



Sultanate of Oman

Ministry of Education



# The effect of using aquarium algae as a biopesticide on plants in Ibri farms

Done by:

Taif Hamid Mubarak Al-Ghafri

Ibri Basic Education School (5-9)

Supervision by two teachers:

Ms. Sheikha Mubarak Al-Sawafi

Ms. Tarfa Hamid Al-Sakiti

December 2023



## Content:

Page	Content
3	Thanks
4	Study summary
5	Research Questions
5	Introduction and literature review
6	Search method 1- Research plan
7	Search method 2- Study site
8-12	Search method 1- Collect and analyze data 2- Results
13	Discuss the results
14	Conclusion
15	Recommendations
17	References
18-21	Appendices

## Thanks, and appreciation

I extend my sincere thanks to everyone who contributed with me in the work and conduct of this research, and I especially thank Ms. Sheikha Al-Sawafi, who has been supervising my research since the beginning of the steps of my preparation for it. I also extend my special thanks to Professor Tarfa Al-Sakiti, the administration of the Ibri School, Dr. Hafez Ali Al-Mahrouqi from Sultan Qaboos University, and my parents, who played the most important role in completing this research.

# Study “The effect of using aquarium algae as a biopesticide on plants in Ibri farms”

Done by:

Taif Hamid Mubarak Al-Ghafri

Superverse:

T. Sheikha Mubarak Al-Sawafi

T. Tarfa Hamid Al-Sakiti

School: Ibri Basic Education (5-9)

Al Dhahirah Governorate / Sultanate of Oman

## Study summary

The research aims to identify the impact of using aquarium algae as a biopesticide in the state of Ibri by answering the following questions:

- 1- What is the effect of using aquarium algae on plant growth?
- 2- What is the impact of using aquarium algae on the environment?

To answer these questions, a scientific research method was applied, where I used three pea plants and made three samples of the algae powder mixture. The first mixture contains algae powder and water, the second mixture contains algae powder, starch, sugar, and water, and the third mixture contains algae powder, water, and sugar. Then note the effect of each mixture of algae in eliminating parasites living on the three samples of pea plants, comparing the growth rates of the three samples, and the effect of biocides made from algae powder on the three samples. Apply the water protocol to well water in terms of (salinity, acidity, temperature, conductivity, oxygen) to know the effect of these elements on plant growth. I studied the three samples of the algae powder mixture and followed the growth of the three plant samples. I found that the plant that was sprayed with the algae powder mixture with water grew faster and had more leaves.

The accumulation of large quantities of algae in the water basins used for irrigation in the Sultanate of Oman constitutes an environmental problem as a result of the stagnation of this water for long periods. Most of the farms in the state suffer from this environmental phenomenon.

I interviewed a specialist in the field of agriculture, Dr. Hafez Al Mahrouqi from Sultan Qaboos University, about **the impact of using algae as crop pesticides and its impact on the environment.**

A community opinion poll was conducted on the problem of the appearance of green algae on the surface of water ponds in farms in the state of Ibri. I found that most people believe that this alga poses a problem for farms in terms of appearance and unpleasant odor, and that they see reusing it in agriculture as something good and new, perhaps better than... Chemical pesticides are a solution to this widespread phenomenon on farms. Therefore, I recommend the necessity of conducting more studies on aquarium algae and establishing multiple industries on them to make algae a natural wealth.

---

**Main terms:**

-(١) Algae: A group of living organisms capable of capturing light energy through the process of photosynthesis, converting inorganic materials into organic materials that store energy. In ancient times, alginates were considered simple plants, some of which are related to ambrosias or what may be called higher plants.

- (٢) Biopesticides are chemical substances used to combat agricultural pests such as insects, fungi, bacteria, weeds, or any type of organisms that can cause harm to plants.

## Research questions:

Through my research, I tried to answer the following questions:

What is the effect of using aquarium algae on plant growth?

What is the impact of using aquarium algae on the environment?

## Introduction and literature review:

Green algae grow on the bottoms or surfaces of water. They may also grow in the form of tangled threads sometimes, giving the water a green color in general. This is the most important thing that distinguishes green algae from others, as it consists of pigments that make it appear green, the most important of which is chlorophyll. The degree of green color varies between pale and bright, and the sizes also vary, as some types grow in a microscopic form that cannot be seen with the naked eye as individuals, and others grow to large sizes in a way that makes green algae resemble plants, as it can be difficult to distinguish between them and the aquatic plants that grow in the bottoms of aquatic systems.

