, Alex Ekwueme Federal University Ndufu-Alike Ikwo, Ebonyi State, Nigeria.
[2]Department of Agricultural Education, University of Nigeria, Nsukka
[3]Department of Art and Humanities, Alex Ekwueme Federal University Ndufu-Alike Ikwo, Ebonyi State, Nigeria.
Corresponding Author: otoziedwin@gmail.com

Abstract

The study investigated technical skills needed by Senior Secondary School (SSS) graduates for Employment in Apiculture Industry. Specifically, it determined skills in beehive management, honeybee harvesting, and honey processing. It tested three hypotheses (HOs) at 0.05 level of significance. A descriptive survey research design was adopted. Population included all 64 agricultural extension officers, 127 senior agricultural science teachers and 16 registered beekeepers making a total of 207 respondents for the study. A-48 item questionnaire was used for data collection. Data were analysed using mean, standard deviation and ANOVA level. Findings include: 15 viable beehive management skills needed by SSS graduates. These include, among others, ability to: provide adequate security ($\overline{X}$=2.76). Other findings are 12 honey harvesting skills. These are abilities to determine when there is honey in comb, use smokers in harvesting bee product ($\overline{X}$ =2.78) among others. Other findings are 15 processing skills which include, among others, ability to separate honey from comb ($\overline{X}$ =2.86). There was no significant difference among the mean responses of the three categories of respondents regarding the three HOs tested by the study. It was recommended that the technical skills identified be incorporated into SSS agricultural science curriculum for teaching honeybee production in schools, among other.

Keywords: Apiculture, Skills, Bee, Beehive, Operations, Harvesting, Management, Honey, Processing.

Introduction

In the past, honeybees were collected from wild nests, a practice that was associated with risk, uncertainty and limited in providing the needed quantity and quality of honey for human consumption. Presently, however, various techniques have given rise to apiculture husbandry, whereby bees are grown in hives in the process of beekeeping. Bees are found all over the world from tropic to the cerotic, in rain forest as well as in deserts. The technology used in honeybee production varies with regions and the level of technological knowledge and performance skills possessed by the bee farmers and management of bee colony differs. This depends on the extent of

awareness and involvement of people in the apiculture enterprise, coupled with series of challenges (sattler, theotine, 2026).

Beekeeping in view of Onu & Ohagwu in Idenyi (2014) is the manipulation of a bee colony by man based on the understanding of the science of tapping the economic benefits of the honeybee. Paterson (2009) added that man makes use of his knowledge of bee biology, scientific and bee venon for the benefits of mankind.

Bee farming has been recognized as a viable source of income since it needs little investment to begin and progress successfully. In Ebonyi State bee farming has not well developed despite clusters of forest and numerous bee hovering around that can easily being cultured for honey production. However, there is evidence that instructional materials for training and re-training farmers on the art and skills of keeping bee for honey are available but there is no training programme on ground in the state that could be utilized in updating the knowledge, skills and attitude of the farmers. Therefore, the need arises to investigate the skills in management, harvesting and processing techniques needed for effective apiculture industry in Ebonyi State.

Management is the active process of decision-making in utilization of human and material resources of an enterprise. This can be achieved through active co-ordination of the function of management, planning, organizing and controlling in order to accomplish the aims and objective of the enterprise. Beehive management therefore is the total of all the process and orientation adopted by honey bee-farmers to get their work done through his sub-ordinates.

