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CREATION OF A SCHOOL APIARY FOR THE DISSEMINATION OF BEEKEEPING TO AGRICULTURAL SCIENCES STUDENTS AT UFGD

**CRIAÇÃO DE UM APIÁRIO ESCOLA PARA A DISSEMINAÇÃO DA
APICULTURA PARA ACADÊMICOS DE CIÊNCIAS AGRÁRIAS DA
UFGD**

**CREACIÓN DE UN APIARIO ESCOLAR PARA DIFUNDIR LA
APICULTURA ENTRE LOS ESTUDIANTES DE CIENCIAS AGRÍCOLAS
DE LA UFGD**

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Abstract: Beekeeping is notably recognized for its good profitability, ease of implementation and management, in addition to the possibility of being an activity associated with another pre-existing crop. However, even with the benefits of the activity, few efforts

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are made towards training technicians and producers, this lack of training being the biggest obstacle to the activity. In this sense, the present work aimed at the implementation of a School Apiary at the UFGD Experimental Farm, in order to allow training of Agricultural Sciences academics and serve as a demonstration model in the future for rural producers. The creation of the School Apiary began with the careful selection of the ideal location to house the *Apis mellifera* bee hives. A survey of the main tree species in the region was carried out, in addition to the elaboration of a beekeeping calendar, in order to plant species with different flowering times, aiming at floral availability throughout the year. After this mapping, boxes with honeycomb foundation were made, and after completion, the boxes were placed in strategic locations, so that the bees could colonize them. Success was obtained in capturing the swarms and in implementing the School Apiary, with this, it was noted that it not only acts in academic training, but also in social education and awareness. Furthermore, the technical training of agricultural science academics is fundamental to prepare them to provide services to beekeepers, regardless of their investment capacity, thus solving one of the main obstacles of the activity.

Keywords: *Apis mellifera*, Training, Rural extension.

Resumo: A atividade apícola é notadamente reconhecida por sua boa rentabilidade, facilidade de implantação e manejo, além da possibilidade de ser uma atividade consorciada com outra cultura pré-existente. Todavia, mesmo com os benefícios acerca da atividade, poucos esforços são realizados no sentido de capacitação de técnicos e produtores, sendo essa falta de capacitação, o maior entrave da atividade. Nesse sentido, objetivou-se com o presente trabalho a implantação de um Apiário Escola na Fazenda Experimental da UFGD, afim de permitir uma capacitação dos acadêmicos de Ciências Agrárias e servir como modelo de demonstração no futuro para produtores rurais. A criação do Apiário Escola iniciou-se com a seleção cuidadosa do local ideal para abrigar as colmeias de abelhas *Apis mellifera*. Foi realizado um levantamento das principais espécies arbóreas na região, além da elaboração de um calendário apícola, afim de implantar plantas com diferentes épocas de floração, objetivando uma disponibilidade floral ao longo do ano. Após esse mapeamento, foram confeccionadas caixas com cera alveolada, finalizada a confecção, as caixas foram implantadas em locais estratégicos, para que as abelhas pudessem realizar a colonização das mesmas. Obteve-se sucesso na captura dos enxames e na implantação do Apiário Escola, com isso, notou-se que o mesmo não atua somente na formação acadêmica, mas, também na formação e conscientização social. Além disso, a capacitação técnica dos acadêmicos de

ciências agrárias é fundamental para prepara-los para prestarem serviços para apicultores, independente da capacidade de investimento dos mesmos, solucionando assim, um dos principais entraves da atividade.

Palavras-chave: *Apis mellifera*, Capacitação, Extensão rural.