Some types of algae are easy to distinguish through the senses of touch and smell, but extreme caution must be used in these two methods, due to the toxicity of some species and their possibility of causing skin rashes. (1) It is worth noting that there are certain types of algae that contain compounds capable of killing or inhibiting the growth of microorganisms, and these compounds are used in the development of biocides. Some algae contain substances such as phytons that can have antibacterial and antifungal properties (2). By observing the growth of large quantities of algae over the aquariums in the farms of Ibri State, I came up with the idea of doing a research project on the possibility of using aquarium algae as biocides for plants in the farms of Ibri State.

Developed countries have begun to benefit from algae to bring about environmental change and eliminate many of the problems that have begun to invade the soil. The most prominent of these is the problem of soil and plant salinity, as algae has proven its ability to eliminate soil and plant salinity and restore the elements that the soil loses by using it as a direct fertilizer for the soil, or dissolving it as a nutrient solution and adding live bacteria to it and using it to spray the plant after it has been fermented for several weeks. (3)

---

(1) -"HOW TO IDENTIFY ALGAE TYPES" Spero, Retrieved 31/10/2021. Edited

(2) -volume 33, pages3483–3496 (2021) Journal of Applied Phycology Published: 28 July 2021/

(3) <https://alroya.om/post/239810/%D8%AF%D9%88%D8%B1-%D8%A7%D9%84%D8%B7%D8%AD%D8%A7%D9%84%D8%A8-%D9%81%D9%8A-%D8%A7%D9%84%D8%AA%D9%86%D9%85%D9%8A%D8%A9-%D8%A7%D9%84%D8%A7%D9%82%D8%AA%D8%B5%D8%A7%D8%AF%D9%8A%D8%A9>

## Hypothesis:

I expect that a biopesticide can be made from algae that grows over the water of aquariums in farms in the state of Ibri, assuming that algae, like other plants, can be exploited in many industries, including the biopesticide industry.

## Search limits:

- **Spatial boundaries:** In this research, plant growth in the home garden will be followed.
- **Time limits:** Information was collected and examined from 9/15/2023 AD to 12/4/2023.

## Search methods:

**First, the research plan:**

Establish a timeline for the research plan

Table (1) shows the chronology of the research plan

<i>Process plan</i>	<b>Month</b>
-Formulate the research problem and determine the necessary tools	<b>September - October 2023</b>
-Collect and analyze data and conduct a scientific experiment	<b>November-December 2023</b>
-Conducting an interview with specialists (stem) About the possibility of using algae as a biopesticide -Conduct an opinion poll for a sample of the community	<b>October 2023</b>
-Drawing conclusions and writing research	<b>December 2023</b>
-Submitting the research in its final form -Preparing for local assessment	<b>February 2024</b>

Table (2) shows the work steps in the research

<b>execution time</b>	<b>Done by</b>	<b>Process</b>
September 2023 to December 2023	Taif Al- Ghafri	Bring pea plant seedlings infected with parasites and conduct an experiment Observing and analyzing the results of the experiment
October 2023		Conducting and analyzing the interview
November 2023		Use the water protocol
November 2023		Collect and analyze experiment data
January-February 2024		Writing conclusions and recommendations and completing the research

-Collecting information about the research topic from available books and the World Wide Web (Internet).

-Bring three seedlings of the same type of pea plant

-A sample of green aquarium algae was collected, dried, and then ground and turned into a powder

-Three types of algae powder mixture were prepared. The first was the algae powder mixture with water, the second was the algae powder mixture with sugar, starch and water, and the third was the algae powder mixture, water and sugar.

-Bring three cans of water sprayers

-Analyzing a well water sample, a water sample with live algae, and another water sample with algae powder using **GLOBE** devices, recording data, conducting an interview, and writing a research report.

-Adopting the experimental and investigative scientific research approach

-Follow up on plant growth on a daily basis and record observations and developments.



- Conducting an interview with Dr. Hafez Al-Mahrouqi
- Collect data and organize it into tables.
- Entering data into the program's website [www.globe.gov](http://www.globe.gov)
- Analyzing data and representing it graphically.