Honeybee skills in beehive management involves knowledge, abilities and attitudes in all the psycho productive activities that are carried out for the well-being of the bee colonies (Arias-Calluani, *et al*, 2023).Honey harvesting as major task in apiculture industry is the process of removing the comb from the hives into a honey container for onward processing. Harvesting is only carried out when there is honey in the comb and farmers possess the ability to identify this period (Idenyi, 2013). This can be made easier when farmers keep bees, which facilitate monitoring of apiary beekeeping calendar and in manipulating other bee keeping activities. Harvested honey is usually moved directly into process section of apiculture industry. Honeybee processing therefore refers to series of activities involved in separating honey from comb until clean and fresh honey is obtained and packaged in clean dry jar with well sealed lids. This process includes decapping, crushing, breaking up the honeycomb and placing them on a piece of fine white lined material tied over the top of a plastic container to allow the honey drip until the cell is empty (Patersofl, 2006). This product (honey) is the sweet pure material food and juice found in cells of the honeybee comb. It is at its best when taken straight from the hive and processed promptly. This equally can only be achieved if bees are reared in hive for honey and other products; Nwankwo (2013) identified separating honey from comb, straining, filtering, use of honey hydrometer, packaging, crushing and re-liquidification as aspect of processing.

The process of getting honey and its subsequent processing and packaging is a essential component of apiculture

industry. This process is strenuous, life threatening and full of uncertainties because of the farmers' incompetence in various aspect of the enterprise. This situation resulted *to* low productivity and makes it difficult for the famers and hunters to meet up with the high demand of honey and other bee product via Royal Jelly, bee venon, bee wax etc).This process of obtaining honey bee is strenuous, life threatening and full of uncertainties, thereby making supply of the products far below demand, hence raising the price of honey above the reach of common members of the society, It is therefore, unfortunate that there is no training programme on ground in Ebonyi that could be utilized in updating the knowledge, skills and attitude of bee farmers on beehive management, honey harvesting and processing competencies.

It thus, appears that the operating beekeepers in Ebonyi State are technically incompetent in beehive management, honey harvesting and process technology for achieving quality honey for meeting local and international demand. Therefore, the need to investigate the skills needed for employing graduates of senior secondary school into Apiculture industry in Ebonyi State.

Purpose of the study

The general purpose of this study was to evolve technical skills needed by Senior Secondary School (SSS) graduates for gainful self-employment in apiculture industry in Ebonyi State. Specifically, the study determined skills required by SSS graduates in:

1.beehive management
2.honey harvesting operations
3.honey process operations,

Hypotheses (HOs)

There was no significant difference in mean responses of extension officers, senior agricultural science teachers and certified bee farmers on skills needed by SSS graduates for:

Ho_1: beehive management
Ho_2: honey harvesting operations
Ho_3: honey processing operations

Methodology

***Design for the study*:** The study adopted a survey research design.

***Population of the study*:** Population of the study was made up of a total of 207 respondents comprises of 127 senior agricultural science teachers., 64 Agricultural extension officers and 16 registered bee farmers, based on information available from: {Secondary Education Board (SEB) 2024), Agricultural Development Programme (EBADP) and Directorate of Livestock/Fisheries (2024) respectively}. These three groups were considered appropriate sources of information on the specific purposes of the study because of their trainings, skills and experience. Due to the manageable size of the population all the 207 respondents were involved in the study.

***Instrument for Data Collection*:** A-48 item questionnaire was used for data collection. The questionnaire was developed based on field observation, review of related literature and the purposes of the study. The questionnaire was structured on four-point responses of 1,2,3,4 respectively. It was validated by three university experts in agricultural. The instrument was reviewed based on the corrections and suggestions made which reduced the number of the items from 52 in the draft copy to 48 before the

final copy was produced and used for the study.

Twenty (20) copies of the instrument were pilot-tested on 20 pilot respondents (10 Agricultural science teachers, 6 extension staff and 4 bee farmers) in Enugu State to establish the reliability of the instrument. Data generated were analyzed using Cronbach Alpha method. The computation yielded a reliability coefficient of 0.87.

***Data Collection Techniques*:** A total of 207 copies of the questionnaire were distributed to the respondents by hand with assistance of two trained research assistants. The questionnaire served as interview guide for illiterate bee farmers. Entire 48 copies administered were completed and returned on the spot and 100 percent return rate was achieved.

