



P-ISSN: 2788-9890 E-ISSN: 2788-9904

NTU Journal of Agricultural and Veterinary Sciences

Available online at: <https://journals.ntu.edu.iq/index.php/NTU-JAVS/index>



The Effect of Feeding on Rapeseed and Bee Bread Plants on the Biological Activity and Productivity of Honey Bee Colonies *Apis Mellifera*

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Article Informations

Received: 25-07- 2023,
Accepted: 15-08-2023,
Published online: 18-10-2023

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Key Words:

rapeseed, bee bread, borage, nutrition, *Apis mellifera*

ABSTRACT

A field study was conducted during the agricultural season 2022-2023 in three locations. The first is the apiary of the College of Agriculture and Forestry, in which the bee sects were feeding and resting on the natural wild plants and bushes present in the apiary and the surrounding areas. The second location was in one of the agricultural fields in the Rashidieh area in which it was planted. Seeds of the bee bread plant- viz. *Borago officinalis*- were a rate of one dunam. The third site was in one of the agricultural fields of the Al-Mazra'i neighborhood of Nineveh Governorate in which rapesee- viz. *Brassica napus*- was planted at a rate of one dunam as well.

The results of the present study showed that the treatment of bee bread (the second site) on 1/10 was superior in recording the highest bee density, worker brood, pollen grain area and mature honey area which was positively reflected in the amount of honey produced with averages of 17.66 bees, 785.66 inches², 302.17 inches², and 803 inches² and 9.08 kg / colony, respectively. The treatment of rapeseed plants (the third site) recorded satisfactory and good results in which it outperformed the comparison treatment with averages of 14.42 bees, 596.66 inches², 257.66 inches², 760.33 inches², and 7. 63 kg / colony, respectively, while this percentage decreased in the comparison treatment (first site) on 11/11, which recorded the lowest averages of 5.17 bees, 341.33 inches², 40.66 inches², 118.33 inches², and 2.54 kg. The results respectively confirmed the necessity of cultivating bee bread and rapeseed plants to provide beds and a good pasture of nectar and pollen through which bee colonies can cross the winter stage and obtain high bee density and good storage of honey and pollen.



Introduction

The honey bee, *Apis mellifera* L., is considered one of the important insects that most of the world cared about especially during the last period of the twentieth century, as the countries of the world tended to breed and care for them and increase their various products, due to their great importance in various agricultural, industrial, therapeutic, cosmetic, economic and educational fields (Al-Ali, 2011). Like all other animals, honeybees require essential ingredients for survival and reproduction. So, bees need carbohydrates (sugars in nectar or honey), amino acids (protein from pollen), lipids (fatty acids and sterols), vitamins and minerals (salts) and water. Nutrients are present in the right proportions for honey bees for survival and growth (Huang, 2018). Feeding honey bee colonies on natural plant sources rich in nectar and pollen, such as rapeseed, bee bread or any other plant source during periods of pollen and nectar deficiency greatly limits their destruction, especially during the fall and winter seasons. The quantities of pollen and nectar stored are related to the strength of the colony and the ability of the queen to lay eggs. When the colony has more food stocks, it quickly reaches its maximum strength before the start of the honey overflow season, while the colonies that suffer from food shortages do not reach their strength except after or during the honeymoon season (copyright, 2019). In view of the lack of studies on the use of rapeseed and bee bread as natural feeding, and its cultivation and provision to bee colonies during the period of nectar and pollen scarcity, this study was proposed which deals with the effect of feeding on rapeseed and bee bread on the vital activity and productivity of honey bee colonies *Apis mellifera* and tries to test their effect as follows:

- 1- The activity of honey bee colonies (measurement of bee density, brood area, pollen area, stored and mature honey).
- 2- Its effect on cell weight and productivity.

Materials & Methods :

A field experiment was carried out during the agricultural season 2022-2023 in the so mention three sites belonging to the Agriculture and Forestry Company, in which the bee swarms fed and swarmed on the natural wild plants and bushes present in the apiary and the surrounding areas (treatment), while the second site was in the agricultural fields in the Rashidieh region And the third site was in the agricultural fields in Al-Mazra' neighborhood in Nineveh Governorate. The second site planted the seeds of bee plants, and the third site planted rapeseed plants and seeds in a form of

lines and in a form of holes with a disc of 1 cm, and between one socket and another 50 cm. Bush cleaning and fertilization, Shaker (2011: 7). To be sufficient, planting season, summer season, season 11, 9 cells per site (3 cells per replicator) taking into account the equal mass of the appropriate bee were conducted all bee colonies. The bee colonies were periodically checked and search records were made in the required traits:

Measuring the Effect of Plant Type on the Vital Activity of Bee Colonies

In order to determine the relationship between the type of plant that the bees feed on for the three sites and its effect on the vital activity of the bee colonies, readings were taken every 14 days to relate to the life cycle of each of the workers and to standardize the readings and reduce the opening of the cells, which negatively affects the bee colonies according to the method of Al-Sayegh (2000). The following characteristics were adopted in the measurement