### Study tools:

- Three seedlings of pea plants
- Samples of algae powder
- Water - Starch – Sugar

### Secondly, the study site

The study was carried out in Ibri State, Al Dhahirah Governorate, specifically at the farm (Maqniyat), as a model for obtaining algae samples that we want to apply as an agent affecting plants.



## Search methods



### Third, collect and analyze data

-Data related to the first question was collected by applying the experimental scientific research method, making three pesticides, the first a mixture of algae powder with water, the second a mixture of algae powder with starch and sugar, and the third an algae powder with sugar, observing the growth of pea plants and the effect of biocides on the plants, and recording the data.

-Scientific measurements were performed to obtain digital data for salinity, conductivity, temperature and humidity properties using GLOBE instruments.



The pictures above show the effect of pesticides on plants, as the plant in the third picture is larger and more growing when it was sprayed with the pesticide that contains (algae + water), which is more effective and a treatment for plants from agricultural pests.

The following picture shows the density of pea plant leaves that were sprayed with the mixture consisting of (algae powder + water)



The two pictures show the pea plant that was sprayed with a mixture of algae powder with water and starch, and the second was sprayed with a mixture of algae powder with water, starch, and sugar.



Table (1) shows the speed of plant growth and the number of leaves that grew during the spraying stage with biocides.

The third sample was sprayed with a mixture consisting of (algae powder + water + sugar)		The second sample was sprayed with a mixture consisting of (algae powder + water + starch + sugar)		The first sample was sprayed with a mixture consisting of (algae powder + water)		Date
Number of sprouted leaves	Growth	Number of sprouted leaves	Growth	Number of sprouted leaves	Growth	
7	Same	7	Same	7	Same	2023/10/23
7	Same	7	Same	8	It increased a little	2023/10/26
6	started to wither	8	It increased a little	11	It increased a little	2023/10/29
4	Wither more	8	Fixed	15	Height increased even more	2023/11/1
0	Died	9	It increased a little	19	Height increased even more	2023/11/3

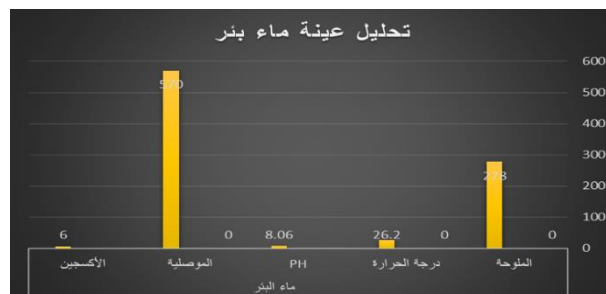
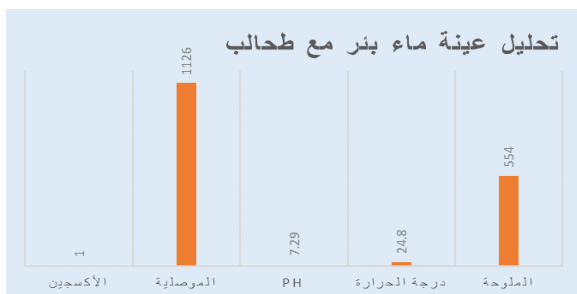
Table (2) shows the degrees of salinity, temperature (ph), and conductivity for a well water sample with algae powder

Conductivity MS	PH	Temperature C	Salinity PPm
1308	8.34	21	919

Table (3) shows (salinity, temperature, pH, conductivity, oxygen) for the well water sample and the well water sample with algae

ماء بئر مع طحالب					ماء البئر				
O2	Conductivity MS	PH	Temperature C	Salinity PPM	O2	Conductivity MS	PH	Temperature C	Salinity PPM
1	1126	7.2 9	24.8	554	6	570	8.0 6	26.2	278

Chart (4) shows a comparison between the degrees of salinity, temperature, PH, conductivity, and oxygen for two samples of normal well water and well water with live algae.



