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HOW TO WRITE RESEARCH ARTICLES FOR AGRICULTURE

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HOW TO WRITE RESEARCH ARTICLES FOR AGRICULTURE

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COVER LETTER

Alhamdulillah, the author's praise to Allah SWT has given mercy, opportunity, and health until the realization of the author's thoughts can be contained in the book titled: "**How to Write Research Articles for Agriculture**". May this book be useful for many people who need it.

This book was made possible because of the encouragement of a number of workshop participants and colleagues from Perkumpulan "Ahli dan Dosen Republik Indonesia (ADRI)". They want authors to be able to document experiences related to writing and publishing scientific papers in the form of books. In addition, the author also has a clear dream to immediately reach the highest functional position as GB 850 or Profesor.

Armed with a clear dream, can become a strong impetus for the author to immediately write an article manuscript. Enthusiasm continues to be maintained to realize my dream. The author realizes that difficulties are definitely in sight. In reality, after trying to submit the first article, it immediately got rejected. Then, the article manuscript submission in other journals was always rejected. From this here, the author a lot of learns from the comments of editors or reviewers. Although a lot of difficulty, the author never gives up and continues to learn. Finally, the author successfully published an article in a reputable international journal. After that, the author continued to write and publish manuscripts in reputable international journals and now it has become a habit.

To be able to write good scientific articles, the author's experience needs to understand how to use related tools to download literature, citations, paraphrases, translations, Grammarly, and others. In addition, you must also understand the structure of the article, how to cite literature, the use of verb tenses, the article template of the intended journal, and others. Each journal has a different style or template so foresight is needed in writing manuscripts.

The book consists of eight Chapters. Chapter 1 discusses the importance of lecturers having dreams of achieving the highest career. Chapter 2 discusses how to write research articles and their benefits for lecturers and universities. Chapter 3 discusses the use of verb tenses and prepositions in manuscripts. Chapter 4 discusses the structure of the research article and the use of English grammar. Chapter 5 deals with supplementary data. Chapters 6, 7, and 8 discuss about submission, revision, acceptance, and publication of manuscripts in journals. Chapter 9 discusses the author's correspondence with the editor from submission to publication.

Hopefully, this book is useful for lecturers, students, and researchers. The author realizes that the content in this book still lacks a lot. Therefore, the author really expects criticism and suggestions from readers in order to improve.

Yogyakarta, October 25, 2023

Author

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CHAPTER 1
CLEAR DREAMS

1.1. Change Mindset

The driving factor for publication in international journals depends on the strength of the subconscious mind. The need to be realized and visualized can accelerate the achievement. Desire has a different meaning from need. Needs are something that must be met in this life, while desires do not have to be realized and are easily forgotten if they encounter difficulties or challenges.

The mind has great power to be utilized in achieving goals. However, it all depends on each person. How many people can harness that potential? The answer is that few people focus on their goals.

The courage to write articles depends on the courage to think that writing is easy if you know how to write. Please learn from people who know how to write. Everyone can do up to proficient writing articles. They can write article manuscripts well, then we can too.

Many lecturers are very enthusiastic about learning to write article manuscripts. They have attended the training many times hoping to write article manuscripts well. They try to be able to write article manuscripts that are worthy of publication in reputable international journals. Figure 1.1 follows as evidence that there is so much interest in learning to write article manuscripts.

Figure 1.1. Workshop in writing article manuscripts in various universities

Figure 1.1 shows that they attended various universities, spending at least three days, and two nights learning to write article manuscripts.

1.2. Clear Dreams

THEREFORE,
HAVE CLEAR DREAMS IN YOUR LIFE

They "**CAN**" because they have clear dreams or targets, so all their actions will be directed according to what they think. Create dreams that are specific, measurable, rational, and timed (SMART). My dream is “I'm ready to be Guru Besar (GB) 850 in 2024”.