Resumen: La apicultura es reconocida por su alta rentabilidad, facilidad de implementación y gestión, y la posibilidad de combinarse con otros cultivos preexistentes. Sin embargo, a pesar de sus beneficios, se realizan pocos esfuerzos para capacitar a técnicos y productores, siendo esta falta de capacitación el principal obstáculo. En este sentido, el objetivo de este trabajo fue implementar un Apiario Escolar en la Granja Experimental de la UFGD, para capacitar a estudiantes de Ciencias Agrarias y servir como modelo demostrativo para futuros productores rurales. La creación del Apiario Escolar comenzó con la cuidadosa selección del lugar ideal para albergar las colmenas de *Apis mellifera*. Se realizó un estudio de las principales especies arbóreas de la región, además de la elaboración de un calendario apícola para implementar plantas con diferentes épocas de floración, buscando la disponibilidad floral durante todo el año. Tras este mapeo, se fabricaron cajas con cera de panal y, una vez terminadas, se colocaron en lugares estratégicos para que las abejas pudieran colonizarlas. La captura de enjambres y la implementación del Apiario Escolar fueron exitosas. Por lo tanto, se observó que la escuela no solo ofrece formación académica, sino también educación social y concientización. Además, la formación técnica de los estudiantes de ciencias agrícolas es esencial para prepararlos para brindar servicios a los apicultores, independientemente de su capacidad de inversión, solucionando así uno de los principales obstáculos para la actividad.

Palabras clave: *Apis mellifera*, Capacitación, Extensión rural.

INTRODUCTION

Beekeeping is an activity notably capable of providing good profitability and relative ease of implementation, making it accessible to producers with different investment capacities. In Brazil, the activity can be enhanced given the richness of its native flora, particularly in the Cerrado region, a biome regarded by many as vast and endowed with great biodiversity (BACAXIXI *et al.*, 2011).

In the Brazilian context, a survey conducted by the Brazilian Institute of Geography and Statistics (IBGE) in 2022 indicated that around 61 thousand tons of honey were produced,

resulting in an approximate income of 958 million reais (IBGE, 2022).

In the same survey, when observing the state of Mato Grosso do Sul, about 720 tons of honey were produced, leading to a profitability of 11 million reais. This information further highlights the profitability of beekeeping. Additionally, the capacity for job creation and income flow within this activity is particularly pronounced when examining the context of small producers and/or family farmers (OLIVEIRA *et al.*, 2019).

The development of beekeeping can also increase the efficiency of land use, as this activity does not require large areas and can be carried out alongside other activities, thus providing income diversification.

Furthermore, beekeeping can also promote environmental benefits, especially in the pollination of floral and arboreal species, positioning bees as agents of preservation and multiplication of natural flora, which positively impacts environmental sustainability and the conservation of biological diversity (MARTINS *et al.*, 2020).

However, beekeeping still lacks specialized professionals to provide technical assistance and share specific knowledge. This challenge was also pointed out by Silva et al. (2020), where the authors stated that this issue is even more significant in family productions.

Given the shortage of specialized professionals in beekeeping and the demand for specific technical knowledge, along with the need to disseminate information to small producers, this work aimed to establish a school apiary for students in the Animal Science program at the Federal University of Grande Dourados, to provide students with greater contact with the activity and prepare them for future actions.

MATERIALS AND METHODS

Choice of Location and Installation of the FCA-UFGD School Apiary

The creation of the FCA-UFGD School Apiary began with the careful selection of the ideal location to house the *Apis mellifera* bee hives. After a detailed analysis of the various areas available at the Experimental Faculty of Agricultural Sciences (FAECA), together with the Coordinator, Prof. Dr. Éder Pereira Gomes, the wooded area illustrated in Figure 1, located at coordinates 22°14'51"S and 54°59'37"W, was chosen. This choice considered several factors, such as the environmental characteristics and safety for both the bees and future visitors to the apiary.



Figure 1. Choice of Location of the FCA-UFGD School Apiary.

After defining the location of the School Apiary, the evaluation and identification of floral and tree species, as well as water sources in the apiary's surroundings, began, aiming to assess the availability of food and water for the bees (Figure 2).



Figure 1. Identification of the main floral species and water sources in the surroundings of the FCA-UFGD School Apiary.

Thus, guided visits were carried out with the help of one of the employees of the FCA Experimental Farm (FAECA), in order to observe and catalog the main floral and tree species, thus enabling the composition of a regional beekeeping calendar. Based on this observation, in addition to the study of the beekeeping potential, a calendar was made with the main species identified in the surroundings of the School Apiary area (Table 1).

Tabela 1. Calendar of the species of the bee pasture in the surroundings of the FCA-UFGD School Apiary.

