



Development Prospects of Biopharmaceutical Plants in Palembang City

Meri Ariyantini^{1*}, Mirza Antoni², R. Riswani²

¹ Master Programme in Management Agribusiness, Faculty of Agriculture, Sriwijaya University, Jalan Padang Selasa 524, Palembang, South Sumatra 30139, Indonesia.

² Agribusiness Program, Faculty of Agriculture, Sriwijaya University, Jalan Raya Palembang-Prabumulih km 32, Indralaya, Indonesia.

*Corresponding author

E-mail address: meri_ariyantinisip@yahoo.com (Meri Ariyantini).

Peer review under responsibility of Biology Department Sriwijaya University

Abstract

Biopharmaceutical plants or medicinal plants are plants grown in the garden that have medicinal properties. The types of biopharmaceutical plants have been cultivated for more than 5 years and are managed by the people of Palembang City who are members of farmer groups and women's groups of biopharmaceutical plant farmers of galangal and lemongrass. Besides being consumed in a fresh form as a kitchen spice, it can also be processed as an addition to herbs, chips, and shredded galangal and can also work as a vegetable pesticide and fertilizer for plants. This study aims to see the prospects for the development of biopharmaceutical plants in the city of Palembang. The method used is a survey method, data collection is carried out directly through interviews using questionnaires. Data processing uses indicator analysis techniques based on, cultivation techniques and demand for biopharmaceutical plants in the last year, namely 2020 with 50 respondents, farmers of biopharmaceutical plants. The results of the analysis show that the survey of farmers' knowledge level of biopharmaceutical crops is 84%, cultivation technique capability is 78% and demand for biopharmaceuticals in 2020 will increase by 15% for galangal and 22% for dissolution in the previous year. Judging from the level of interpretation of the score of each indicator which is above 60% and the demand for biopharmaceutical plants has increased. That can be said the prospect of developing biopharmaceutical plants in Palembang City is promising.

Keywords: Biopharmaceutical Plants, Knowledge, Cultivation, Demand

Received: November 15, 2021, Accepted: December 1, 2021

1. Introduction

Indonesia has 30,000 species of plants with biopharmaceutical properties from 40,000 types of flora that grow in the world. As many as 26% of these plants have been cultivated as many as 940 types of plants have been used as traditional medicine and 74% are still growing wild in the forest [1]. The use of biopharmaceutical plants has long been carried out by the Indonesian people according to their knowledge. Knowledge about the use of biopharmaceutical plants increases along with increasing knowledge of types of diseases [2]. Biopharmaceutical plants in Indonesia have a really important role, especially for people who live in rural areas with limited health facilities. Biopharmaceutical plants that are of the empon-empon type, one example is a ginger rhizome, this plant has various proven properties including, free radical, and chemotherapy agent cancer [3].

The opportunity for the development of biopharmaceutical plant cultivation is still really wide open in line with the development of the herbal medicine, herbal medicine, phytopharmaca, and traditional cosmetics industries. The biopharmaceutical plant is defined as a type of plant that which part or all of the plant is used as an ingredient or medicinal herb. Other experts classify medicinal plants into three groups, namely: traditional biopharmaceutical plants are plant species that are known or believed by the public to have medicinal properties and have been used as raw materials for medicines, modern plants are species plant that have been scientifically proven to contain compounds or ingredients. Bioactive with medicinal properties and their use can be justified medically and potential biopharmaceutical plants are plant species that are suspected to contain or possess medicinal compounds or bioactive ingredients but have not yet been proven to be used in a medical-scientific manner as medicinal ingredients.

Horticultural data shows that the collected biopharmaceutical plants include 15 (fifteen) types of biopharmaceutical plants, which consist of *Ginger*, *Galangal*, *Aromatic ginger*, *Turmeric*, *Zingiber zerumbet*, *Curcuma domestica*, *Curcuma heyneana*, *Fingerroot*, *Dringo*, *E. cardamomum*, *Noni*, *Phaleria macrocarpa*, *Stachytarpheta mutabilis*, *Andrographis paniculata*, and *aloe vera*. Beside from the unit of the harvested area and the form of the results, biopharmaceutical plants can be divided into rhizome and non rhizome plants. The group of rhizome plants consist of *Ginger*, *Galangal*, *Aromatic ginger*, *Zingiber zerumbet*, *Curcuma domestica*, *Curcuma heyneana*, *Fingerroot* dan *Acorus calamus*. Traditional herbs and biopharmaceuticals have long been used by the Indonesian people as an alternative to food mixtures or to cure and prevent the emergence of various diseases. The content of phytochemical compounds in traditional spices and biopharmaceuticals is referred to as compounds that play a role in their activities that are beneficial to human health.

