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Integrated Farming of Stingless Bee and Pesticide-Free Chilli Fertigation: Sharing Experience from Knowledge Transfer Project (KTP-RIGS) with *Persatuan Anak Kuantan Utara* and Organic Farm Venture

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ABSTRACT

Persatuan Anak Kuantan Utara (PAKUTA) has been established with the aim of improving the socio-economic well-being of communities especially the B40 families around the Northern Kuantan areas. Through a collaborative effort among PAKUTA, Organic Farm Venture and IIUM, a pilot project on 'cili api bara' fertigation has been conducted under the KTP-RIGS program. This pilot project consists of about 250 polybags of chilli, handled by En Ahmad Bakar who is one of the B40 members of PAKUTA at Kg. Beserah, Kuantan. Several academic staff from IIUM have been invited to be the technical advisors for this project. A colony of stingless bees has also been installed in this pilot project. Apart from the knowledge and skill transfer on Good Agricultural Practices (GAP) of pesticide-free chilli fertigation and stingless bee integrated farming for the B40 members of PAKUTA, additional elements on proper financial record keeping and business documentation along with appropriate post-harvest handling of chilli and stingless bee honey have been also incorporated in this project.

Keywords: Community project, Sustainable Development Goal, Stingless bee integrated farming, Pesticide-free chilli fertigation, environmentally friendly.

ABSTRAK

Persatuan Anak Kuantan Utara (PAKUTA) telah ditubuhkan dengan tujuan untuk mengukuhkan kesejahteraan sosio ekonomi komuniti setempat terutamanya keluarga B40 disekitar kawasan Kuantan Utara. Hasil usahama di antara PAKUTA, Organic Farm Venture dan IIUM telah menatijahkan projek pilot tanaman fertigasi cili api bara di bawah program KTP-RIGS IIUM. Projek pilot ini terdiri daripada 250 polibeg cili yang diusahakan oleh En Ahmad Bakar, salah seorang daripada ahli B40 dari PAKUTA di Kg. Beserah, Kuantan. Beberapa orang staff akademik dari IIUM telah dijemput sebagai penasihat teknikal untuk projek ini. Koloni lebah kelulut juga telah diletakkan di dalam projek pilot ini. Selain dari pemindahan teknologi dan ilmu pengetahuan kepada ahli B40 PAKUTA berkenaan Amalan Pertanian Baik (GAP) bagi penanaman integrasi di antara fertigasi cili bebas racun dan penternakan lebah kelulut, elemen tambahan dari aspek pengurusan kewangan dan dokumentasi perniagaan termasuk amalan pasca tuai juga telah turut dijalankan.

Kata kunci: Projek komuniti, Sustainable Development Goal, Penternakan integrasi lebah kelulut, Fertigasi cili bebas racun, Mesra alam sekitar.

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Introduction

The 'Life on Land' is one of the Sustainable Development Goals (SDGs) listed by the United Nations Development Programme (UNDP) as a universal call to end poverty, protect the planet and ensure that all people enjoy peace and prosperity by 2030. Specifically, SDG15 'Life on Land' emphasises on integrating the ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and mobilising a significant increase in the financial resources to conserve the biodiversity and ecosystems. In addition, the SDG 2 'Zero Hunger' emphasize on achieving food security, improved nutrition and promote sustainable agriculture. Food security could be regarded as a global issue and challenge in achieving the holistic SDG. In order to achieve food security, sustainable agricultural practices must be promoted and adopted on a global scale. Excessive use of pesticides will not only lead to environmental contamination but will also jeopardise human health as well as damaging the natural ecosystem and biodiversity (Rostam et al., 2018).

