

RESULTS ON THE DETERMINATIONS OF THE HONEY POTENTIAL OF BUCKWHEAT FLOWERS FROM THE CORNETU BEE

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Abstract. Buckwheat (*Fagopyrum esculentum*) is a pseudocereal species that can be successfully cultivated in various climatic zones, including in Romania. Buckwheat is a valuable crop for Romania, both for its edible seeds with special nutritional properties, and for its contribution to the production of honey from organic crops. The present study describes the results obtained during the monitoring of a cover crop with buckwheat plants, established in a stationary apiary in Cornetu commune (in the southwest of Ilfov county, Romania). Experiments were carried out in order to identify some schemes with land cover plants and their valorization for the sustainable development of honey crops and later incorporation by mechanical plowing in the field, after the October 2023 flowering period. The establishment of the culture was carried out in June, and the determinations regarding the nectariferous potential of buckwheat were carried out during the flowering period of August 2023. In the case of determining the nectariferous potential of buckwheat, the capillary method was used, as the direct method for dosing nectar. The results obtained from the quantitative (mg/flower) and qualitative (% sugar) determinations of the nectar secretion accumulated in 24 hours in 50 flowers/inflorescence served to establish the honey production per unit of surface. Thus, on the one hand, the amount of sugar in mg/flower was obtained, and on the other hand, the evaluation of the number of flowers per hectare. The values determined by the glycemic index for the nectar of buckwheat flowers varied from 0.1 mg/flower to 0.25 mg/flower between reference hours 9 and 18. The present paper integrates both the proposals and the development objectives proposed to the partners involved in the project (beekeepers and farmers but also the rural society), as well as the results of our own research on the territory of the basic apiary in order to ensure the territorial balance.

Keywords: *buckwheat (Fagopyrum esculentum) sustainable agricultural practices, honeydew plant.*

INTRODUCTION

Buckwheat is recognized for its nutritional benefits, being a good source of protein, fiber, vitamins and minerals. In addition, buckwheat is also valued for its low gluten content, which makes it an attractive alternative for people who are gluten intolerant or who want to reduce wheat consumption (Ion et al., 2018; Woo et al., 2016).

As for honey, buckwheat can play an important role in honey production. Buckwheat plants are rich in nectar and provide a source of food for bees during certain periods of the year (Ion, et al., 2018; Asociația Crescătorilor de Albine din România, 2012; Chalcoff et al., 2006; Goodman et al., 2001; Cîrnu, 1980). Buckwheat honey has a distinct taste, often considered strong and intense, with slightly bitter notes. It can vary in color from pale yellow to dark apple. Buckwheat honey is valued for its nutritional properties and potential health benefits (Woo et al., 2016; Modvala et al., 2016; Ion et al., 2008; Cawoy et al., 2006).

Cawoy, et al., (2009), mention the fact that in buckwheat, the nectar is composed of sucrose, fructose and glucose. The two hexoses (fructose and glucose) are the major

components of buckwheat nectar (85%; "hexose-dominant" nectar). Fructose becomes the main sugar by more than 50% at the peak of flowering. In the review article published by Cawoy, et al., (2006), regarding the floral biology of common buckwheat (*Fagopyrum esculentum* Moench) it is mentioned that the average nectar production of the buckwheat crop is estimated at 0.08- 0.10 mg of sugar per flower in full bloom. Under controlled conditions, a flower produces about 0.16 µl of nectar after 10 hours of secretion.

The sugar concentration harvested from field lots varies throughout the day: from 34% early in the morning to less than 10% at midday. However, other total sugar concentrations are reported in the literature, which can vary from 36 to 51% under field conditions and up to 55% under controlled conditions, and fluctuations in climatic values would be responsible for these fluctuations. Through the previous studies reported, it was found that due to the replacement of perennial vegetation with annual vegetation in the scheme of cultivated species, the organic substance at the level of the soil surface decreased a lot (Dobre et al., 2014).

The "cover crops" principle will be applied to the soil to be permanently green, without periods of black soil, not covered by vegetation in order to obtain green fertilizers. By keeping the soil green, it is aimed at improving fertility and the possibility of giving large harvests (Drăgan et al., 2022 a). Applying green fertilizers increases the synthetic fertility indicator, enriches the amount of macro and microelements, increases the humus content, improves soil respiration potential and enzyme activity. Green fertilizers in the form of "cover crops" improve all the ecological and biological functions of the soil, ensuring nutritional balance and the sustainability of crops (Drăgan et al., 2022a; Drăgan et al., 2022b).

The multidisciplinary team from the Faculty of Biotechnologies of the University of Agronomic Sciences and Veterinary Medicine in Bucharest, carried out experiments in order to identify schemes with plants to cover the land and to capitalize on them for the sustainable development of honey crops and later inclusion through mechanical plowing in the field, after the flowering period, from October 2023.