In the City of Palembang, biopharmaceutical plants are used in the cultivation of Family Welfare Empowerment or commonly abbreviated HATINYA PKK [4]. PKK is one of 10 PKK cultivation activities that aims to increase the of all people in the City of Palembang to plant various biopharmaceutical plant and process biopharmaceutical plants into plants that are beneficial to health and this activity is included in Pokja III and IV.

Palembang city has 18 sub-districts and 108 urban villages with an area of 400.2 km². Of the 18 sub districts that focus on cultivating Toga which includes Biopharmaceutical plants, Sematang Borang District is only limited to seasons and processing results for certain activities. The types of biopharmaceutical plants that are cultivated and managed by farmers or women who are members of farmer groups are Toga plants which are included in Biopharmaceutical plants, rhizome types such as galangal and lemongrass. Besides being consumed in fresh form as a kitchen spice, this plant can also be processed as additional seasoning, chips and shredded galangal. It is different in Plaju District, there is a group of women who use Moringa leaves, vile shard, and bitter as herbal tea ingredients. The center for galangal farmers is in Sematang Borang District. While lemongrass is a medicinal plant but is included in seasonal horticultural plants. Medicinal plant resources in the city of Palembang have been known to have properties to improve human health. So far, the Toga plant has only been used as a food and beverage flavoring ingredient and as a raw material for traditional herbal medicine.

Based on data from the Central Statistics Agency in 2020, namely in Palembang City, the harvest area of rhizome biopharmaceutical plants cultivated by farmers is the highest type of galangal biopharmaceutical plant, which is 47 hectares and the center for galangal farmers is in Sematang Borang District [5]. Meanwhile, lemongrass

is a biopharmaceutical plant but is included in horticultural seasonal crops. The area of lemongrass cultivation in Palembang is approximately 1.2 hectares based on data from the Agricultural Extension Information System (Simluhtan).

In Sematang Borang Sub district, for more than five years, family medicinal plants which are included in agricultural crops and plants, both cultivated and processed, the results are galangal chips and herbal drinks. Based on interviews with farmers, that most of the cultivation is hereditary and has become the main thing that is cultivated even though the price received by farmers is lower than the market price.

The development of biopharmaceutical plants in Palembang City is based on indicators, namely the level of knowledge, cultivation ability and the number of requests in a certain year. In addition, research that exposes biopharmaceutical plants in the city of Palembang is also still relatively minimal.

Definition of Biopharmaceutical Plant

Biopharmaceutical plants are gifts from nature to help people in curing diseases so that they can live healthy lives. According to [6], biopharmaceutical plants are plants that are used by the community to be mixed and served as medicine to cure diseases that are intentionally planted or grow wild.

According to [7], biopharmaceutical plants are one of the important components in medicine, in the form of traditional herbal ingredients and have been used for hundreds of years. Biopharmaceutical plants have been used by the Indonesian people for centuries in the form of herbal medicine to solve various health problems they face and are a cultural wealth of the Indonesian nation that needs to be nurtured, cared for and preserved. The development of this natural biopharmaceutical deserves greater attention not only because of its open development potential, but also the market demand for raw materials for these traditional medicines continues to increase for domestic and international needs.

Benefits of Biopharmaceutical Plants

There are several important benefits regarding biopharmaceutical plants which are viewed from several sides, including the economic side, the environmental side, and the social side [8]

- a. The economic benefits of biopharmaceutical plants are that they can increase people's income and improve public health plants so as to reduce the use of synthetic which are relatively expensive and gave many side effects.
- b. The benefits of biopharmaceutical plants from the en-

vironmental point of view are that they can become natural collections in maintaining biodiversity and preserving the original plants of Indonesia.

- c. Social benefits of biopharmaceutical plants, which can increase knowledge about medicinal plants.