Month	Species
January	<i>Copaifera langsdorffii</i> (Pau-óleo); <i>Machaerium acutifolium</i> (Jacarandá); <i>Psychotria carthagenensis</i> Jacq (Café do mato); <i>Schinus terebinthifolia</i> (Aroeira vermelha); <i>Myracrodruon urundeuva</i> Allemão (Aroeira do sertão); <i>Dipteryx alata</i> Vogel (Baru); <i>Inga vera</i> (Ingazeiro); <i>Ludwigia octovalvis</i> (Camarambaia); <i>Peltophorum dubium</i> (Canafístula); <i>Clitoria fairchildiana</i> (Sombreiro).
February	<i>Copaifera langsdorffii</i> (Pau-óleo); <i>Machaerium acutifolium</i> (Jacarandá); <i>Psychotria carthagenensis</i> Jacq (Café do mato); <i>Baccharis punctulata</i> ; <i>Myracrodruon urundeuva</i> Allemão (Aroeira do sertão); <i>Inga vera</i> (Ingazeiro); <i>Ludwigia octovalvis</i> (Camarambaia); <i>Peltophorum dubium</i>

	<i>(Canafistula); Clitoria fairchildiana (Sombreiro).</i>
March	<i>Syagrus romanzoffiana (Pindó); Copaifera langsdorffii (Pau-óleo); Machaerium acutifolium (Jacarandá); Baccharis punctulata; Myracrodruon urundeuva Allemao (Aroeira do sertão); Ludwigia octovalvis (Camarambaia); Peltophorum dubium (Canafistula); Clitoria fairchildiana (Sombreiro).</i>
April	<i>Machaerium acutifolium (Jacarandá); Baccharis punctulata; Myracrodruon urundeuva Allemao (Aroeira do sertão); Ludwigia octovalvis (Camarambaia); Eucalyptus pilularis (Eucalipto); Clitoria fairchildiana (Sombreiro).</i>
May	<i>Machaerium acutifolium (Jacarandá); Myracrodruon urundeuva Allemão (Aroeira do sertão); Ludwigia octovalvis (Camarambaia); Eucalyptus pilularis (Eucalipto); Clitoria fairchildiana (Sombreiro).</i>
June	<i>Machaerium acutifolium (Jacarandá); Myracrodruon urundeuva Allemão (Aroeira do sertão); Ludwigia octovalvis (Camarambaia); Eucalyptus pilularis (Eucalipto).</i>
July	<i>Myracrodruon urundeuva Allemão (Aroeira do sertão); Handroanthus albus (Ipê); Eucalyptus pilularis (Eucalipto).</i>
August	<i>Cecropia obtusifolia (Embaúba); Handroanthus albus (Ipê); Vernonthura tweediana (Assa-peixe); Cecropia pachystachya Trécul (Embaúba do brejo); Eucalyptus pilularis (Eucalipto).</i>
October	<i>Syagrus romanzoffiana (Pindó); Machaerium acutifolium (Jacarandá); Psychotria carthagenensis Jacq (Café do mato); Patagonula americana (Guajuvira); Trichilia catiguá (Catiguá); Genipa americana L. (Genipapo); Schinus terebinthifolia (Aroeira vermelha); Cecropia obtusifolia (Embaúba); Dipteryx alata Vogel (Baru); Vernonthura tweediana (Assa-peixe); Cecropia pachystachya Trécul (Embaúba do brejo).</i>
November	<i>Syagrus romanzoffiana (Pindó); Machaerium acutifolium (Jacarandá); Psychotria carthagenensis Jacq (Café do mato); Patagonula americana (Guajuvira); Genipa americana L. (Genipapo); Schinus terebinthifolia (Aroeira vermelha); Cecropia obtusifolia (Embaúba); Dipteryx alata Vogel (Baru); Cecropia pachystachya Trécul (Embaúba do brejo).</i>
December	<i>Syagrus romanzoffiana (Pindó); Copaifera langsdorffii (Pau-óleo);</i>

Machaerium acutifolium (Jacarandá); *Psychotria carthagenensis* Jacq (Café do mato); *Patagonula americana* (Guajuvira); *Genipa americana* L. (Genipapo); *Schinus terebinthifolia* (Aroeira vermelha); *Dipteryx alata* Vogel (Baru); *Inga vera* (Ingazeiro); *Ludwigia octovalvis* (Camarambaia); *Peltophorum dubium* (Canafistula); *Clitoria fairchildiana* (Sombreiro).