MATERIAL AND METHODS

Buckwheat (*F. esculentum*) is a crop that can be grown successfully in various climatic zones, including in Romania. It prefers well-drained soils and exposed to the sun, but it can also tolerate less favorable conditions (Drăgan et al., 2022a; Drăgan et al., 2022b; Zugravu, 2020). The establishment of the buckwheat culture was carried out in June 2023 (June 17, 2023) and the determinations regarding the mellifer potential in buckwheat were carried out during the flowering period of August 2023.

The sowing was carried out on the land of the basic apiary in Cornetu, Ilfov county, by distributing them in a mechanized way, in order to ensure the appropriate distance between the plants and to facilitate the conditions of healthy growth and development. In the locality chosen for experimentation in Ilfov County, agriculture occupies an important place, having great reserves and development possibilities determined by soil qualities, climatic factors, technical and material endowments and adequate labor force. Buckwheat seed, of the "Zita" variety, was provided by the Romanian Seed Industry Alliance (AISR), from Bucharest (Romania).

Determinations of honeydew potential in buckwheat. The importance of measuring the honeydew potential achieved on this occasion consists not only in the coherent determination, on scientific and objective bases, of this parameter but also through the experience thus accumulated, which can open a valuable action directive for the evaluation of this plant species -buckwheat- from the point of view of view of beekeeping importance. The collection of samples was carried out in the first half of August 2023 (August 05-18, 2023), in the basic apiary in Cornetu, (Ilfov county, S_E part of Romania).

There are different direct or indirect methods for determining honeydew potential, each of them presenting advantages and disadvantages (Ion et al., 2008). In the case of determining nectariferous potential in buckwheat, the capillary method was used, as the direct method for nectar dosing, being frequently used in research works (Ion et al., 2018; Ion et al., 2007; Goodman et al., 2001), in honey bee species. It is also an operative and sufficiently precise method, compared to other direct methods.

At the same time, this method allows the analysis of the nectar both quantitatively (mg/flower) and qualitatively (% sugar), without the analyzed flowers necessarily being detached from the plant (Jabłoński, 2002).

To determine the nectar, in the buckwheat plants that were to be analyzed, the plants were covered with gauze insulators 24 hours before the analysis (Figure 1.a), so that they would not be visited by pollinating insects and to facilitate the most accurate measurement of the amount of nectar secreted in this time interval. The amount of nectar determined in this way was conventionally considered to be the one secreted in 24 hours. It should also be noted that the inflorescence of the buckwheat plant lasts only one day. According to the procedure described by Jabłoński (2002) and Ion et al. (2018), nectar samples from buckwheat flowers were taken using the capillary, which was initially weighed empty on the analytical balance (Figure 1.b).

After extracting the nectar from a certain number of flowers, the capillary was reweighed, so that the amount of collected nectar (mg/number of flowers) was obtained by the difference. The obtained value was divided by the number of flowers from which the extraction was made, to find out the amount of accumulated nectar (mg/ flower) in a 24-hour interval. The hand-held refractometer was used as an analytical tool, used to measure the density of sugars in the solution, and the Brix scale interval (symbolized Bx) used to measure the ratio between the density of sugar (sucrose) and water, in which the given amount of sugar is dissolved. is from 0 to 32. Later, the nectar from the capillary was transferred (on average 2-3 drops) to the surface of the refractometer (Figure 1.c) to read the concentration (%) of sugar.



a)



b)



Figure 1. Work stages applied to the buckwheat crop, in the basic apiary in Cornetu (Ilfov county, Romania), for making honey determinations: **a)** isolation of inflorescences in buckwheat plants, **b)** empty capillary weighing balance, **c)** reading the amount of sugar using the refractometer.

The result obtained from the calculation of the nectar secretion from a buckwheat flower, in one determination is multiplied by 3 to obtain the nectar production per flower, 3 representing the number of repetitions of the determinations made/day, in the 24-hour interval corresponding to the viability of the buckwheat flower.

The data obtained regarding the secretion of nectar (quantity and concentration) served to determine the production of honey per surface unit. For this purpose, for the assessment of sugar production per hectare, the recommendations developed by ION researchers, et al., were taken into account. (2007), by which, in parallel with the nectar analyses, the number of flowers/plant was also determined for each individual plant. With the previous knowledge of the plant density applied to the establishment of the buckwheat culture per surface unit, the number of flowers per hectare was determined by calculation, and subsequently the amount of sugar in mg/flower.