Parts of Plants Used as Medicine

Utilization of plants can use one or all parts of the plant. Plant parts used as biopharmaceuticals are tubers, stems, leaves, shoots, roots, fruits, and flowers. These parts can be used directly as biopharmaceuticals or must go through several processing processes and then used as biopharmaceuticals [2].

According to [6] the parts of plants that are most widely used by the community are the leaves, while those that are used the least are the flowers, stems, fanfare, and shoots.

According to [9] besides being beneficial for health, biopharmaceutical plants also have high economic value so that they can be sold as raw materials for traditional, or sold in finished dosage forms such as instant herbal medicine. Cultivation of biopharmaceutical plants for families can spur small and medium-sized businesses in the field of herbal medicines even if it is done individually.

According to [10] in his research revealed the function of the yard as a source of income and improvement of nutrition, this is because the yard can increase income if it is managed properly. By planting various plants, you can reap the benefits at once, namely to be used by the family and the excess can be sold, even more so if it is used as raw material for agro-industry so that the results of these plants gain added value by turning them into processed products.

2. Materials and Methods

2.1 Research Time

This research was conducted from August to October 2021 in three sub-districts, namely Suka Mulya Village, Karya Mulya Village, and Sri Mulya Village, which are centers of biopharmaceutical plant farmers in Sematang Borang District, Palembang City.

2.2 Sampling Method

The sampling method used in this study is the homogeneous purposive sample method. The homogeneous purposive sample method is a sample chosen because it has the same characteristics or a collection of characteristics, namely the same farmer who cultivates galangal and lemongrass biopharmaceutical plants for more than five

years. The samples taken are farmers who own land for biopharmaceutical plants in Suka Mulya, Sri Mulya and Karya Mulya Villages, Sematang Borang District, Palembang City. From each district, two farmer groups have high production. The total population in this study was 82 populations with a sample size of 50 respondents, which is 60 percent of the population.

2.3 Research Variables and Measurement Scale

To measure the level of success of the cultivation of biopharmaceutical plants, namely by looking at how much knowledge of biopharmaceutical plant farmers about the types and benefits of biopharmaceutical plants, the ability of farmers to cultivate biopharmaceutical plants properly and correctly and how much demand for biopharmaceutical plants, both fresh and processed in the form of the last one year. Assessment of respondents' answers is done by giving a score of 1 to 5.

Table 1. Assessment Variables and Operational Definitions of Assessment

Variable	Indicator	Scale Measurement
Prospect	1. Increasing knowledge of farmers about the types and benefits of medicinal plants 2. Farmers are able to apply the cultivation of medicinal plants properly and correctly 3. demand for medicinal plants in a given year	1. Promising 2. Not Promising
Knowledge	1. Types of medicinal plants 2. Benefits 3. How to process it	5: Really Understand 4: Understand 3: Understand enough 2: Not Understand 1: Really Not understand
Cultivation Ability	1. Seeding 2. Land cultivation 3. Planting 4. Harvest 5 Post harvest	5. Really Capable 4: Capable 3: Capable Enough 2: Not capable 1: Really Incapable
Demand	Increasing the demand for biopharmaceutical plants	If the demand for medicinal plants in a certain year has increased compared to the previous year, it is said that the prospect of developing medicinal plants is promising

To find out the answers of the respondents, the calculation and grouping of the rating scales were carried out according to the ideal score. The ideal score is determined in the following way;

Ideal score = Scale Value x Number of Respondents

Description of score interpretation:

Score: 5

Number 80 % < X 100 %:

Really Understand / Really Capable

Score: 4

Number 60 % < X 80 %:

Understand / Capable

Score: 3

Number 40 % < X 60 %:

Understand enough / Capable Enough

Score: 2

Number 20 % < X 40 %:

Not Understand/Not capable

Score: 1

Number 0 % X 20 %:

Really Not understand/Really Incapable

If from the respondent's data based on the questionnaire distributed, the interpretation of the score for the level of knowledge and cultivation ability is equal to 60% and up to 100%. Meanwhile, if the number of requests for biopharmaceutical plants increases based on the demand graph, it can be said that the development of biopharmaceutical plants in the city Palembang Promising.