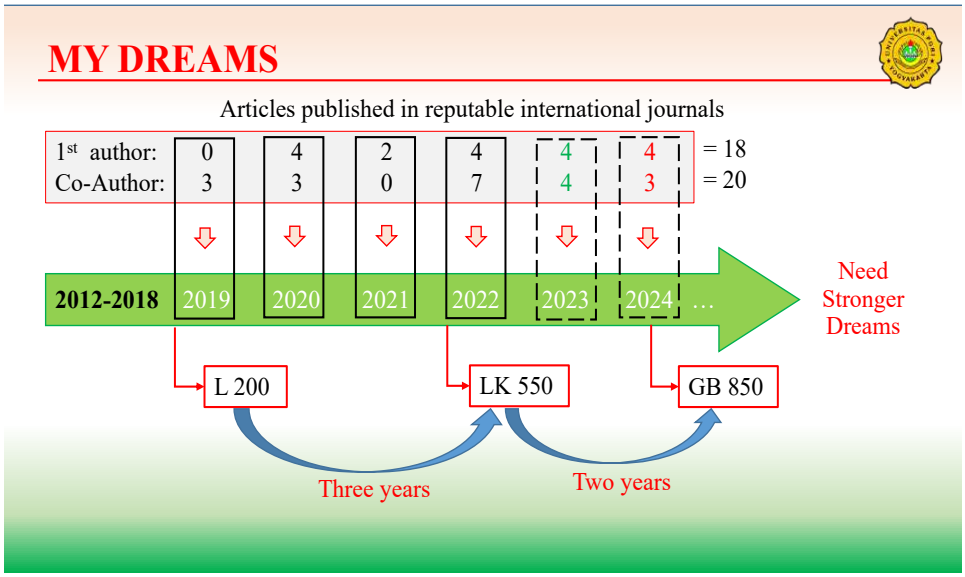

Figure 1.2. Clear dreams by the author

The dream can be explained that GB 850 (specific) in 2024 (timed), which means the dream was made in 2019. Publication as the first author of at least two articles per year and also a co-author (rational and measurable). Some lecturers have extraordinary achievements that had reached GB 850 within five years from the functional position of LK 200 (accurate).

Figure 1.2 shows that I (the author of this book) have decided to become a GB 850 in 2024. It turns out that with this dream, all targets become easy to realize. I continue to try and pray so that every year I can publish at least two articles as a first author. As it turns out, articles can publish quite a lot of them.

It takes struggle and hard work to realize the dream that has been set. Keep doubts because with just 1% doubt can lead to failure. Start with a strong intention, even if it is very heavy. Indeed, to start it is very heavy. Start by reading

and writing even if it's just one sentence. If done every day, it will become a habit and gradually become a necessity. Furthermore, deciding to be ready to write and publish an article in a reputable international journal is extraordinary. Never give up and always work wherever you are as shown in Figure 1.3.

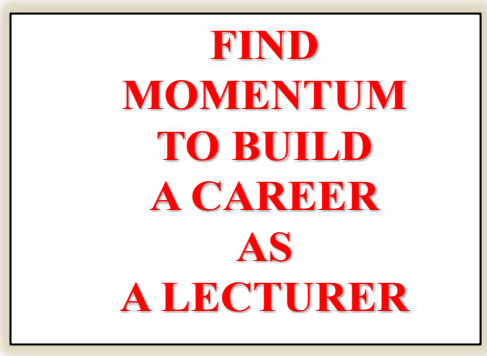

Figure 1.3. Pouring thoughts in the article manuscript

Being able to make one manuscript article every semester will become a habit. Indeed, with a dream that SMART can encourage the courage to publish articles in reputable international journals.

1.3. Writing as Habits

Why is writing and publishing articles in reputable international journals a problem for many lecturers in Indonesia? After being traced there are many classic reasons, including:

1). Do not have a clear target in the lecturer's career.
2). Don't want to learn from others to write articles.
3). There is no intention and passion to write articles.
4). It has no cost for publication.
5). There is no fee assistance for article publication.
6). Can't find a supportive environment.
7). And there are many other reasons.

These reasons cause failure to be able to publish articles. All of that can be easy if you have 100% confidence, that there is help from God. Furthermore, you must be able to find and join the environment of people who like to write articles. Furthermore, encouragement will be obtained from their environment. Finally, there is an effort to be able to write and publish articles in quality journals.

For example, at first, I was also not very interested in writing articles. Because I am in a very supportive environment, I can also publish in reputable international journals. The expertise in writing the article was because of repeated habits. Over time, writing will become a habit in everyday life as a

lecturer. To be more focused, then look at your dreams every day. Furthermore, it can improve the ability to write and publish articles.

I BELIEVE THAT YOU CAN

Nothing to win without confidence

In the period 2019-2023, we have published **28 articles** in reputable international journals (Q2-Q4) with **13 articles as first author**. The several published articles can be seen in Tables 1.1 to 1.5.