Applying water protocol activities to a sample of well water and another sample of well water with algae powder using GLOBE devices (conductivity, PH, oxygen) at school



## Applying the weather protocol (temperature and humidity) and water protocol inside the farm.



Inserting data into the  
GLOBE website

### - The second question:

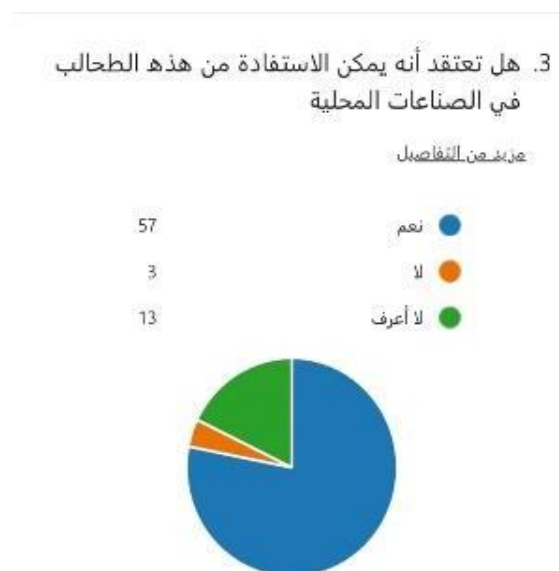
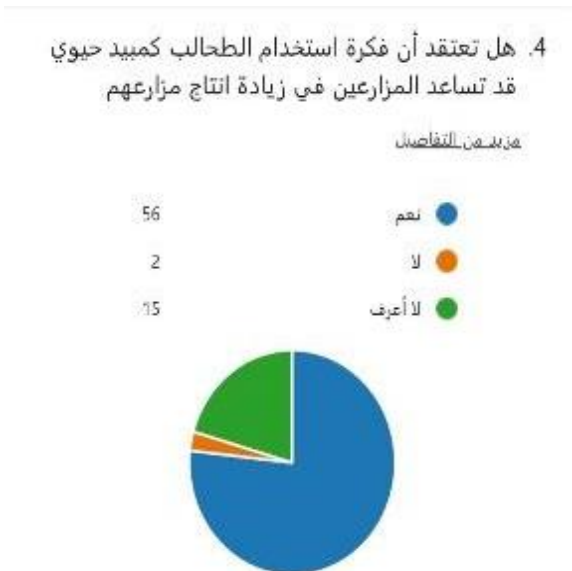
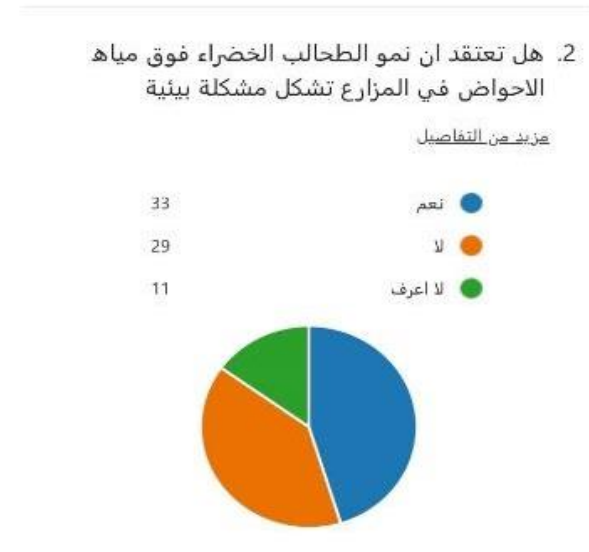
-What is the impact of using aquarium algae on the environment?

The second question was answered through an interview with Dr. Hafez Ali Al Mahrouqi from the College of Agricultural and Marine Sciences at Sultan Qaboos University, as there is an effect of aquatic algae in combating plant diseases and pests without causing any negative impact on the environment. These algae can be used as an alternative to chemical pesticides used to improve sustainable agriculture. When asked about the ways in which the application of aquarium algae as an effective and safe biocide can be improved, he explained that more studies and scientific research must be carried out to reach better results.

The same question was also answered by applying an opinion poll to a sample of the community about the impact of using aquarium algae as biocides. The survey showed that 33% of individuals believe that the growth of algae over pond water on farms constitutes an environmental problem, and that 57% of them believe that algae can be used in local industries, and 56% of them believe that the idea of using algae as a biopesticide may help farmers. To increase the production of their farms. While 42.5% of

them believe that using aquarium algae as a biocide does not cause any environmental problems. Through conducting the survey, I found that many people believe it is necessary to benefit from aquarium algae because it poses an environmental problem within farms.