The glycemic index is a constant characteristic of each plant species, as well as within the species, which represents the amount of sugar (in mg) secreted by a flower in 24 hours. That is why the glycemic index is used to compare different species regarding their importance as a honey source. In the present determinations of sugar production per buckwheat flower of the "Zita" variety, the amount of nectar (in mg/flower) was multiplied by its concentration in sugar (%).

The honey production/ha field unit, is another element used in characterizing the honeydew potential of the species, respectively of the variety/hybrid taken into account. This represents the amount of honey (in kg) that is theoretically obtained in one season from one hectare of land cultivated with the analyzed species. From the recommendations presented by Ion, et al., (2007), it emerges that in order to estimate honey production/ha, the amount of sugar/ha is first calculated based on the following data: carbohydrate index; average number of plants/area unit; and the duration (in days) of a flower.

Later, after finding out the result of calculating the amount of sugar per hectare, the calculation of honey production per hectare can be continued, following the recommendations presented by ION, et al., (2007), by the fact that 100 parts of honey contain on average 80 parts sugar and 20 parts water.

For beekeepers, the estimation of the honey harvest according to the amount of nectar brought by the bees in the hive becomes a plausible calculated estimate, which in practice can register variations influenced directly or indirectly by a whole series of biotic and/or abiotic factors.

Weather conditions values recorded during the experiment at the Cornetu apiary. It should be noted that each plant has its own nectar secretion system, both during its flowering period and during the day, and the quantitative and qualitative production of nectar is conditioned by a series of meteorological factors and generally environmental conditions, such as would be: pedological factors, sunlight, environmental temperature, air and soil humidity, precipitation, the existence or not of winds and their intensity and the occurrence of prolonged drought periods (Ion et al., 2008; Cawoy et al., 2006).

Regarding the pedological factors, it should also be stated that the structure and composition of the soil and the subsoil where honey plants grow and develop can considerably influence nectar secretion.

The temperature of the environment is of particular importance for the amount of nectar secreted (Pătruică et al., 2008; Lazăr, 2002). Most plants start to secrete nectar when the temperature rises to at least +10°C and, as this value is exceeded, the amount of secretion also increases and it is optimal in the temperature range 16-25°C. Then, after 25°C, in an increasing sense, the amount of nectar secretion gradually decreases and above 35°C it is zero, the secretion completely stops. It is worth noting that, at high temperatures, during the middle of the day, many plants age a little due to the large loss of moisture, especially from the leaves, and this leads to the temporary cessation, until revival, of nectar secretion (Lazăr, 2002).

For the month of August 2023 (Meteoblue- Romania Meteo Archive-August 2023; Vremea în Cornetu Județul Ilfov), in the area of Cornetu (Ilfov county), temperature values were mostly between 30-35°C during the day, and between 15-20°C during the night, according to the data illustrated in the diagram in Figure 2.