Table 1.1. Number of articles published in 2019

No	Quartile	Articles have been published
1.	Q2	Kamis, W. A., Kob, C. G. C., Affand H. M., Yunus, F. A. N., and **Paiman** (2018). The effect of implementing the green skills module on design technology subject: assesing the pupils' green skills practices. Special isue on ICEES2018, 15-16 October 2018. *Journal of Engineering Science and Technology*, pp. 18-25.
2.	Q3	Kanetro, B., Swasono, D. H., and **Paiman** (2019). Improvement of starch gelatinization and amino acid profile of growol with addition of germinated mungbean (*Vigna radiata*). *Sys. Rev. Pharm.* 10(2): 48-52.
3.	Q2	Rahman, Z., Azman, M. N. A., Kamis A., Kiong T. T., and **Paiman** (2019). Exploration of sustainable solid waste management through composting projects among school students. *International Journal of Innovation, Creativity and Change*, 9(5): 129-147.

Table 1.2. Number of articles published in 2020

No	Quartile	Articles have been published
1.	Q2	**Paiman** and Effendy, I. (2020). The effect of soil water content and biochar on rice cultivation in polybag. *Open Agriculture*, 5: 117-125.
2.	Q2	**Paiman**, Yudono, P., Sunarminto, B. H., and Indradewa, D. (2020). Soil solarization for control of weed propagules. *Journal of Engineering Science and Technology,* 15(1): 139-151.

Table 1.2. Continued

3.	Q2	Iqbal Effendy, **Paiman**, and Morison (2020). The role of rice husk biochar and rice straw compost on the yield of rice (*Oryza sativa* L.) in polybag. *Journal of Engineering Science and Technology*, 15 (4): 2135-2148.
4.	Q3	Monsuru Adekunle Salisu, Zulkefly Sulaiman, Ridwan Che Rus, Mohd Yusoff A., Samad, Norhanizan Usaizan, Yusuff Oladosu, and **Paiman** (2020). Water use efficiency, plant growth and vegetative traits of rubber (*Hevea brasiliensis*) seedlings grown using different growing media and water levels. *Australian Journal of Crop Science*, 14 (9): 1497-1505.
5.	Q3	**Paiman**, Ardiyanta, Muhammad Ansar and Iqbal Effendy, B. Trisno Sumbodo (2020). Rice cultivation of superior variety in swamps to increase food security in Indonesia: a review. *Reviews in Agricultural Science*, 8: 300-309.
6.	Q3	Muhammad Ansar, Bahrudin, Saiful Darman, and **Paiman** (2020). Application of bokashi fertilizer and duration of water supply to increase growth, yields, and quality of shallot in dryland. *International Journal of Design and Nature and Ecodynamics*, 15: 711 – 719.
7.	Q3	**Paiman**, Siti Nurul Fasehah Ismail, and A. Shah. 2021. Recent developments of weed management in rice fields: a review. *Review in Agricultural Science,* 8: 343-353.

Table 1.3. Number of articles published in 2021

No.	Quartile	Articles have been published
1.	Q2	**Paiman**, Ardiyanta, C. Tri Kusumastuti, Sri Gunawan, and Fani Ardiani. 2020. Maximizing the rice yield (*Oryza sativa* L.) using NPK fertilizer. *Open Agriculture Journal*, 15: 33-38.
2.	Q4	**Paiman**, Sukhemi, and Nina Widyaningsih (2020). Weed control technology to increase growth and yield of mungbean (*Vigna radiata* L.) in soils types. *Journal of Physics: Conference Series*, 1823: 012022.

Table 1.4. Number of articles published in 2022

No.	Quartile	Articles have been published
1.	Q2	**Paiman**, Bambang H. Isnawan, Achmad F. Aziez, Subeni, and Monsuru A. Salisu (2022). The role of agronomic factors in salibu rice cultivation. *Open Agriculture Journal*, 15: 1-7.