## The results of an opinion that you applied to a sample of the community



Through applying an opinion poll, I found that many community members believe that the phenomenon of aquatic algae is an environmental problem that causes annoying odors to farmers and distorts the general appearance of ponds. The idea of reusing them in the manufacture of biopesticides to combat agricultural pests is a wonderful idea because they are natural materials first and solve the problem of chemical pesticides that have health effects on humans and plants. Secondly, because it finds a solution to the phenomenon of pond algae that appears in the water of aquariums in a very large way, which affects the environment and humans.

By conducting an interview with Dr. Hafez Ali Al Mahrouqi, a doctor at the College of Agricultural and Marine Sciences at Sultan Qaboos University

It has been shown that utilizing algae to make biopesticides does not harm the environment at all and helps in the sustainability and development of agriculture, provided that security and safety policies are followed when dealing with it like other chemical pesticides. The doctor also noted the need to conduct more studies and research on this topic in order to reach more effective results.

## Results:

The results in Table No. (1) were used to answer the first research question. **The effect of using aquarium algae on plant growth** was investigated by measuring the growth rate of the pea plant and the number of leaves that grew. I found that the number of leaves that grew in the first plant that was sprayed with the mixture consisting of (algae powder and water) was much greater than the number of leaves that grew in the plant that was sprayed with the mixture consisting of (algae powder, water, sugar, and starch) and the plant that was sprayed with the mixture consisting of (algae powder, water and sugar) and that the length of the first plant was greater than the length of other plants.

The results of the interview analysis and opinion poll were used to answer the second question: **What is the impact of using aquarium algae on the environment?** The phenomenon of algae growth on the surface of the water of aquariums poses an environmental and health problem for humans, as community members believe that the growth of algae on the surface of the water in farm ponds leads to the appearance of annoying odors and the growth and reproduction of many insects and parasites, in addition to distorting the general view. While the process of utilizing these algae in industries based on the production of alternative materials to chemical pesticides helps in treating the phenomenon of pond algae, in addition to producing natural biocides that contribute to the development of agriculture and preserve human health.



## Discuss the results

The results of the experiment showed that the length of the plant in the first sample increased significantly during the experiment period, while in the second sample the length of the plant increased, but to a lesser extent. As for the third sample, the length of the plant did not increase, and at the end it withered and died. The number of leaves in the first sample increased significantly and the parasites and worms present in it disappeared. As for the second sample, the number of leaves increased, but to a much lesser extent than the first sample. As for the third sample, the number of its leaves decreased until it withered and died.

By using the results of the experiment, interview, opinion poll, and applying the water protocol and the air protocol, I found that:

It is possible to use aquarium algae as a biopesticide in the field of agriculture, which may suffer from the presence of some agricultural pests, which in turn affect the growth of plants and agricultural crops, and the number of leaves present in them. By reviewing a study conducted in Egypt on “commercial algae products as biocides to combat powdery mildew in zucchini,” the study showed that the chemical changes caused by the algae preparations used increased the plant’s ability to resist diseases. (4) Through this study, we see the extent to which The ability of algae to resist agricultural diseases and increase the strength of the plant itself to resist these diseases. However, more experiments and studies must be conducted on this type of algae to prove that it is suitable as an environmentally friendly biopesticide that contributes to the elimination of agricultural pests and the type of materials found in aquarium algae that contribute In eliminating parasites, worms, and others that affect plant growth.

---

(4) Ahmed Souad, El-Sayed Rasha, Suleiman Farid, Abdel-Hakim Helmy, Study of commercial algae products as biocides to combat powdery mildew in zucchini, Alexandria Journal for Scientific Exchange, Volume 43, Issue 4, pp. 669-679, November 2022.

## Conclusion:

Through the researcher's use of the results of the experiment, the opinion poll, the interview with the specialist, and the use of the water and air protocols in the scientific experiment, she concluded that it is possible to use aquarium algae to make biopesticides to combat some agricultural pests to which agricultural crops are exposed. The researcher also stresses the necessity of taking the necessary precautions when dealing with algae in order to avoid any harmful effects on human health because it is also a source of transmission of bacteria and diseases and must be dealt with extreme caution. The researcher believes that these results are a preliminary nucleus for future research that can be applied to study this type of algae and prepare a scientific basis and standards by which to judge their suitability as biopesticides that are an alternative to the chemical pesticides currently spread in the markets. This requires a broader study of the land cover protocol to know the types of parasites and diseases that they treat these pesticides.