***Data Analysis Techniques*:** Data were analyzed using mean ($\bar{X}$), standard deviation (SD) and ANOVA at 0.05 level of significance. Mean 2.50 and above ($\bar{X} \geq 2.50$) was regarded as "agreed" for the items. Any item with mean less than 2.50 was indicated "disagree". The null hypotheses was rejected if the calculated f-ratio was greater than the f-table value and hence was significant, otherwise it was accepted.

Results

Table 1: Mean response of Farmers, Teachers and Extension Officers on Beehive Management Skills Need by Senior Secondary School Graduates

S/N	Beehive Management Skills	$\bar{X}_1$	SD_1	$\bar{X}_2$	SD_2	$\bar{X}_3$	SD_3	$\bar{X}_g$	D
	Ability to:								
1	provide adequate security	2.65	0.63	2.76	0.12	2.81	0.81	2.74	N
2	maintain healthy environment	2.70	0.41	2.91	0.02	2.53	0.83	2.71	N
3	set up beehive appropriately	2.90	0.58	2.55	0.18	0.71	0.90	2.72	N
4	feed the bees at early stages	2.72	0.67	2.83	0.06	2.80	0.91	2.78	N
5	protect the bee from sunlight	3.20	0.29	2.67	0.10	2.93	0.84	2.93	N
6	prevent overcrowding in the hive	2.81	0.47	2.75	0.18	2.84	0.78	2.80	N
7	identify bee diseases for treatment	2.68	0.73	2.72	0.48	2.68	0.69	2.69	N
8	keep appropriate bee farming records	2.55	0.80	2.90	0.20	3.02	0.72	2.82	N
9	prevent predators	2.80	0.78	2.56	0.51	2.70	0.67	2.69	N
10	avoid destruction of the hive colony during and after harvesting honey	2.93	0.66	2.74	0.16	2.90	0.74	2.86	N
11	impact bee colony following the guide procedure	2.61	0.61	2.59	0.21	2.65	0.79	2.62	Ns
12	operate beehive gently during routine work	2.75	0.70	2.86	0.35	2.70	0.66	2.77	N
13	control robbing	3.01	0.56	2.55	0.43	2.87	0.59	2.81	N
14	prevent honey loss and swarming	2.78	0.74	2.59	0.60	2.68	0.68	2.68	N
15	keep good apiary beekeeping calendar for routine management	2.69	0.88	2.71	0.33	2.73	0.71	2.72	N

N_1 = 16(Farmer) N_2 = 127 (Teachers), N_3 = 64 (extension officers) N = needed $\bar{X}_1$ = mean of the farmers, $\bar{X}_2$ = mean of the Teachers, $\bar{X}_3$ = mean of the extension officers $\bar{X}_g$ = Grand mean D = Decision.

Table1 1 shows mean and standard deviation responses of bee farmers, agricultural science teachers and extension officers on beehive management

skills needed by Senior Secondary school graduates have grand mean ($\bar{X}_g$) range between 2.62 and 2.93 for the 15 skill items. These mean ranges were all above the criterion of 2.50 for accepting an item needed. Hence, all the 15items investigated statements were all viable beehive management skills needed by Senior Secondary School graduates for employment in apiculture industry. The closeness of the standard deviation as shown by the grand standard deviation indicated homogeneity in their responses.

Table 2: Mean response of Farmers, Teachers and Extension Officers on Honey Harvesting Skills needed by Senior Secondary School graduates