- 1- Bee density / bee frame: it was calculated on the basis of the number of frames occupied by bees on both sides, with the exclusion of the few bees outside the frames and on the sides and base of the hive, according to Al-Sayegh (2000).
- 2- Measuring the area of the enclosed workers' lap (2 inches)
- 3- Pollen area measurement (2 inches)
- 4- Measuring the area of ripe honey (2 inches)
- 5- Measuring the cultivar productivity / kg

Honey was measured in two stages according to the method of Al-Sayegh (1988), where honey was estimated in the first stage by calculating the excess area in honey production in square inches every 14 days and for all cells and sites. The tires extracted for the purpose of sorting were numbered for each replicate of each treatment after which tires were weighed while they were filled with honey, and then weighed after sorting them by manual sorting while they were empty returning the sorted tires to their cells after sorting. In order to facilitate the process of measuring the previous characteristics in inches 2, one of the tires of the Lancasteroth cell was modified where the tire was divided into 17 inches long and 8 inches wide. From the inside, and for the purpose of measurement, a wire frame was placed over the frames of the characteristics under study, and then the number of square inches occupied by it was calculated (Al-Sayegh, 1988).

Statistical Analysis:

The experiments were designed according to the randomized complete block design of the factorial trials, and the results were analyzed according to the analysis of variance table using the electronic computer according to the SAS program. (Al-Zubaidy and Al-Falahy, 2016)

Results and Discussion :

The Effect of Feeding *Borago Officinalis* and *Brassica Napus* in the Bee Density of Bee Colonies.

The results of Table (1) showed that the bee density varied among the treatments. This might be caused by a shortage in the food stock of the bees, where the bee bread plant on which the bee colonies fed excelled by recording the highest bee density in the two readings dated 10/1 and 10/14, with an average of 17.66 and 15.42. frame, respectively, followed by the treatment of rapeseed plant in which bee colonies fed at the same date of taking the readings with an average of 14.42 and 13.00 / bee, respectively. of the bee density at the last reading dated 11/11 in the comparison treatment with an average of 5.17 / frame. The results showed that bees might be exposed to destruction in the comparison treatment due to the sharp decrease in bee density compared with the treatment of bee bread and rapeseed, which maintained their good density and can withstand harsh conditions, i.e. the harsh winters. The results can be explained by the lack of pollen and nectar imports in the comparison treatment, unlike the bee bread treatment which was characterized by abundance of nectar and pollen, which was positively reflected on the bee density. This is consistent with what Al-Hamdani (2014) and Al-Sayegh (2000) found that the lowest average bee density reached by sects in Nineveh Governorate during the autumn season was 3.7 frames in the comparison treatment.

Table (1): The effect of feeding bee bread and colza plants on bee density

The date of taking the readings	The effect of overlap between coefficients and readings			The overall average of the readings
	The second site (bee bread plant)	The third site (colza plant)	The first site (control)	
1/10	17.66 a	14.42 c	7.00 f	13.02 a
14/10	15.42 b	13.00 d	6.83 d - f	11.75 b
28/10	13.33 C d	11.17 e	6.00 e f	10.16 c
11/11	10.33 b - d	10.00 d e	5.17 j	8.5 d
The overall average of transactions	14.185 a	12.147 b	6.25 c	

Numbers with similar letters are not significantly different according to Dunkin's multiple range test at the probability level of 0.05%.

2- Effect of feeding *Borago officinalis* and *Brassica napus* on brood area / ² inch

The results of Table (2) showed a close homogeneity in the brood area reared in the bee colonies tested and according to the bee density and treatment, as the highest average was 785.66 and 742.66 inches ² respectively in the treatment of bee bread on 10/1 and 10/14, while it reached 596 66.66 and 525.66 inches ² respectively in the treatment of colzam at the same date as the readings. These areas were associated with available pollen grain areas and the prevailing environmental conditions. For different treatments, the reason for this decrease might be due to the lack of pollen grains in the comparison treatment, which negatively affected the brood area.

Table (2): Effect of feeding bee bread and colza plants on brood area / inch²

The date of taking the readings	The effect of overlap between coefficients and readings			The overall average of the readings
	The second site (bee bread plant)	The third site (colza plant)	The first site (control)	
1/10	785,66 a	596,66 c	496,66 d	626,326 a
14/10	742,66 bc	525,66 b - d	469,67 d	579,33 b
28/10	770,00 b	496,66 d	444,66 cd	570,44 c
11/11	567,33 d	444,66 cd	341,33 e.	451,106 d
The overall average of transactions	716,412 a	515,91 b	438,08 c	

Numbers with similar letters are not significantly different according to Dunkin's multiple range test at the probability level of 0.05%.