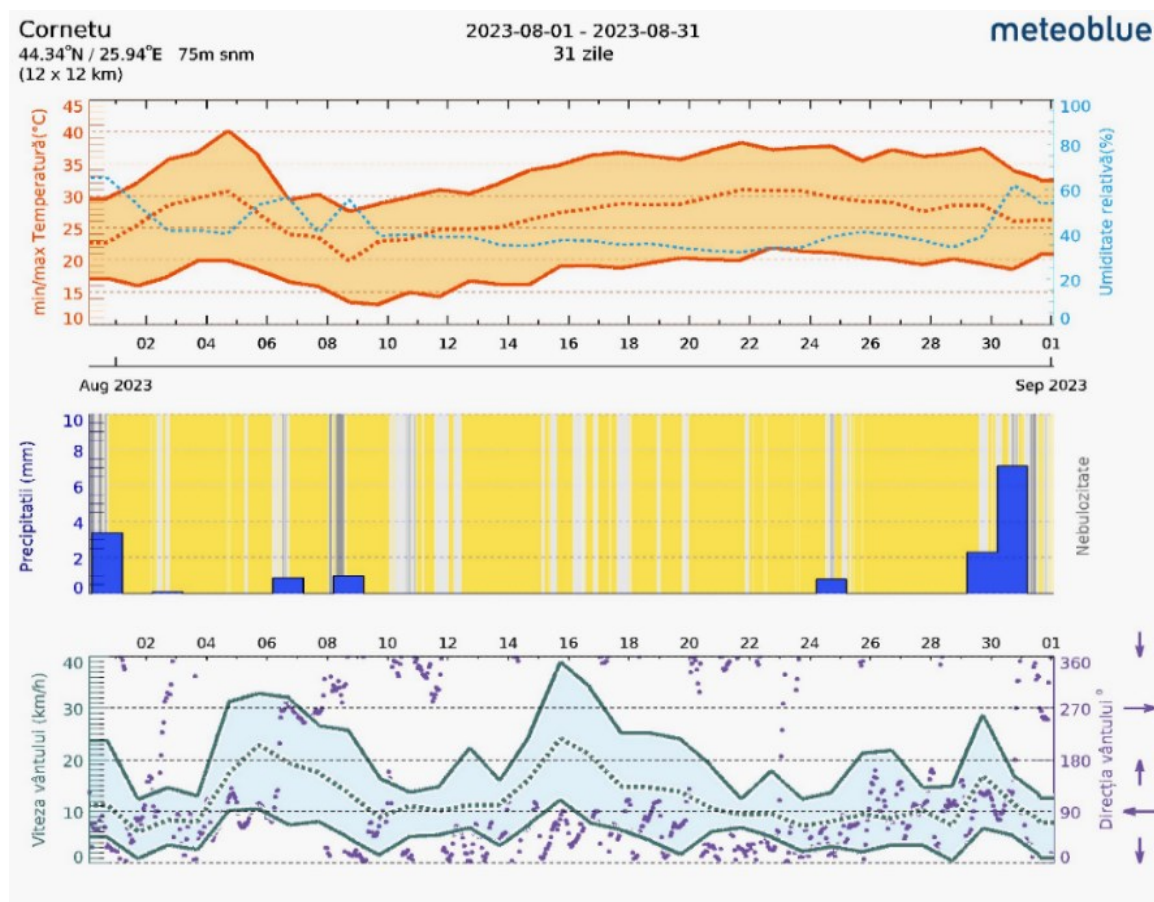


Figure 2. Diagram with meteorological records; Climatic values recorded in August 2023, Cornetu location in Ilfov county. (according to: Meteoblue- Romania Meteo Archive-August 2023).

Air and soil humidity also influence the amount of nectar secretion (Zugravu, 2020; Ion et al., 2018; Pătruică et al., 2008; Lazăr, 2002). There are many species of plants that like moisture, so in willow and linden, high soil moisture leads to a substantial increase in the amount of secreted nectar. Research shows that, for optimal nectar secretion, the best range of relative humidity is 60-80%, and the closer we get to 80%, the amount of secretion increases but the sugar content decreases, i.e. by increasing increases the amount, the nectar becomes more diluted. By reducing the humidity, the reverse phenomenon occurs, the amount of secreted nectar decreases, instead it becomes more concentrated, i.e. it increases its sugar content.

For the month of September 2023 (Meteoblue- Romania Meteo Archive- September 2023; Vremea în Cornetu Județul Ilfov), in the area of Cornetu, Ilfov county, the maximum temperature values mostly reached 30°C and only in a few days values of +35°C during the day, and between 15 - 20 °C during the night, according to the climate data illustrated in the diagram in Figure 3.

According to the centralized agrometeorological data for the period September 2022 - August 2023, in the report prepared by METEO ROMANIA (Meteo Romania - Agrometeorological Characterization - 01 September 2022 – 31 August 2023), references are made to the amount of precipitation recorded in the interval 01-31 August 2023 , for the territorial region of Muntenia (the S-E area of Romania), by the fact that they were quantitatively reduced, registering values of 3-25 l/ sq m (in the local areas of N, central, S and W of Muntenia), as well as values normal of 25-50 l/ml (on extensive areas of Muntenia).