The use of bees as natural pollinators would enhance the process of pollination and fertilisation of flowers which will lead to higher productivity of fruit and overall yield of plants and crops. The natural ecosystem between insect pollinator such as bees and plants have been more or less affected due to excessive usage of harmful agrochemicals, mainly pesticides and fungicides. Therefore, the present KTP-RIGS project is executed as an effort to promote pesticide-free agricultural practices for food production and retain the natural ecosystem and symbiosis between insect pollinator and plants. This research is inspired by the *Quranic* verse (2:195) that encourages us to do good things and avoid doing unsustainable practices as below:

وَأَنفِقُواْ فِي سَبِيلِ ٱللَّهِ وَلَا تُلۡقُواْ بِأَيۡدِيكُمۡ إِلَى
ٱلتَّهۡلُكَةِۛ وَأَحۡسِنُوٓاْۛ إِنَّ ٱللَّهَ يُحِبُّ ٱلۡمُحۡسِنِينَ ١٩٥

"Spend in the cause of Allah and do not let your own hands throw you into destruction ⌜by withholding⌝. And do good, for Allah certainly loves the good doers" (2:195).

Among the various types of crops, chilli has been selected to be the chosen crop for this KTP-RIGS project. Based on the latest 'Supply and Utilization Accounts Selected Agricultural Commodities, Malaysia 2016-2020' released by the Department of Statistics Malaysia (DOSM), chilli recorded a self-sufficiency ratio (SSR) of only 30.9%, indicating that the local supply can only fulfil 31% of the national total demand of chilli. In addition, per capita consumption (PCC) of chilli in 2020 was about 2 kg/year. Hence, the import dependency ratio (IDR) of chilli was recorded at 72.4, which is the highest among other types of vegetables. From the free market economic point of view, an insufficient supply of highly demanded commodity will result in an unavoidable price hike which may lead to a food crisis, hence jeopardising the food security of the nation. However, from the perspective of microeconomics, highly demanded commodities may be sold at higher prices which will contribute to a higher profit for the farmers and other parties along the supply chain. For example, the farm-gate price for 'cili api bara' is RM16/kg, which is much higher compared to the red chilli (cili besar) and 'cili solok', which are sold at RM6/kg and RM4/kg, respectively. Hence, this KTP-RIGS project focuses on the integrated farming of pesticide-free 'cili api bara' with an easy rearing insect pollinator, the stingless bee (kelulut). Moreover, this project also promotes community engagement among the IIUM researchers, local community and industry, leading towards economic empowerment of the local community. In the case of the proposed KTP-RIGS, a team of IIUM

researchers with diverse backgrounds and expertise (i.e. crop production, stingless beekeeping, engineering and technology, pharmaceutical industry and financial/economics), coming from various Kulliyyah (i.e. Science, Engineering, Nursing, Pharmacy, and IIBF) and campuses (i.e. Kuantan and Gombak) gathered to transfer the integrated knowledge in the academia for the benefit of the ummah, public community and also the industry.

Methodology

Collaborative partners of this project are the PAKUTA as a community partner and Organic Farm Venture (OFV) as an industrial partner. Although PAKUTA was newly established on February 2020, just before the Covid-19 pandemic, the society managed to recruit nearly 30 members with 10 members in the B40 income group. Moreover, PAKUTA has also managed to assist about fifty (50) B40 families during the pandemic through social welfare activities by distributing a food basket. Meanwhile, OFV is a start-up company focusing on agriculture and farming activities mainly chilli fertigation, mushroom, and rabbit rearing. In overall, the project involved knowledge transfer activities on GAP and proper management of stingless beekeeping. The pesticide-free chilli fertigation farming of about 250 polybags was conducted at the house of one of the PAKUTA members (location coordinate: 3°52'34"N 103°21'50"E) as shown in Figure 1. A stingless bee log was also installed in the compound area.