2.4 Data Collection Procedure

Data collection was carried out directly through interviews using questionnaires, both orally and in writing which required face to face contact between the researcher and the respondent. In general, this research is focused on surveys, in-depth interviews with sample farmers, and analyzing the data obtained (exploration research).

2.5 Data Analysis

The data obtained from the field were analyzed by tabulation and then analyzed mathematically and described descriptively by describing the data obtained in the field in the form of a systematic description.

3. Results and Discussion

Prospects for the Development of Biopharmaceutical Cultivation

The prospect of developing biopharmaceutical plant cultivation can be seen many people know the types and use of medicinal plants both for their own consumption as family medicine based on the benefits of these biopharmaceutical plants and for sale, as well as the sustainability of biopharmaceutical plant cultivation will be successful if farmers can apply the techniques proper cultivation of biopharmaceutical plants [11].

There are several types of biopharmaceutical plants which each region has its own potential to be cultivated and utilized, such as in the city of Palembang, biopharmaceutical plants or medicinal plants that are often cultivated and utilized and processed into herbal drinks are rhizomes such as ginger, lemongrass, turmeric, kaempferia galanga, ginger and galangal. The types and benefits of biopharmaceutical plants can be seen in table 2 below:

Based on [12], the tradition of consuming ingredients from biopharmaceutical plants for various purposes has been carried out by previous ancestors. One of the goals is to treat, both for yourself and for others. This shows that traditional medicine using biopharmaceutical plants has become a culture and has real contribution to health for the community. Therefore, ingredients from biopharmaceutical plants are constructive, effective, safe and relatively inexpensive, so the presence of these ingredients will be needed at any time. Traditional biopharmaceutical ingredients are believed to provide healing for almost incurable diseases.

Utilization of biopharmaceutical plants is part of the Palembang community's strategy in meeting their needs to overcome health-related problems. This strategy is part of a certain community culture known as local wisdom. In the context of this research, the culture in question is the local culture of the Palembang people in relation to nature which defines local wisdom as a view of life and knowledge as well as various life strategies in the form of activities carried out by local communities in answering various problems in meeting their needs.

Table 2. Types and Benefits of Biopharmaceutical Plants **Farmer Knowledge**

Type of Plants	Benefits
<i>Gynura divaricata</i>	Anticoagulants (coagulants = substances that facilitate and accelerate blood clotting), dilute blood clots, stimulate circulation, eliminate bleeding, remove heat, and cleanse toxins
<i>Zingiber officinale</i>	As a traditional biopharmaceutical and phytopharmaca because of the presence of gingerol, overcoming bone pain (the active ingredient of the extract)
<i>Amomum compactum</i>	As a flavor enhancer in food, overcoming heartburn, intestinal spasms, liver and gallbladder complaints, loss of appetite, cold, cough, sore mouth and throat, infectious diseases, stimulant for urinary problems, constipation
<i>Strobilanthes crispus</i>	Destroys gallstones, Treats bladder disease, As a laxative, lowers cholesterol
<i>Kaempferia galanga</i>	Empirically used for: cough, bacterial infection, dysentery, appetite, tonic, colds, stomachache, asthma and anti-fungal biopharmaceuticals.
<i>Curcuma domestica</i>	Stops bleeding, itchy biopharmaceuticals, appendicitis appendicitis, uterine inflammation, vaginal discharge, stomach and liver disorders biopharmaceuticals
<i>Alpinia galanga</i>	Eczema, tinea versicolor, gabag, scabs, stomach ulcers and ear infections
<i>Zingiber zerumbet</i>	New kidney crushing and laxative
<i>Allium Sativum</i>	can increase and accelerate the activity of mucous membranes in the respiratory tract, which helps relieve congestion and expel mucus
<i>Averrhoa bilimbi L</i>	As a biopharmaceutical for rheumatism and skin diseases such as tinea versicolor
<i>Morinda citrifolia</i>	Increase stamina, Lower high blood pressure, Reduce postoperative nausea
<i>Andrographis paniculata</i>	able to protect the liver from the negative effects of galactosamine and paracetamol, can suppress the growth of cancer cells
<i>Curcuma aeruginosa</i>	Increase appetite, overcome skin diseases, eliminate toxins in the body and treat intestinal worms
<i>Boesenbergia pandurata</i>	Overcoming digestive disorders, overcoming cavities, internal heat biopharmaceuticals and facilitating breast milk
<i>Curcuma zanthorrhiza</i>	Tto lower blood fat, prevent blood clots as an antioxidant, increase immunity

Source: B2P2TOOT Tawangmanu 2012.