S/N	Honey Harvesting Skills	$\bar{X}_1$	SD_1	$\bar{X}_2$	SD_2	$\bar{X}_3$	SD_3	$\bar{X}_g$	D
	Ability to:								
1	determine when there is honey in comb	2.75	0.70	2.76	0.60	3.14	0.72	2.88	N
2	use smoker in harvesting bee products	2.65	0.66	2.54	0.87	3.02	0.63	2.74	N
3	use protective materials like glove suit while harvesting	2.60	0.63	2.90	0.93	2.93	0.40	2.81	N
4	remove the frames from the beehive before harvesting	2.98	0.61	2.67	0.84	2.78	0.46	2.81	N
5	avoid killing of bee during harvesting	2.71	0.70	2.54	0.69	2.60	0.78	2.62	N
6	retain the bee in hive after harvesting	2.59	0.69	3.01	0.98	2.75	0.75	2.78	N
7	open the hive gently	2.68	0.72	2.86	0.73	2.87	0.83	2.80	N
8	handle comb to avoid honey waste	2.97	0.64	2.87	0.81	2.80	0.66	2.88	N
9	avoid destroying the bee colony during harvest	2.85	0.78	2.80	0.92	2.70	0.91	2.78	N
10	identify mature comb	2.95	0.59	2.74	0.71	2.79	0.83	2.83	N
11	approach the hive without fear	2.79	0.88	2.68	0.79	2.65	0.59	2.71	N
12	determine from bee calendar best period to harvest	2.84	0.79	2.73	0.04	2.74	0.48	2.77	N

N_1 = 16(Farmer) N_2 = 127 (Teachers), N_3 = 64 (extension officers) N = needed $\bar{X}_1$ = mean of the farmers, $\bar{X}_2$ = mean of the Teachers, $\bar{X}_3$ = mean of the extension officers $\bar{X}_g$ = Grand mean D = Decision.

Table 2 shows mean and standard responses of bee farmers, agricultural science teachers and extension officers regarding honeybee harvesting skills with good mean ($\bar{X}_g$) ranging from 2.61-2.88 which were all above benchmark for accepting an item as needed. This means that the 12 skill items were all accepted as being needed by Senior Secondary School graduates for employment in apiculture industry in Ebonyi State. Then closeness of the standard deviation (SD) indicates uniformity in their responses.

Table 3: Mean responses of the Famers, Teachers and Extension Officers on the Honey processing Skills needed by Senior Secondary School graduates

S/N	Honey Processing Skills	$\bar{X}_1$	SD_1	$\bar{X}_2$	SD_2	$\bar{X}_3$	SD_3	$\bar{X}_g$	D
	Ability to:								
1	separate honey from the comb	3.10	0.72	3.13	0.75	2.76	0.97	3.00	N
2	strain honey	3.05	0.70	2.94	0.86	2.90	0.68	2.96	N
3	filter the honey to remove impurities	2.85	0.85	3.02	0.80	2.93	0.91	2.93	N

Table 3 Continues

4	use honey hydrometer for honey processing	2.78	0.77	3.12	0.89	2.75	0.83	2.88	N
5	maintain maximum water content of 17.4%	3.01	0.64	2.78	0.79	2.90	0.74	2.90	N
6	pack honey in jar	2.69	0.84	2.85	0.92	2.73	0.98	2.76	N
7	crush honeycomb	2.64	0.93	2.86	0.85	2.85	0.16	2.74	N
8	place crushed combs on the mosquito mesh	2.71	0.86	2.77	0.81	2.75	0.65	2.74	N
9	reliquefy the honey by warming honey gently over a heat source	2.83	0.87	2.69	0.86	2.73	0.59	2.75	N
10	label honey jar/container properly for identification	2.90	0.67	2.83	0.94	2.91	0.96	2.88	N
11	utilize modern processing equipment	2.75	0.96	2.91	0.91	2.82	0.85	2.83	N
12	keep honey in bee proof room/condition to stop robber bee stealing it	2.95	0.73	2.68	0.83	3.01	0.46	2.88	N
13	pass hot rod or knife over comb	3.09	0.75	2.79	0.98	2.68	0.58	2.82	N
14	ability to blow hot air from a fan heater around crystallized honey	2.64	0.81	2.84	0.75	2.93	0.70	2.80	N
15	fit small bottling tank tap at the bottom	2.83	0.78	3.07	0.68	2.87	0.86	2.92	N

N_1 = 16(Farmer) N_2 = 127 (Teachers), N_3 = 64 (extension officers) N = needed $\bar{X}_1$ = mean of the farmers, $\bar{X}_2$ = mean of the Teachers, $\bar{X}_3$ = mean of the extension officers $\bar{X}_g$ = Grand mean D = Decision.