With the elaboration of the beekeeping calendar, it was noted that in a large portion of the months of the year, there are species with great beekeeping potential in the surroundings of the apiary area (1 km radius). However, there are few species whose flowering occurs between the months of May and August. In order to enrich the beekeeping vegetation during these months, a survey of possible species suitable for implementation was carried out, in order to supply the food demand for the bees. The potential species for use are shown in Table 2.

Table 2. Annual crops with beekeeping potential.

Species	Seeds per hectare	Sowing or planting time/season	Start of flowering after sowing or planting	Flowering duration/ Flowering period	Observations
Nabo forrageiro (<i>Raphanus sativo</i> L.)	8 a 12 kg	April to June	60 to 90 days	30 days	Good producer of pollen and nectar
Canola (<i>Brassica napus</i>)	3 a 4 kg	April to June	55 to 65 days	20 to 40 days	Presence of bees increases grain production
Trevo branco (<i>Trifolium rapens</i>)	3 kg	April to May	70 days	150 days	Good producer of pollen and nectar
Trigo mourisco (<i>Fagopyrum esculentum</i>)	25 a 30kg	October to March	25 days	45 days	In regions where frost occurs late, flowering may be prolonged until the occurrence of the first frost

Source: EPAGRI.

Beeswax Processing

The beeswax was melted using a double boiler (bain-marie), not exceeding a temperature of 65°C (149°F). After melting, the liquid wax underwent a lamination process, where a wooden board was dipped into the liquid wax and immediately placed in cold water to cause it to harden.

To achieve the ideal thickness of the wax sheet, the board was dipped once into the liquid wax. After this step, the process of cell imprinting of the wax sheet began, using a cell imprinting roller. With this equipment, imprints/markings of the cell bases were made on each

of the prepared sheets (Figure 3).



Figure 2. Beeswax Processing: Melting, Lamination, and Cell Imprinting of Beeswax.

Setting up the Bait Hives

The assembly and preparation of the bait hives to be installed in the School Apiary area was carried out in order to collect bee swarms. For this purpose, the foundation sheets were embedded in the brood frame using an electric embedder (Figure 4). After this process, the cardboard bait hives were assembled to house approximately five frames with foundation (Figure 5).



Figure 3. Embedding of Beeswax Foundation in Brood Frames.



Figure 4. Setting up the Bait Hives

Two prepared bait hives were placed in the School Apiary area at FAECA, tying the hives to tree trunks at a height of 1.0 to 1.5 m (Figure 6). To improve identification, colored non-woven fabric (TNT) strips were placed near and close to the bait hives. Two bait hives were placed in the Horticulture sector area of FCA-UFGD (Figure 7).



Figure 5. Placement of the bait hives in the FCA-UFGD School Apiary.



Figure 6. Placement of the bait hives in the FCA-UFGD Horticulture sector.

After the installation of the bait hives, the hives were monitored weekly. Bird attacks were observed on the bait hives located in the horticulture sector area, damaging them. Therefore, after attempts at restoration and further bird attacks, it was decided to transfer the bait hives from the Horticulture sector to the area near the Broiler Aviary – UFGD.

Preparation of the Hives

The hives were waterproofed with vegetable oil to increase their durability (Figure 8). After this step, the brood and honey super frames were assembled, embedding beeswax

foundation in each frame.

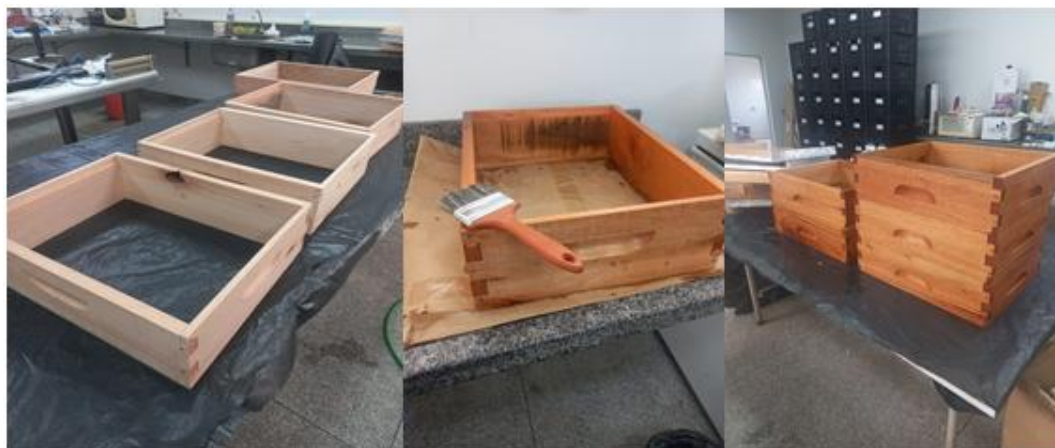


Figure 7. Hive Preparation and Waterproofing.