The knowledge survey was carried out by filling out questionnaires. Respondents were taken as many as 50 samples of galangal and lemongrass biopharmaceutical farmers. Respondents in this survey consisted of women and men, namely women as much as 54% while men 46%. The age of the majority of respondents in the range of 40-49 years is as much as 36%. The final education of the respondents varied from the elementary, junior high and high school levels, but most of them were from the senior high school level, which was 44%. The number of respondents in SD, SMP and SMA, respectively, was 17, 11 and 22 (Table 3).

The survey was conducted to determine the level of knowledge of biopharmaceutical farmers in Palembang City. This is seen how much farmers know about the types of biopharmaceutical plants and the usefulness of the biopharmaceutical plants themselves are measured based on the value criteria and a measurement scale of 1 to 5.

Table 3. Respondent's Description

Characteristics	Frequency	Percentage
Gender		
Female	27	54
Male	23	46
Last Education		
Elementary School	17	34
Junior High School	11	22
Senior High School	22	44
Age		
30-39	10	20
40-49	18	36
50-59	17	34
60-69	1	2
70-79	4	8

Table 4. Farmer Knowledge Level

Value Criteria	Knowledge Level (%)	
	Score	Score Interpretation
5	80 % < X ≤ 100 %	Really Understand 84
4	60 % < X ≤ 80 %	Understand -
3	40 % < X ≤ 60 %	Understand enough -
2	20 % < X ≤ 40 %	Not understand -
1	0 % ≤ X ≤ 20 %	Really Not Understand 14

In the survey of farmers' knowledge level of biopharmaceutical plants, it was found that the level of knowledge of farmers was 84%, it means that farmers were really understanding about the types and benefits of biopharmaceutical plants. This is seen from the classification level, which is really understanding if the score is $80\% < X \leq 100\%$ (Table 4).

From Table 4 above, it can be seen that the level of Really understanding of farmers' knowledge about medicinal plants is mostly in the 4th assessment criteria, namely, as many as 43 respondents agree and the remaining 7 people do not really understand knowledge about medicinal plants, this is because those who understand get knowledge of medicinal plants that are passed down from generation to generation. from parents which are commonly used as an additional spice in the kitchen and are used as a medicine for health. In addition, some farmers can also process these biopharmaceutical plants to be used as vegetable pesticides and fertilizers in controlling pests and diseases in plants. While the 7 people only know it as an additional favor.

Technical Ability of Biopharmaceutical Plant Cultivation

In the city of Palembang, the most widely cultivated biopharmaceutical plants are rhizome plants such as ginger, turmeric, aromatic ginger and galangal. Based on data from the Central Statistics Agency of South Sumatra, the harvested area of biopharmaceutical plants can be seen in Table 5 below:

Table 5. Harvested Area of Biopharmaceutical Plants by Plant Type in South Sumatra (M2) 2017-2019

Type of Plants	2017	2018	2019
<i>Acorus calamus</i>	5450	5.476	10.894
<i>Zingiber officinale</i>	1.348.280	495.618	784.023
<i>Amomum compactum</i>	1.299	354	243
<i>Strobilanthes crispus</i>	9.56	11.348	717
<i>Kaempferia galanga</i>	153.072	205.297	413.460
<i>Curcuma domestica</i>	778.680	816.252	885.481
<i>Alpinia galanga</i>	556.828	510.675	654.778
<i>Zingiber zerumbet</i>	8.668	14.928	4.683
<i>Aloe vera</i>	1.111	3.238	31.149
<i>Phaleria macrocarpa</i>	5.020	19.042	3.114
<i>Morinda citrifolia</i>	3.492	9.319	2.683
<i>Andrographis paniculata</i>	1.412	5.773	16.326
<i>Curcuma aeruginosa</i>	3.820	8.574	15.444
<i>Boesenbergia pandurata</i>	3.261	6.714	12.771
<i>Curcuma zanthorrhiza</i>	21.517	23.414	60.707

Source: Central Bureau of Statistics, 2019

Based on [13] noted that the harvested area for the most widely cultivated biopharmaceutical plants is the rhizome type, namely *ginger*, *turmeric*, *galangal*, *aromatic ginger*. At the city of Palembang, of the four types of rhizome plants that are widely cultivated in home gardens and agricultural land are galangal and lemongrass. For Harvest Area, Production and Productivity of galangal in Palembang City in 2015 – 2019 can be seen in table 6 below.