Table 1.4. Continued

2.	Q3	Achmad Fatchul Aziez, Agung Prasetyo, and **Paiman** (2022). The effect of drought stress on the growth and yield of soybean. *Applied Ecology and Experimental Research (AEER)*, 20(4): 3569-3580.
3.	Q3	Ansar and **Paiman** (2022). The effect of coconut water and moringa leaf extract on growth and yield of shallots. *Applied Ecology and Experimental Research (AEER)*, 20(4): 3509-3517.
4.	Q3	**Paiman**, Ahmad Khanif Hidayat, Said Syahrul Shobirin, and Sani Ismawatun Khasanah (2022). Efficacy of weed extract types as bioherbicides in rice (*Oryza sativa* L.) cultivation. *Research on Crops,* 23 (3): 488-496.
5.	Q3	Muhammad Ansar, Bahrudin, and **Paiman** (2022). Application of cow urine fertilizers to increase growth and yield of mustard plants. *Research on Crops.* 23 (3): 566-573.
6.	Q4	Achmad Fatchul Aziez, Agus Budiyono, Endang Suprapti, Agung Prasetyo, Fardhan Aji Pranantyo, and **Paiman** (2022). Soybean varieties respond to the shade of teak trees. *Indian Journal of Agricultural Research,* 56(5): 551-556.
7.	Q3	**Paiman**, Ardiyanta, Subeni, Kharisun, and Yussof S.F. (2022). Effect of waterlogging on weed seed germination and growth in lowland rice. *Applied Ecology and Experimental Research (AEER),* 20(6): 5397-5408
8.	Q3	**Paiman**, Muhammad Ansar, Fani Ardiani, Siti Fairuz Yussof (2022). Minimizing weed competition throught waterlogging in rice (*Oryza sativa* L.) under various soil types. *Research on Crops,* 23(4): 755-762
9.	Q3	Ardiyanta, Cicilia Tri Kusumastuti, Okti Purwaningsih, **Paiman** (2022). Profitability of tomato farming through the eco enzymes application. *Reserach on Crops,* 23(4): 808-814.
10.	Q3	Agusalim Masulili, Sutikarini, Rini Suryani, Ida Ayu Suci, Ismail Astar, Hardi Dominikus Bancin, and **Paiman** (2022). The role of biochar amendments in improving the properties of acid sulphate soil. *Research on Crops,* 23(4): 787-794
11.	Q3	Muhammad Ansar, Bahrudın, Maemunah, and **Paiman** (2022). The effect of harvest age and storage duration on viability and vigor of shallot tubers. *Research on Crops,* 23(4): 566-573.

Table 1.5. Number of articles published in 2023

No.	Quartile	Articles have been published
1.	Q2	Agusalim Masulili and **Paiman** (2023). Effect of A Mixture of Water Hyacinth Compost and Rice Husk Biochar on the Improvement of Alluvial Soil Properties to Increase the Growth of Red Ginger (*Zingiber officinale* L.). *Open Agricultural Journal*. 17: e187433152303270
2.	Q3	**Paiman**, Ardiyanta, Cicilia Tri Kusumastuti, Agusalim Masulili, and Siti Fairuz Yussof (2023). A review on planting system of Jajar Legowo for increasing the rice yield in Indonesia. *Research on Crops,* 24(3): 433-441
3.	Q4	**Paiman** (2023). Response of growth and yield of Salibu rice on the stem cuttings height of parent crops after harvest. *AIP Conference Proceedings*. 2491: 010027
4.	Q3	**Paiman** and Edo Hendrawan (2023). The role of Allium extracts in stimulating rice growth. *Applied Ecology and Experimental Research (AEER),* 21(5): 4343-4352
5.	Q3	Agusalim Masulili, Agus Suyanto, Setiawan, Mulyadi, and **Paiman** (2023). Effect of pineapple skin bokashi on improvement of soil properties and growth of shallot (*Allium ascalonicum* L.). *Research on Crops,* 24(2): 319-325

What is the benefit of having many articles published in various reputable international journals? We will be known by many scientists around the world because it is promoted by Scopus, WOS, or other indexers. Even though we are sleeping, vacationing, relaxing, or carrying out other activities, it turns out that articles are read and cited by other authors. In addition, we also have the opportunity to share knowledge with many people in need.

In this world, it turns out that many scientists have successfully written and published scientific articles in reputable international journals. But many people still believe in academics that: "writing and publishing articles is very difficult". Are you believe it? For those of us who are intending to write, I believe that statement.

Your mind should not be influenced by negative statements from the surrounding environment. We must be good at managing the mind properly. Despite the negative response, it was still received with a positive response. Keep negative thoughts away that will disturb the mind. Believe that writing is easy if you know how to write.

What will happen depends on your mind

FOCUS AND LOVE "WHAT YOU DO"

1.4. Start to Write Manuscript

Start to write now. Don't wait for the right time or empty. Success belongs to busy people, but good at organizing and utilizing time. Amid that busyness, certain people can produce many scientific works. However, for people who think too much and wait for free time, it turns out that they do not produce too many articles.