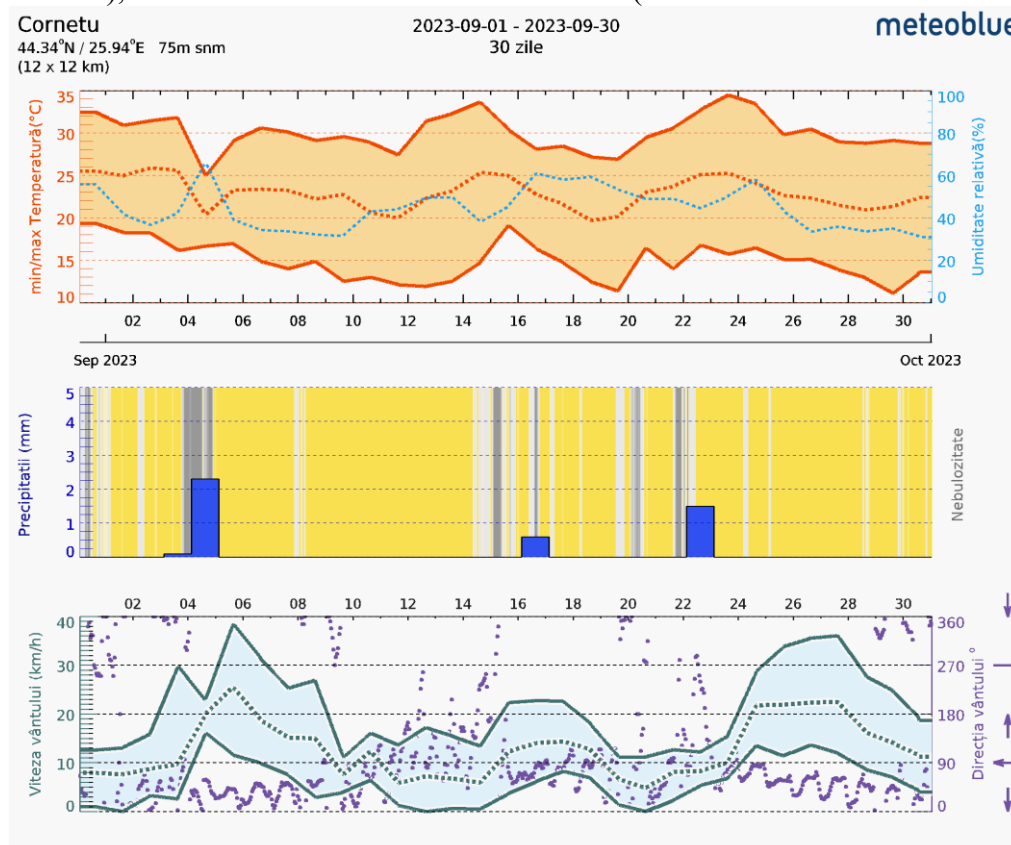


Figure 3. Diagram with meteorological records; Climatic values recorded in September 2023, Cornetu location in Ilfov county. (according to: Meteoblue- Romania Meteo Archive- September 2023).

Also for the "scorch" analysis parameter, expressed by the amount of "scorch units" ($\Sigma T_{max.} \geq 32^{\circ}C$) in the interval 01 June - 31 August 2023, accumulations of 51-222 "scorch units" were recorded on surfaces extended from Muntenia, signifying an accentuated intensity of the "heat" (Meteo Romania - Agrometeorological Characterization - 01 September 2022 – 31 August 2023).

RESULTS AND DISCUSSIONS

The results obtained from the quantitative (mg/flower) and qualitative (% sugar) determinations of the nectar secretion accumulated in 24 hours of inflorescence, served to determine the production of honey per surface unit. Thus, on the one hand, the amount of sugar in mg/flower was obtained, and on the other hand, the number of flowers per hectare.

In Table 1, a significant difference can be observed in favor of the evaluated values, in Cornetu apiary, at the level of buckwheat culture samples.

The values determined by the glycemic index for the nectar of buckwheat flowers varied from 0.1 mg/flower to 0.5 mg/flower between reference hours 9 and 18. The carbohydrate index for buckwheat varied from 0.1 mg/flower to 0.25 mg/flower at 9 o'clock. The glycemic index is the determining factor for the level of the honey harvest, but other factors also intervene, according to those previously mentioned.

According to the calculated data, presented in Table 1, for the months of August and September of the year 2023 for the buckwheat crop (*F. esculentum*), a production in the amount of approx. 28.4909 kg/ha-honey, this value being very close to the one in the specialized literature for buckwheat, through the average results recorded in the 3 series of determinations of honey collection/evaluation of honey potential (kg/ha), carried out in the apiary from Cornetu (Ilfov county, Romania).

Table 1. Calculated values* at the level of buckwheat samples, to estimate honeydew potential during the average duration of flowering (26 days), from the culture located in Cornetu Apiary

Experimental Series	Average number of flowers / ha	Glycemic index	The entire flowering period	Potential daily honeydew	Potential mellifer/ culture
		(mg/flower)	(number of days)	(kg/ha/day)	(kg/ha)
SERIES 1 (9.00 a.m.)	475.200.000	0,0027	26	1,6062	41,7600
SERIES 2 (12.30 a.m)	475.200.000	0,0015	26	0,8071	22,6698
SERIES 3 (16.30 a.m.)	475.200.000	0,0014	26	0,8093	21,0428
Average values		0,0019	26	1,0742	28,4909

* Average duration of flowering = 26 days (harvest date 05.08.2023 during at the hours 9-12.30-16.30).

By comparing for the entire flowering period 26 days/August-September 2023, the calculated value is 28.4909 kg honey/ha (cf. average values), of the estimation of the honey collection / evaluation of the honey potential (kg/ha), with the production of honey from specialized literature for buckwheat (Goodman et al., 2001).

Also, Jabłoński (2002), mentioned that regarding buckwheat plant, the average nectar production in the field, is estimated at 0.08-0.10 mg of sugar per flower during the full flowering period. Under controlled conditions, a flower produces about 0.16 µl of nectar after 10 hours of secretion. The sugar concentration harvested from field lots varies throughout the day: from 34% early in the morning to less than 10% at midday. However, other total sugar concentrations are reported in the literature, ranging from 36 to 51% under field conditions and up to 55% under controlled conditions. In this regard, it is mentioned that differences in air humidity and secretion rate could be responsible for these fluctuations.