## Recommendations

I recommend conducting more experiments related to algae and discovering their impact on plants and the environment. I also recommend creating an agricultural reserve specialized in algae in Al Dhahirah Governorate to develop the study. And increasing research and studies in the field of algae in the Sultanate of Oman, especially freshwater algae and its importance in the economy. Directing small and medium enterprises to exploit these algae in local industries, to turn these algae into a natural national wealth. It was also recommended that there be national laboratories concerned with research on algae of all kinds.

## Reference:

(1)"HOW TO IDENTIFY ALGAE TYPES" Spero, Retrieved 31/10/2021. Edited

(2)volume 33, pages3483–3496 (2021) Journal of Applied Phycology Published: 28 July 2021/

الحمداني مريم ، ٢٨ مايو ٢٠١٩م ، دور الطحالب في التنمية الاقتصادية ، ٦ ديسمبر ٢٠٢٣م ، جريدة الرؤية من : (3)

<https://alroya.om/post/239810/%D8%AF%D9%88%D8%B1->

[%D8%A7%D9%84%D8%B7%D8%AD%D8%A7%D9%84%D8%A8-%D9%81%D9%8A-](https://alroya.om/post/239810/%D8%AF%D9%88%D8%B1-%D8%A7%D9%84%D8%B7%D8%AD%D8%A7%D9%84%D8%A8-%D9%81%D9%8A-)

[%D8%A7%D9%84%D8%AA%D9%86%D9%85%D9%8A%D8%A9-](https://alroya.om/post/239810/%D8%AF%D9%88%D8%B1-%D8%A7%D9%84%D8%B7%D8%AD%D8%A7%D9%84%D8%A8-%D9%81%D9%8A-%D8%A7%D9%84%D8%AA%D9%86%D9%85%D9%8A%D8%A9-)

[%D8%A7%D9%84%D8%A7%D9%82%D8%AA%D8%B5%D8%A7%D8%AF%D9%8A%D8%A9](https://alroya.om/post/239810/%D8%AF%D9%88%D8%B1-%D8%A7%D9%84%D8%B7%D8%AD%D8%A7%D9%84%D8%A8-%D9%81%D9%8A-%D8%A7%D9%84%D8%AA%D9%86%D9%85%D9%8A%D8%A9-%D8%A7%D9%84%D8%A7%D9%82%D8%AA%D8%B5%D8%A7%D8%AF%D9%8A%D8%A9)

(٤) أحمد سعاد ، السيد رشا ، سليمان فريد ، عبد الحكيم حلمي ، دراسة منتجات الطحالب التجارية كمبيدات حيوية

لمكافحة مرض البياض الدقيقي في الكوسا، مجلة الإسكندرية للتبادل العلمي المجلد ٤٣، العدد ٤، ص ٦٦٩-

ص ٦٧٩، نوفمبر ٢٠٢٢

## Appendices

### Interview with Dr:

Hafez Ali Al Mahrouqi from the College of Agricultural and Marine Sciences at Sultan Qaboos University

**-What algae are suitable for use as a biopesticide and what are the plant species which can be applied successfully?**

Blue-green algae, a microorganism that is considered a type of algae, contains chlorophyll and uses energy from the sun to perform photosynthesis. These algae may be used in several fields, including pest control as biocides. They contain natural substances that have antibacterial and antifungal properties and may be used to control agricultural pests in safe and effective ways.

**-Does algae have an effect on controlling plant pests and diseases without a negative effect on the environment?**

Yes, algae can be used to manufacture biopesticides without affecting the environment.

**-What are the policies and regulations that must be taken into account when using algae aquariums as a biocide in agriculture?**

Follow security and safety policies in all biocide-manufacturing processes, such as wearing masks and gloves to protect the respiratory system from odors emanating from algae and to avoid developing a skin rash from contact with these algae.

**-Can aquarium algae be used as an alternative to chemicals pesticides an improvement to sustainable agriculture?**

Yes, algae can be used to manufacture natural biopesticides that replace chemical pesticides in eliminating various agricultural pests. Which improves agricultural productivity and helps to sustain it.

**-What are the ways in which the application of aquarium algae can be improved effectively and safely?**

This can be done by conducting further research and studies in this field.

# Benefit from research results by publishing via social media