Figure 1: Location, layout, and chilli polybags arrangement

In addition, a periodic visit by the IIUM experts to transfer the knowledge and hands-on skills on GAP in the application of organic pest control, fertiliser, and proper management of stingless beekeeping was taught. Knowledge transfer and training sessions on financial literacy, proper financial record keeping and business management, proper harvesting methods of stingless bee honey and good

post-harvest practices were also conducted. Overall activities conducted starting from March 2022 are shown in Figure 2. Chilli plants started flowering within two months after transplanting. Harvesting period lasted about three months duration after the plants started flowering.

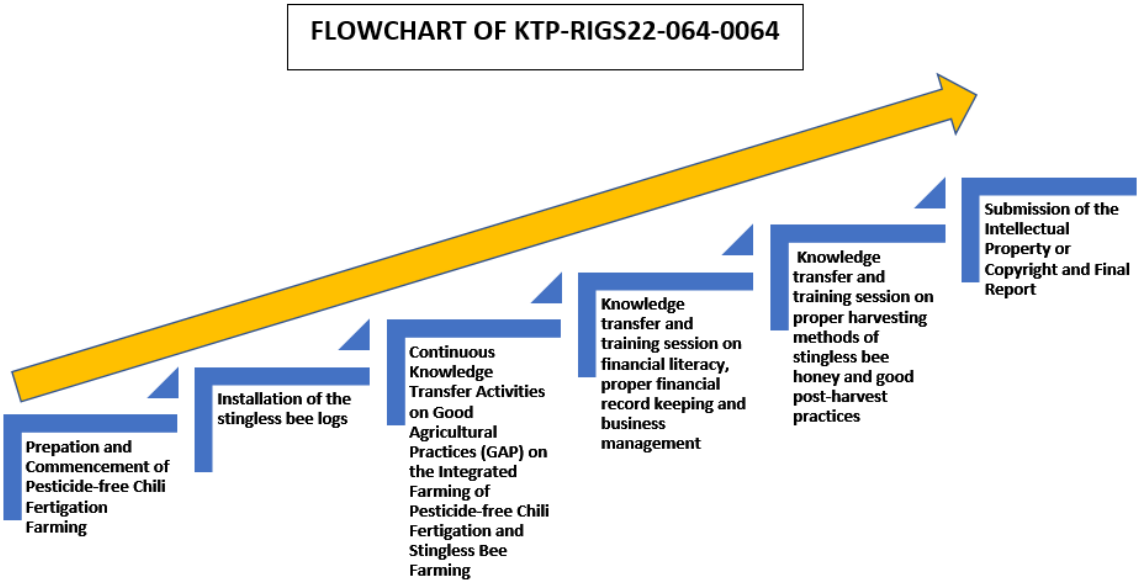

Figure 2: Flow chart of the project

Results and Discussion

In the present project, pesticide-free chilli fertigation farming was successfully conducted (Figure 3). The pests and diseases of the plants were controlled by using organic pesticides such as wood vinegar and neem oil. Chilli (*Capsicum annum* L.) is known to be one of the vegetable crops that have various uses in culinary preparations and traditional medicine (E'rahim et al., 2021). It is a member of the Solanaceae or also known as nightshade family that also consists of other common species in Malaysia such as tomatoes, potatoes, and petunias which could be propagated through seeds (Shamsuddin et al., 2021). The variety of this species can be characterised according to the different sizes and shapes. This vegetable species is known to contain low in calories and high in potassium, vitamin A, and vitamin C (Chew, 2018). Additionally, it has been proven that fresh chilli is an outstanding source of metabolites with well-known antioxidant activity, suggesting that it may be used to cure cancer, prevent gastric ulcers, and boost immunity (Sun et al., 2007). All of *C. annum's* beneficial characteristics demonstrate the crop's importance in terms of uses, nutritional value, and medicinal properties. Fertigation is a modern farming system with the use of periodic watering (irrigation) and fertiliser application. The word fertigation is actually a combination of fertilizer and irrigation. In the fertigation system, fertiliser is applied in the form of liquid fertiliser, known as AB fertiliser. The fertiliser is applied along with irrigation on a periodic basis using an automated system consisting of a water pump, timer and drip irrigation system. Fertigation system promotes rapid root growth, optimum nutrient uptake and overall crop yield.