Swarm Capture

With all the material prepared, bee captures began at FAECA. Three swarms were captured, one being a flying (migratory) swarm and two established swarms, which had been established for some time.

The first swarm was collected from a kitchen cabinet on the FAECA premises. It was a small swarm that had arrived at the location about two days prior to capture (Figure 9). Being a recently established swarm, there were no built honeycombs, which facilitated the capture.

For the collection, a nucleus hive with five frames of foundation was used. The bees were placed inside the nucleus hive and subsequently taken to the FCA-UFGD School Apiary. Weekly, 500 ml of sugar syrup in a 1:1 water-to-sugar ratio was administered for the swarm's maintenance until its complete adaptation and observation of food collection by the bees.



Figura 8. Capture of a Recently Established Swarm at FAECA.

The second capture was carried out in the sheep farming sector of FAECA. The swarm had been established for a long time in a trough near the fence of the sheep farming sector (Figure 10). The third swarm was collected in the sugarcane plantation area at FAECA (Figure 11).



Figure 9. Capture of a Swarm Established in the Sheep Farming Sector of FAECA.



Figure 10. Capture of a Swarm Established in the Sugarcane Field of FAECA.

RESULTS AND DISCUSSIONS

The establishment of the apiary was an educational success, especially with the participation of students in the project's execution. The School Apiary functions as a demonstration unit for students, enabling a greater understanding of the technology, thus preparing them to establish units in communities.

The creation of demonstration units is highlighted by Ramos et al. (2023), where the authors affirm their effectiveness for the transfer of information and technologies to rural communities. The authors also state that these units allow the demonstration of techniques for process development, thus potentially improving the productivity of these communities.

The mutual and collective effort of the students for the execution of the School Apiary allows the students to achieve a small specialization in the beekeeping area, thus enabling them for later service to beekeepers, especially in small properties or family properties, even more so when the lack of specific knowledge is the main obstacle for family producers (SILVA *et al.*, 2020).

Furthermore, the dissemination of beekeeping is an essential tool, especially for rural communities, promoting collective action, providing environmental benefits, in addition to income generation (ANDRADE *et al.*, 2023).

It is necessary to carry out activities aimed at the development of students, especially in cultures in which they have less interest. In addition, as a higher education institution, the University must awaken in students the desire to carry out extension activities, and not only for research.

This prior preparation is fundamental so that future technicians can observe rural communities and small producers with different eyes, encouraging them to expand their concepts, observing in rural extension something essential.

In addition to this, the preparation of students and contact with communities allows them to know the reality of the place where the University is inserted (SILVA, 2023). Therefore, the School Apiary not only acts on academic training, but also on social training and awareness, a factor of extreme value in the preparation of these students. According to Facco et al. (2022), university extension consists of actions that aim to share knowledge with the external community, seeking to solve their needs.

The social awareness of future technicians is key in social and productive development, especially in rural communities. This interaction between students and the

community promotes mutual growth and an exchange of knowledge, knowledge, and experience, benefiting both parties. These benefits further strengthen the need for extension activities.

Given the success with the implementation of the School Apiary, it is expected to hold field days, lectures, practical classes, in addition to receiving producers who have an interest in beekeeping activity, thus being able to provide the theoretical basis and practical experience.

In addition, it is also expected to positively impact the conservation of local species, through the pollination process carried out by bees, that is, carrying out a local biodiversity conservation action.

CONCLUSION

The creation of the FCA-UFGD School Apiary was essential to expand the knowledge of those involved in the project and the students who were able to observe the materials and hive management.

Furthermore, it was possible to address the significant gap in some disciplines, such as the lack of practical classes.

The training of agricultural science students is fundamental to prepare them to provide services to beekeepers, regardless of their investment capacity.

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