Monitoring the frequency of flower visitation by pollinating bees.

The determinations and observations carried out in the field concerned both the frequency of flower visits by pollinating bees, as well as the duration of these visits, finally establishing the attractiveness index for buckwheat (the product of the frequency of visits and the average duration of a visit).

The frequency of surveying the buckwheat crop by honey bees is an indirect method for determining the honey potential of the plant (Ion, 2009).

The frequency of visits was determined by counting the honeybees (Figure 4), which visited the flowers in a period of five minutes, both in the pea culture established in the Cornetu apiary and by analyzing the evolution of the pickings throughout the beekeeping season triggered by the beekeepers in the project AGROAPIS.

Each observation was performed on groups of 4 neighboring bouquets in 9 repetitions.



Figure 4. Aspects of the monitoring activity and evaluation from the mellifer point of view of buckwheat plants (period of monitoring samples August - September 2023, AGROAPIS).

The insects that visited the buckwheat bouquets were honey bees and insects from the spontaneous entomofauna represented by lepidoptera (butterflies), diptera (flies), hymenoptera (wasps). On average, honeybees participated in 78.6% pollination, while insects from the spontaneous entomofauna participated in 18.2%. It should be mentioned that, in general, during the whole period of observations, there were no cases of expulsion or competition between honey bees and spontaneous pollinating insects (Figure 5).

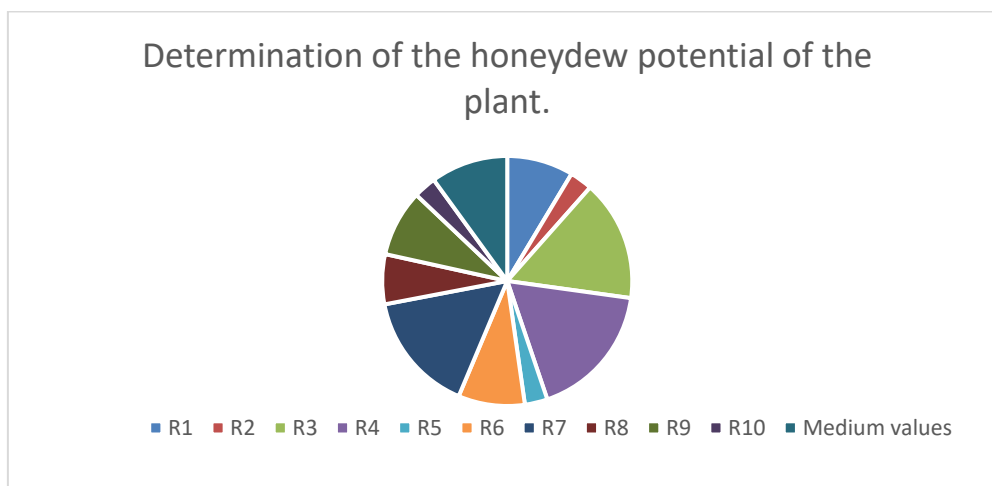


Figure 5. Research frequency of buckwheat crop by honey bees

Following the field observations, it was found that due to the withering of the ligulate flowers, the attractiveness of the buckwheat flower gradually decreased, the buckwheat flower having a vegetation duration of only one day.

Monitoring the research time on the same bouquet. The average research time on the same bouquet of flowers, in different stages of flowering, varied as follows: newly blooming - 1.6 minutes; blooming – 5 minutes; wither - 5 seconds; elapsed - 0 seconds. The bouquets were more intensively visited by bees compared to those without ligulate flowers (manually removed at the beginning of flowering), the research frequency being 5 times higher, which highlighted the role of ligulate flowers in attracting honeybees. Throughout the month of September and until October 18, 2023, the bees had a source of collecting nectar and pollen.

From the analysis of the collection evolution over the entire beekeeping season triggered by the project beekeepers from August to October, a period of intense collection without periods with collection gaps according to the pollen collected at the control hives located in the 4 locations of the project emerges. Knowing this picking period for the buckwheat plant is of particular importance for the productivity of the apiary, because the beekeeper does not have to intervene on the replacement food. Due to the severe drought in the last 3 years on the territory of Romania, the local honey base has been seriously affected. This research helps the specific beekeeping area to prevent effective economic measures.

By knowing the capacity of the honey resources in buckwheat, the apiary area has a particular practical importance, because the nectar-polleniferous potential largely conditions the degree of economic development of the beehives.