Figure 3: A) Fresh chilli, B) Weight of harvested chilli, C) Wood vinegar and D) Neem Oil

In addition, an integrated farming of pesticide free chilli and stingless bee was also successfully established (Figure 4). Indeed, a copyright entitled "Panduan Teknologi Integrasi Cili pesticide free - Kelulut was also produced (Figure 5). Stingless bee industry could be regarded as an emerging industry in Malaysia. As compared to honey bee from the genus of *Apis sp*., stingless bee is easier and more convenience to be reared, even in the neighbourhood areas due to its stingless behaviour and convenient to handle. Stingless bee honey has been demonstrated scientifically to have abundance of goodness for health, such as improving memory and gut health (Mustafa et al. 2019). The potential of stingless bee honey in maintaining good health and therapy have made it labelled as a superfood in the 10-10 MySTIE Framework. In fact, MARDI declared stingless bee as a potential industry for national honey production and pollination service serves an alternative to current beekeeping project using *Apis sp*. (Ismail & Ismail 2018).

The National Stingless Bee Industry Development Plan has been launched by the Department of Agriculture (DOA) and invite industrial players and stingless beekeepers to collaborate in developing this industry. DOA has reported that there were more than 700 stingless beekeepers in Malaysia with 58,593 colonies within their farms. However, this number is still insufficient to meet the local demands for individual consumption and industrial use (Ismail & Ismail 2018). With appropriate knowledge and technology transfer programmes and human resource development, stingless bee industry in Malaysia can be enhanced towards making this industry as a country's commodity (Isah et al. 2019). Malaysia is still importing honey from other countries to meet the local demand and this indicates the need to increase the local supply of honey (Isah et al., 2019). This opportunity will act

as a promising future for Malaysians, individuals or organisations, to embark into the stingless bee industry as a sustainable income resource.

Figure 4: A) Stingless bee colony and B) Honey extraction process

Figure 5: Copyright on integrated pesticide free chilli and stingless bee farming

Apart from farming, a knowledge transfer and training sessions on financial literacy, proper financial record keeping, and business management were also conducted (Figure 6). The knowledge transfer session enhanced participant's knowledge and understanding of personal financial management particularly on the importance of budgeting, savings, reducing expenses and investments. Moreover, a knowledge transfer session on proper harvesting methods of stingless bee honey and good post-harvest practices was also successfully conducted (Figure 6). In this knowledge transfer session, participants learned about basic management of stingless bee farming, proper honey harvesting procedures, and good post-harvest practices. Honey product was also bottled and sold to the public.

Figure 6: Knowledge transfer and training on financial literacy and stingless bee farming. A) Poster on financial literacy session. B) Session of C) Group photo of participants attended financial literacy session. D) Poster on Stingless bee keeping. E) Group photo of participants attended stingless bee keeping session. F) Honey product from the project.

Conclusion

The present KTP-RIGS project combines both aspects of crop and honey production into an integrated system following the *sunnatullah* and natural ecosystem. As mentioned in Surah Al-Qamar, verse 49, Allah has created everything on this earth with intricacy making it completely perfect.

٤٩ ۞إِنَّا كُلَّ شَيْءٍ خَلَقْنَـٰهُ بِقَدَر

"Verily all things we have created in proportion and measure." (54:49)

The stingless bee will function as a natural pollinator of chilli flowers which will promote a higher rate of successful fertilisation and fruit development, translating into higher harvestable yield. At the same time, the bees will produce honey that may be self-consumed or to be sold in the market for higher returns. This knowledge transfer project brings benefits for both the PAKUTA members and Organic Farm Venture personnel, contributing to the enhancement of their economic well-being. This knowledge transfer project has also benefitted the villagers and other communities around Beserah areas.

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