Table 3 shows mean and standard deviation responses bee farmers, agricultural science teachers and extension officers regarding honeybee processing skills needed by Senior Secondary School graduates. These grand mean ($\bar{X}_g$) ranged between 2.74 and 3.00 which were all above the cut-off point of 2.50 for accepting an item. Therefore, the 15 skill items investigated were all viable processing skills for achieving quality honey for international market standard, hence, the 15 honey processing skills examined were all needed by Senior Secondary School graduates for employment in apiculture industry for sustainable quality honey processing in Ebonyi State.

Table 4: ANOVA Results on mean responses of Bee Farmers, Agric Science Teacher and Extension Officers on Beehive Management Skills

Source variation	Df	Sum squares (SS)	Mean square	Fical	f-critical	Sig	Dec
Between group	2	00026	.0013				
Within group	204	414	2.029	.00064	3.00	Ns	Do not reject
Total	206	414.00026					

DF = degree of freedom, F-cal = ratio calculated .F-critical = Table value. NS=not significant

Table 4 shows summary of the computation of mean responses of the three groups of respondents using one way analysis of variance (ANOVA) and the result showed that the F-cal of .0064 is less than the critical value of 3.00 with 2 and 204 degree of freedom at 0.05 level significance. Therefore, there is a good reason not to reject the null hypothesis, because the result is not significant. This follows that there is no significant difference between the opinions of the three categories of the respondents with respect to beehive management.

Table 5: ANOVA Results on Mean Responses of Farmers, Senior Agric Science Teachers *Extension Officers on Honey Harvesting Skills*

Source variation	Df	Sum squares (SS)	Mean square	Fical	f-critical	Significant	Dec
Between group	2	.0013	0.00065				
Within group	204	414	2.029	0.00032	3.00	NS	Do not reject
Total	206	414.0013					

DF = degree of freedom, F-cal = ratio calculated. F-critical = Table value. NS=not significant

Table 5 shows the summary of ANOVA on the mean rating of the opinions of bee farmers, agricultural science teachers and extension officers regarding honey harvesting skills. The result revealed that the computed F-ratio is 0.00032 and F-critical (F-table) is 3.00 indicating that F-calculated value is less than the critical value. Therefore, the null hypothesis is not rejected because the value is not significant (NS). This implies that there was no significant difference in the mean ratings of the opinions of the three categories of the respondents regarding honeybee harvesting skills for effective and efficient honey harvesting task.

Table 6: ANOVA Results on Mean Responses of Bee Farmers, Senior Agric Science Teachers on Honey Processing Skills.

Source variation	Df	Sum squares (SS)	Mean square	Fical	f-critical	Significant	Dec
Between group	2	.0013	0.00065				
Within group	204	414	2.029	0.00032	3.00	NS	Do not reject
Total	206	414.0013					

DF = degree of freedom, F-cal = ratio calculated F-critical = Table value. NS=not significant

Table 6 shows the summary of one-way analysis of variance (ANOVA) of the mean ratings of bee farmers, agricultural science teachers and extension officers on honey processing skills. It would be observed from table 6 that calculated F-ratio is 0.0035 and critical value (Table value) is 3.00. The result showed that F-cal (0.0035) is less than the critical value of F (3.00). Therefore, null hypothesis was not rejected since the calculation is not significant (NS). This implies that there was no significant difference among the opinions of the respondents regarding honey processing skills.