Table 6. Harvested Area, Production and Productivity of Galangal in Palembang City 2015-2019 (M²)

Year	Harvested Area (m ²)	Production (kg)	Productivity (Kg/M ²)
2015	447.906	1.115.286	2.49
2016	526.071	1.399.349	2.66
2017	556.828	1.347.523	2.42
2018	510.675	1.128.404	2.21
2019	654.778	1.532.180	2.34

Source: Central Bureau of Statistics and Directorate General of Horticulture, 2019

The ability of farmers to cultivate biopharmaceutical plants can be seen based on filling out the questionnaire. Based on these data, the level of ability of farmers' cultivation techniques is 78%, meaning that farmers can carry out biopharmaceutical plant cultivation techniques properly and correctly. This can be seen from the level of classification that is capable of the score is $60\% < X < 80\%$ (Table 7).

Table 7 Ability Level of Farmers' Cultivation Techniques

Value Criteria	Cultivation Techniques Ability (%)	
	Score	Score Interpretation
5	$80\% < X \leq 100\%$	Really Capable
	%	Capable
4	$60\% < X \leq 80\%$	Capable enough
	%	
3	$40\% < X \leq 60\%$	Not capable
	%	
2	$20\% < X \leq 40\%$	
	%	
1	$0\% \leq X \leq 20\%$	Really Incapable

The 50 respondents, there were 11 farmers who were not able to carry out biopharmaceutical plant cultivation techniques properly and correctly, because

they still did not know how to control pests and diseases in biopharmaceutical plants, the dose of fertilization and focused more on processing results than cultivating because of their yards. In urban areas and the main occupation is housewives. Meanwhile, 39 other farmers are able to perform biopharmaceutical plant cultivation techniques because their main occupation is farmers and the experience of farmers is above 10 years on average.

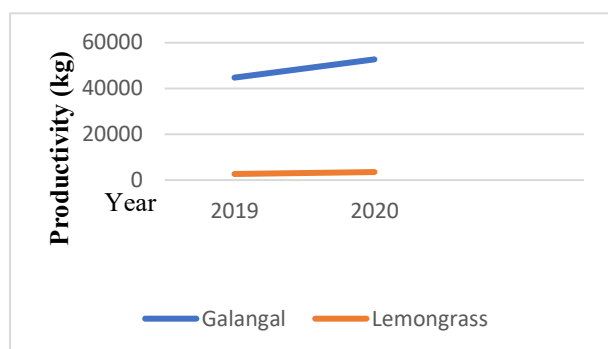


Figure 1. Graph of Demand for Biopharmaceutical Plants (Source: Respondents/farmers of biopharmaceutical plants)

Biopharmaceutical Plant Demand

Biopharmaceutical plants have a fairly high contribution to world drug production. From a total of about 40.000 types of medicinal plants that have been known in the world, 30.000 of them are allegedly located in Indonesia. This number represents 90% of medicinal plants found in the Asian region. Of these, 25% of them or about 7,500 species are known to have herbal or medicinal plant properties [1]. Palembang City is one of the cities producing biopharmaceutical plants such as galangal and lemongrass [13]. Based on the results of research in the field, it is known that the demand for biopharmaceutical plants in the city of Palembang in the last year was 52,570 kg of galangal and 3,344 kg of lemongrass, which can be seen in the graph below.

From the results of interviews and questionnaires, it can be seen that the demand for biopharmaceutical plants in 2020 has increased, for galangal has increased by 15% and for lemongrass has increased by 22%. One of the factors influencing the increase in demand for biopharmaceutical plants is due to the COVID-19 pandemic where biopharmaceutical plants are believed to increase the body's immune system.