CONCLUSIONS

Buckwheat plants are rich in nectar and provide a source of food for bees in the period between honey picking and specific months of August - October taking into account the climate changes of the last 3 years of research. The plants from the buckwheat culture established in 2023 at Cornetu Apiary, were analyzed from the point of view of the honeydew potential, and following the determinations made between 9 am and 6 pm, it resulted that the carbohydrate index values varied from 0, 1 mg/flower to 0.25 mg/flower.

From the analysis of the collection evolution over the entire beekeeping season triggered by the beekeepers from the AGROAPIS project from August to October, an intense collection

period without periods with collection gaps resulted, in correspondence with the pollen collected at the control hives located in the 4 locations of the project.

Proper planting and harvesting can help diversify agricultural production and provide healthy and varied food options. By keeping the soil green improving fertility and the possibility of more abundant harvests. In conclusion, buckwheat is a valuable crop in Romania, not only for its edible seeds and nutritional properties, but also for its contribution to honey production.

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REFERENCES

- ASOCIAȚIA CRESCĂTORILOR DE ALBINE DIN ROMÂNIA, INSTITUTUL DE CERCETARE DEZVOLTARE PENTRU APICULTURĂ (2012). Apicultura - Manualul cursantului, Ediția I. Editura LVS Crepuscul Ploiești, Prahova, 330pp, ISBN 978-606-593-011-7;
- CAWOY, V., LEDENT, J.-F., KINET, J.-M., JACQUEMART, A.-L. (2009). Floral Biology of Common Buckwheat (*Fagopyrum esculentum* Moench). *The European Journal of Plant Science and Biotechnology*, vol. 3(1), 1-9. Available from: <http://hdl.handle.net/2078.1/72617>;
- CAWOY, V., DEBLAUWE, V., HALBRECQ, B., LEDENT, J.-F., KINET, J.-M., JACQUEMART, A.-L. (2006). Morph differences and honeybee morph preference in the distylous species *Fagopyrum esculentum* Moench. *International Journal of Plant Sciences*, 167, 853-861. Available from: <https://doi.org/10.1086/504924>;
- CHALCOFF, V. R.; AIZEN, M. A.; GALETTO, L. (2006). Nectar concentration and composition of 26 species from the temperate forest of South America. *Annals of Botany*, 97(3), 413-21. Doi: [10.1093/aob/mcj043](https://doi.org/10.1093/aob/mcj043). Available from: <https://academic.oup.com/aob/article/97/3/413/291870>;
- CÎRNU, I. V. (1980). Flora meliferă - Editura Ceres, București, 206 pp;
- DOBRE, P., JURCOANE, S., MATEI, F., STELICA, C., FARCAS, N., MORARU, A.C. (2014). *Camelina sativa* as a double crop using the minimal tillage system. *Romanian Biotechnological Letters*, 19(2), 9190-9195. Available from: <https://rombio.unibuc.ro/wp-content/uploads/2022/05/19-2-11.pdf>;
- DRĂGAN, M., DĂNĂILĂ-GUIDEA, S. M., BĂȘA, A. G., JURCOANE, Ș., DOBRESCU, C. (2022a). Practice of green cover crops, with benefits for increase of soil properties and the value of bee production, *Agronomy Series of Scientific Research/Lucrări Științifice Seria Agronomie*, 65(1), 181-186. Available from: <https://www.uaiasi.ro/revagrois/PDF/2022-1/paper/32.pdf>;
- DRĂGAN, M., CRISTEA, S., JURCOANE Ș., DĂNĂILĂ-GUIDEA, S. M. (2022b). Research on cultures of honey plants at the level of Cornetu commune, in Ilfov County – Minireview. *Annals of the Academy of Romanian Scientists. Series Agriculture, Silviculture and Veterinary Medicine Sciences*, Vol.11(2), p.77-87; Available from: <https://aos.ro/wp-content/anale/AVol11Nr2Art.8.pdf>;
- GOODMAN R., HEPWORTH G., KACZYNSKI P., MCKEE B., CLARKE S., BLUETT C. (2001). Honeybee pollination of buckwheat (*Fagopyrum esculentum* Moench) cv. Manor. *Australian Journal of Experimental Agriculture* 41, 1217-1221. DOI: <https://doi.org/10.1071/EA99008>;
- ION, N., ODOUX, J.-F., VAISSIÈRE, B. E. (2018). Melliferous Potential of Weedy Herbaceous Plants in Crop Fields of Romania from 1949 to 2012. *Journal of Apicultural Science*, 62(2), 149-165. Doi: <https://doi.org/10.2478/jas-2018-0017>;
- ION, N. (2009). Cât produce o familie de albine. *Lumea Apicolă*, nr. 22, p. 20-22;