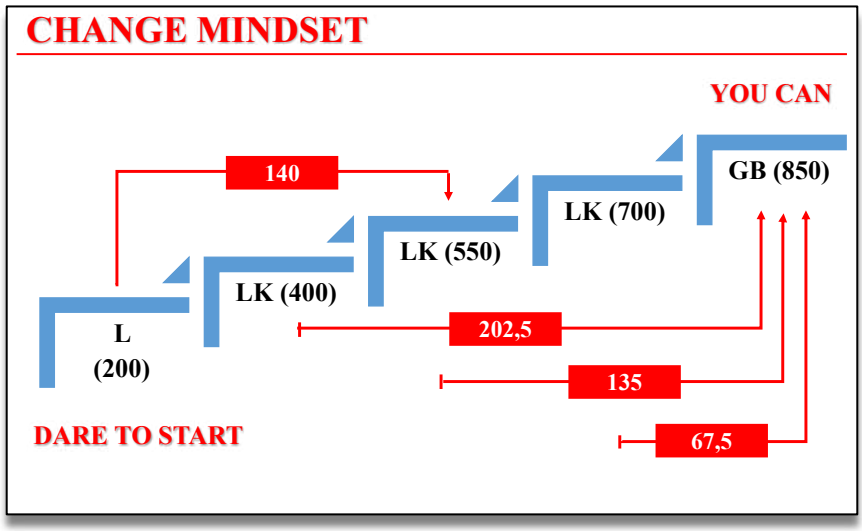

Figure 1.2. Road to GB 850

CHAPTER 2
RESEARCH ARTICLE

2.1. Article Types

There are several types of articles including research articles, review articles, letters, and short communications (Figure 2.2). In this book, we will only discuss research articles.

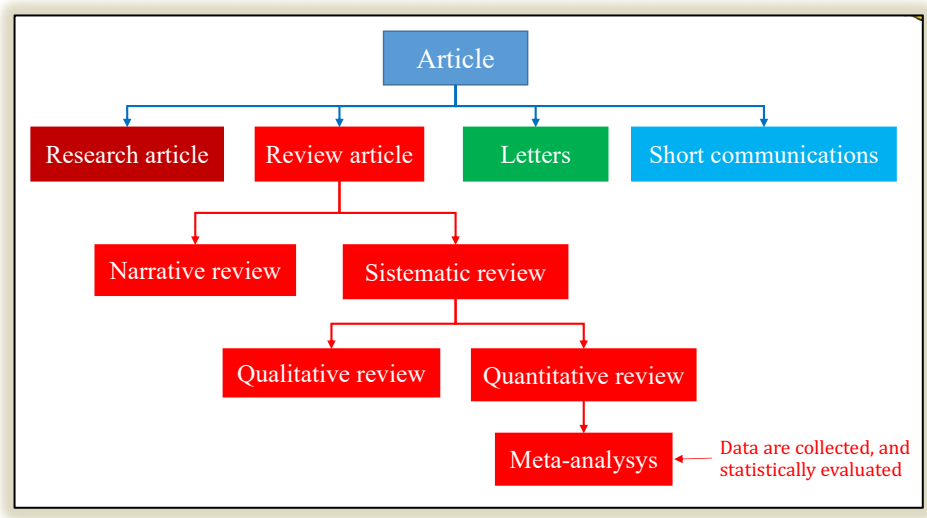

Figure 2.2. Types of the scientific articles

Perbedaan research artikel, review artikel, letter, dan short communication:

1) Research articles are detailed studies reporting original research conducted by the author. They include hypothesis, background study, methods, results, interpretation of findings, and a discussion of possible implications
2) Review articles give an overview of existing literature in a field, often identifying specific problems or issues and analyzing information from available published work on the topic with a balanced perspective.
3) Letters are usually short and flexible articles that express readers' opinions on previously published articles, or provide evidence to support/oppose an existing viewpoint.
4) Short/rapid/brief communications are usually a concise format used to report significant improvements to existing methods, a new practical application, or a new tool or resource. These need to be reported quickly as the need to communicate such findings is very high.