4. Conclusion

Biopharmaceutical plants such as galangal and lemongrass have often been used by the people of Palembang City, both as kitchen spices, mixtures of herbal drinks and as medicine. The results of the analysis show that in the survey the level of knowledge of biopharmaceutical plant farmers is 84%, the ability of cultivation techniques is 78% and the demand for biopharmaceutical plants in 2020 increases by 15% for galangal and 22% for lemongrass. Compared to the previous year. Judging from the level of interpretation of the score of each indicator which is above 60% and the increasing demand for biopharmaceutical plants, it can be said that the prospect of developing biopharmaceutical plants in Palembang City is promising.

5. Acknowledgement

Thanks to Mr. Ir. Mirza Antoni, M.Sc., Ph.D and Mrs. Dr. Riswani, S.P., M.Si for all the input and suggestions and guidance so that this research is completed, and thanks to all parties involved in the process of making this journal.

References

- [1] L. Sari and N. Andalia. 2019. Inventarisasi Tumbuhan Obat di Taman Hutan Kota Banda Aceh. *Jurnal Serambi Konstruktivis*. Diakses 21 Juni 2021.
- [2] K. Tadjuka, S. Ningsih, dan B. Toknok. Keaneekaragaman Jenis Tumbuhan Obat Pada Kawasan Hutan Lindung Di Desa Tindoli Kecamatan Pamona Tenggara Kabupaten Poso. *Jurnal Warta Rimba*, Vol. 2 No. 1, PP. 120 – 128. 2014.
- [3] DM Syafitri, J Levita, M Mutakin, A. Diantini. A review: Is ginger (*Zingiber officinale var. Roscoe*) potential for future phytomedicine. *Indonesian District, Poso Regency. Jungle News*, Vol. 8. No. 1, PP. 120-128. 2018.
- [4] Harnojoyo, S. 2020. Kegiatan Lomba Halaman Asri Teratur Indah dan Nyaman atau disingkat HATINYA PKK. Palembang.
- [5] Badan Pusat statistik. 2020. Kelompok Tanaman Biofarmaka Rimpang. Jakarta. Statistik Tanaman Biofarmaka Indonesia.
- [6] Gunadi, D. 2017. Studi Tumbuhan Obat Pada Etnis Dayak di Desa Gerantung Kecamatan Monterado Kabupaten Bengkayang. Fakultas

Kehutanan Universitas Tanjung Pura.

- [7] Astria, S. Budhi, dan L. Sisillia. 2014. Kajian Etnobotani Tumbuhan Obat Pada Masyarakat Dusun Semoncol Kecamatan Balai Kabupaten Sanggau. 400-406. Online. Tersedia: Jurnal. untan.ac.id. Diakses 21 Juni 2021.
- [8] IR. Sastrahidayat, 2016. Penyakit Pada Tumbuhan Obat-Obatan, Rempah-Bumbu dan Stimulan. Malang: UB Press.
- [9] Batubara, P. 2020 (*Natural Product Chemistry-Center of Tropical Biofarmaka Bogor Agriculture Institute, Indonesia*), (*Scopus Id: 26031903000*).
- [10] A. Aseptianova dan E. H. Yuliany. Penyuluhan Manfaat Belimbing Wuluh (*Averrhoa bilimbi Linn.*) sebagai Tanaman Kesehatan di Kelurahan Kebun Bunga, Kecamatan Sukarami, Palembang. Abdihaz: Jurnal Ilmiah Pengabdian pada Masyarakat, Vol. 2 No. 2. 2020.
- [11] A. Hikmat, E. A. M. Zuhud, Siswoyo, dan E, Sandra. Revitalisasi Konservasi Tumbuhan Obat Keluarga (TOGA) Guna Meningkatkan Kesehatan dan Ekonomi Keluarga Mandiri di Desa Contoh Lingkar Kampus IPB Darma Bogor. Jurnal Ilmu Pertanian Indonesia. Vol. 16. No. 2. 2011.
- [12] Balai Besar Penelitian dan Pengembangan Tanaman Obat dan Obat Tradisional. Tawangmangu. Eksplorasi Pengetahuan Lokal Etnomedisin dan Tumbuhan Obat Berbasis komunitas di Indonesia. 2012.
- [13] Badan Pusat statistik. 2019. Kelompok Tanaman Biofarmaka Rimpang. Jakarta. Statistik Tanaman Biofarmaka Indonesia.