- ION, N., ION, V., FOTA, G., COMAN, R., ȘTEFAN, V. (2008). Contributii privind stabilirea metodei de prognozare a culesurilor melifere in vederea rentabilizarii stuparitatului pastoral/ Contributions on the method to forecast the honey flows in view of optimizing the transhumance. Final Program- Symposium On General Management And Best Beekeeping Practice "Beekeeping Simple And Clear", Bucharest - Romania, September 11-14, 2008; Available from: <http://www.fiitea.org/foundation/symposium/finalprogram.pdf>;
- ION, N., ȘTEFAN, V., ION, V., FOTA, G., COMAN, R. (2007). Results concerning the melliferous characteristics of the sunflower hybrids cultivated in Romania / Rezultate privind caracteristicile melifere ale hibridurilor de floarea-soarelui cultivate în România. *Lucrări Științifice: Zootehnie și Biotehnologii*, 40(2), 80-89, Editura AGROPRINT Timisoara. Available from: https://www.usab-tm.ro/fileadmin/fzb/simpozion_2009/phf_2007/cuprins_2007_vol_2.pdf;
- JABŁOŃSKI, B. (2002) Notes on the method to investigate nectar secretion rate in flowers. *Journal of Apicultural Science*, 46 (2), 117–124;
- LAZĂR, Ș. (2002). Bioecologie și tehnologie apicolă. Iași: Alfa. 462 p. ISBN 973-8278-11-2;
- METEOBLUE- ARHIVA METEO ROMANIA-August 2023, Cornetu, jud.Ilfov / (METEOBLUE-ROMANIA METEO ARCHIVE-August 2023), in the area of Cornetu, Ilfov county. Available from: https://www.meteoblue.com/ro/vreme/historyclimate/weatherarchive/cornetu_romania_680754?fstlengeth=1m&year=2023&month=8;
- METEOBLUE- ARHIVA METEO ROMANIA_Septembrie 2023, Cornetu, jud.Ilfov / (METEOBLUE- ROMANIA METEO ARCHIVE- September 2023), in the area of Cornetu, Ilfov county. Available from: https://www.meteoblue.com/ro/vreme/historyclimate/weatherarchive/cornetu_romania_680754?fstlengeth=1m&year=2023&month=9;
- METEO ROMANIA - CARACTERIZARE AGROMETEOROLOGICĂ - 01 Septembrie 2022 – 31 August 2023 (METEO ROMANIA - AGROMETEOROLOGICAL CHARACTERIZATION - 01 September 2022 – 31 August 2023). Available from: <https://www.meteoromania.ro/wp-content/uploads/comunicate/Caracterizare-agrometeorologica-2022-2023.pdf>;
- MODVALA, S., EREMIA, N., SCRIPNIC, E. (2016). The Technology of pastoral beekeeping. *Scientific Papers-Animal Science Series: Lucrări Științifice - Seria Zootehnie*, Iași, 66 (21), 29-34. Available from: https://www.uaiasi.ro/firaa/Pdf/Pdf_Vol_66/Susana_Modvala.pdf;
- PĂTRUICĂ, S., DEZMIREAN, D. S., BURĂ, M., JURCOANE, R., SPOREA, A. (2017). Monitorizarea activității coloniilor de albine în timpul adunărilor majore din 2017. *Bulletin of University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca. Animal Science And Biotechnologies*, 74(2), 92-96. DOI: <https://doi.org/10.15835/buasvmcn-asb:0001>. Available from: <https://journals.usamvcluj.ro/index.php/zootehnie/article/view/12812>;
- VREMEA ÎN CORNETU JUDEȚUL ILFOV. Available from: <https://vremea.ido.ro/Cornetu~680749.htm>;
- ZUGRAVU, A. (coordinator) (2020). Guide to apicultural potential, climate conditions, air and soil quality in the Black Sea Basin. Available from: https://blacksea-cbc.net/wp-content/uploads/2020/12/BSB136_ITM-BEE-BSB_Guide-to-apicultural-potential-climate-conditions-air-and-soil-quality-in-the-Black-Sea-Basin_RO.pdf;
- WOO, S.H., ROY, S., KWON, S., CHO, S.-W., SARKER, K., LEE, M.-S., CHUNG, K.-Y., KIM, H.-H. (2016). Concepts, Prospects, and Potentiality in Buckwheat (*Fagopyrum esculentum* Moench): A Research Perspective. In: Meiliang Zhou, editors: *Molecular Breeding and Nutritional Aspects of Buckwheat*; Elsevier BV: Oxford: Academic Press, 21–49 pp. ISBN:978-0-12-803692-1. DOI: [10.1016/B978-0-12-803692-1.00003-1](https://doi.org/10.1016/B978-0-12-803692-1.00003-1);