Discussion of findings

The study identified 15 beehive (colony) management competencies relevant in the management of bee colony for optimal honey production. This finding is conformity with the findings of Ayansola (2012) on skills required by secondary school leavers for entry into beekeeping occupation and Idenyi (2015) in beehive management competencies needed by beekeeper for sustainable entrepreneurship in apiculture in Ebonyi State. The authors identified similar competencies in beehive management. These abilities investigated are necessary factors for empowering bee farmers for

increased effectiveness and efficiency in the industry. In the same vein, Atanas and zlatk (2025) reported that poor management of bee colony leads to colony collapse disorder (CCD). They further noted that the loss of even a position of bee population can severely disrupt food production, a risk that grows as the human population rapidly increases. Obitan et al in Ekele et al (2019) reported that for efficiency in bee management, there is need to identify swarming season in the area to be able to control it, clean dirt from beehive for effective production. These inadequacies in technical skills possession of the operators gives rise to high incidence of bee mortality which are frequently increasing. Protecting, bee population in this context requires harnessing technological progress, optimizing crop selection, breeding resilient bee strains, and implementing environmentally sustainable practices. Also Kviesis, Komasilous. Ozols and Zacepins (2023) reported that the ability to control parasites and diseases remains a cornerstone of modern apiculture, The author further explains that strategies such as temporarily caging queen bees, RNA interference, (RNAI) treatment targeting varroa mite and hive microblome manipulation exemplify emerging approach that enhance colony health while minimizing chemical exposure.

In similar development,, the study identified 12 technical skills found to be relevant for improved employee performance in honeybee harvesting operations in apiculture industry. This finding is in line with findings of Cock et al (2024) who maintained that harvesting bee products involves wearing bee veil, light smoker, puffing smoke around beehive entrance among other. This is also in line with the findings, of Okenne et al (2020) who reported that assembling equipment for harvesting bee products by bee keepers and extension agent improves efficiency in the industry. This implies that beekeepers knowledge in handing honey harvesting is imperative for honey quality assurance in achieving international market standard. Paterson (2026) pointed out that bee farmers who possess beekeeping competencies at low level still need improvement to optimize their efficiency in the enterprise. Therefore employee in the industry need to acquire the basic skills as identified in this study through appropriate extension education approaches. Onu and Ohagwu (2010) maintained that bee farmers need to possess adequate knowledge of the best time to work with the bee as well as mastering an apiary calendar to enable them follow up all the activities of the bee throughout the year. In similar development Ekele et al. (2019) identified the following: abilities to remove honey from comb, stimulate bees queen from hive, remove royal jelly suction, push the unripe combs behind the last brood, assemble harvesting equipment in readiness for harvesting among others. This is similar to the findings of the present study regarding harvesting skills.

This study found that 15 work-skills in honey processing operations studied were viable skills to be possessed by senior secondary school graduates for employment in apiculture industry in Ebonyi State. This finding is in consonance with the findings of Idenyi and Owo (2015) who revealed that adequate competency on techniques of honey processing is ideal in achieving international market standard in

marketing honeybee products. Hence, prospective employees of labour in apiculture industry need to possess the prerequisite abilities for optimal honey quality production. Furthermore, et al. (2019) examined competencies required for processing bee products to include, ability to tie the straining cloth on a container, assembling processing equipment in readiness for processing, cut honey combs into small pieces, strain the honey from the comb till last drop, package the honey in container, store pollen in dry cool place in sealed containers among others as vocational skill needs for honey processing in readiness for employment in apiculture industry. Gueshi et al (2025) maintained that in processing bee products, the keepers required straining cloth, clean bucket or container, then tie the cloth on the bucket and cut the honeycombs into pieces and place on the cloth, hence the need to possess this ability. Atanas and Zltko (2025) further stressed that honey processing work skills are key determinants of honey quality in achieving international market standard.

Conclusion

Based on the findings of this study, it was concluded that the bee farmers, agricultural science and extension officers in Ebonyi State agreed that 42 skills identified in beehive management, honeybee harvesting and honey processing were viable enough in capacity building of senior secondary school graduates for employment in apiculture industry, hence these skills are needed by senior secondary school graduates. This implies that senior secondary school graduate who desires to be employed in honey bee production industry must be made to acquire these skills identified which were found to be relevant in operating apiculture industry.

Recommendations

Based on the findings of this study the following were proffered;

1. Agricultural science teachers should plan their lesson to reflect the identified skills in the three competency areas studied.
2. The services of extension workers should be extensively utilized in re-training programme for practicing bee farmers.

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