3- Effect of Feeding *Borago Officinalis* and *Brassica Napus* on Pollen Grain Area / Inch²

The results of Table (3) indicated that some treatments had a slight significant difference in the area of pollen grains, as the two treatments of bee bread and colza recorded the highest average pollen area of 302.17 and 257.66 inches² respectively when reading on 1/10. It was also noted that the recorded areas fluctuated from the pollen grains stored inside the hexagonal springs depended on the progress of the season and took the readings which were related to the area of the brood of the

reared workers and the bee density. The plant sources available and the reason might be due to the lack number of eggs laid by the queens. So, the incubation area decreased, and thus the demand for pollen grains decreased, and the above results were consistent with (Mustafa, 2011) in terms of bee density and incubation of the workers, as the fall season was considered poor in terms of the availability of grains pollen, which affects brood rearing. The researcher added that the highest average recorded in Erbil governorate was 74.3 inches² as indicated by (Abdullah et al., 2017) that the borage plant is considered one of the plants rich in nectar and pollen and is used in nutrition and for therapeutic purposes as well.

Table (3): Effect of feeding bee bread and colza plants on pollen grain area / inch²

The date of taking the readings	The effect of overlap between coefficients and readings			The overall average of the readings
	The second site (bee bread plant)	The third site (colza plant)	The first site (control)	
1/10	302,17 a	257,66 b	46,67 f	202,166 a
14/10	196,13 c	174,33 bc	46,66 f	139,04 b
28/10	147,17 d	136,83 c – e	45,66 d – f	109,886 c
11/11	138,83 cd	121,33 e.	40,66 j	100,273 d
The overall average of transactions	196,75 a	172,537 b	44,912 c	

Numbers with similar letters are not significantly different according to Dunkin's multiple range test at the probability level of 0.05%.

4- Effect of Feeding *Borago officinalis* and *Brassica Napus* Bee Bread Plants on the Area of Ripe Honey / Inch²

The results of Table (4) show that the fall season was characterized by a clear lack of plant sources that can provide the bees with the nectar needed for daily consumption especially in the comparison treatment, which recorded the lowest average of 118.33 inches² on 11/11, where it is noted that the food stock of honey began to gradually decrease. This was due to the continuous consumption in all cults and to the varying degrees according to the area of the brood raised in the different treatments and to the lack of nectar which is often used for direct consumption in feeding. The bee bread treatment was distinguished by recording a large

area of honey that amounted to 3 times its area in the comparison treatment with an average of 803,33 inches² dated 1/10, while in the treatment of rapeseed plants at the same reading amounted to 760.33 inches² i.e. more than doubling its area in the comparison treatment at the same reading. This confirmed the role and importance of these plants in providing nectar, pollen and good pasture for bees during the lack of plant sources especially in the fall and winter season. These treatments continued to record good and satisfactory honey areas by constantly taking the readings compared with the comparison treatment that recorded the lowest averages. This is consistent with what Al-Muhairi (2012) mentioned that the lowest average honey area in the Hawija region was 199 inches² which was recorded on 11/6/ 2010.

Table (4): The effect of feeding bee bread and rapeseed plants on the area of ripe honey / inch²

The date of taking the readings	The effect of overlap between coefficients and readings			The overall average of the readings
	The second site (bee bread plant)	The third site (colza plant)	The first site (control)	
1/10	803,33 a	760,33 bc	286,00 b – d	616,553 a
14/10	785,66 b	679,83 c	234,33 e	566,606 b
28/10	368,66 cd	363,33 d	164,33 ef	298,773 c
11/11	244,66 c – e	228,50 de	118,33 f	197,163 d
The overall average of transactions	550,577 a	522,997 b	200,747 c	

Numbers with similar letters are not significantly different according to Dunkin's multiple range test at the probability level of 0.05%.

5- The Effect of Feeding *Borago Officinalis* and *Brassica Napus* Plants on the Average Honey Production (kg / colony)

The results of Table (5) indicated that the treatments significantly and clearly differed in the amount of honey produced, as the treatment of bee bread plant excelled by recording the highest average of 9.08 kg / colony, and the treatment of rapeseed plant recorded a good and satisfactory quantity with an average of 7.63 kg / colony. The comparison treatment recorded the lowest quantity with an average of 2.54 kg / colony, which indicated the need for a good

pasture for the colonies of bees during a shortage of pollen and nectar, which helped the hives to overcome the difficult climatic conditions during the winter period as well as their appropriate production of honey without the need for artificial feeding and thus providing an economic return by relying on natural feeding and providing good nectar sources through the cultivation of bee bread and rapeseed plants during different periods and dates. It contained bee sects, and Abdullah and Mahdi (2019) indicated that the bee bread plant (borax) is considered one of the good plants that provide pasture for bees rich in nectar and pollen and increase the productivity of bee colonies.

Table (5): The effect of feeding bee bread and colza plants on the average honey production (kg / colony)

Effect of feeding transactions		
The second site (bee bread plant)	The third site (colza plant)	The first site (control)
9,08	7,63	2,54
a	b	C

Numbers with similar letters are not significantly different according to Dunckin's multiple range test at the probability level of 0.05%.

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