2.2. Structure of the Research Article

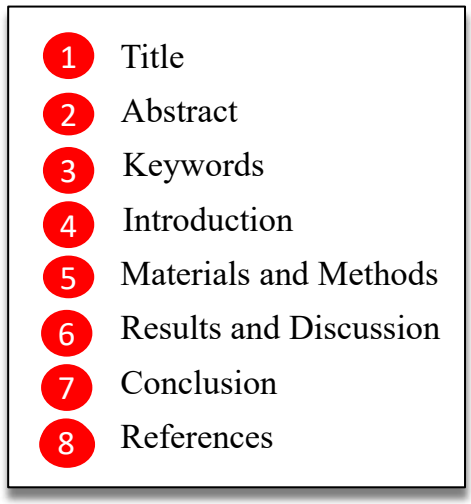

Figure 2.3. Structure of the research article

2.3. Flow of Article Writing

Perhaps, there is confusion for lecturers or students to write articles. The author must understand where to start in the right way. The stages for writing quality and correct articles can be seen in Figure 2.4.

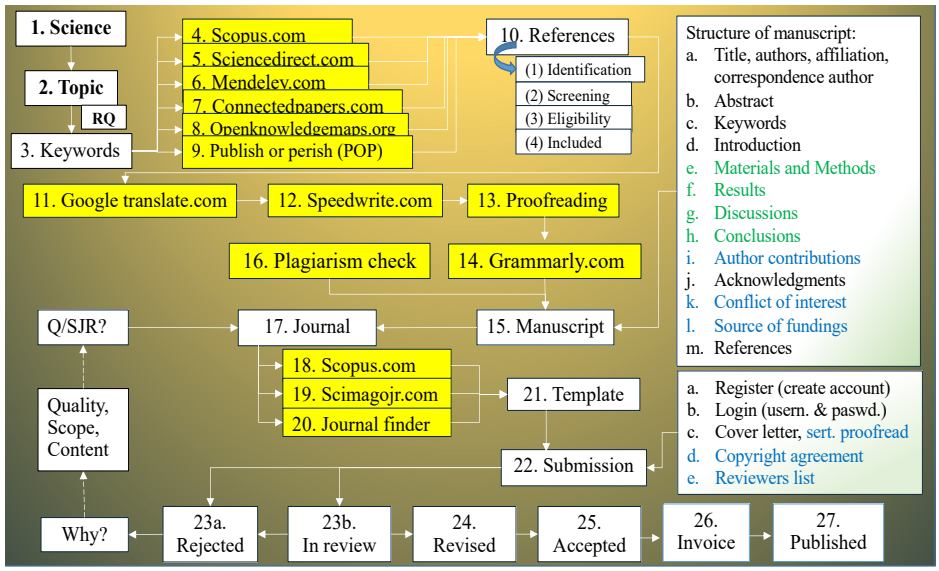

Figure 2.4. Flow of writing a research article

Figure 2.3 explains that in general the process of writing until article publication can be divided into three stages, namely:

1. Stage 1, namely initial preparation which includes determining the research topic by the field of science, selecting keywords, and collecting references with available tools.
2. Stage 2, namely preparing an article manuscript includes reading and writing references, including manuscripts, paraphrasing, Grammarly, and proofreading.
3. Stage 3, namely article publication includes selecting the journal destination (adjusting the template), submission, rejection (rejected), in process (in review), improvement (revised), acceptance (accepted), and publishing (published).

2.4. Inhibiting Factors of Article Writing

Many reasons are often conveyed by a student or lecturer who cannot produce articles published in reputable international journals, including:

1. Fear of rejection → Try it
2. Wanting instant → is not the best way
3. Don't want to take the time to read (?)
4. Waiting for free time to write → must be placed
5. Too much preparation → just starts from the small first
6. Too much to intend → to act immediately
7. Hurt by reviewers → learn from them

Some of these factors become obstacles for a person. Excuses should be thrown far away. Start reading one article and typing the summary result even if it's just one sentence. Furthermore, it is repeated every day to become a habit.

2.5. Career for Lecturer

Articles published in reputable international journals have multiple effects. The benefits of articles for lecturers and universities can be explained below (Figure 2.4). In addition, scientific articles that have been published can be used to measure the quality of graduate students.

Articles produced by lecturers have many benefits. Among them, dosen can develop its existence as a keynote speaker or resource person so that it can share knowledge with many people. Of course, this expertise will increase the popularity of lecturers both at home and abroad. Science and the skills are needed by many people. In addition, there is additional fortune obtained, for example as a resource person.

Promotion to functional positions to Professor requires special requirements for articles published in reputable international journals. People with high productivity can reach the highest functional positions faster. However, many lecturers are unable to rise to the position of Associate Professor or Professor due

to the low number of scientific articles they have. The highest functional positions are indispensable to improving the accreditation of universities.

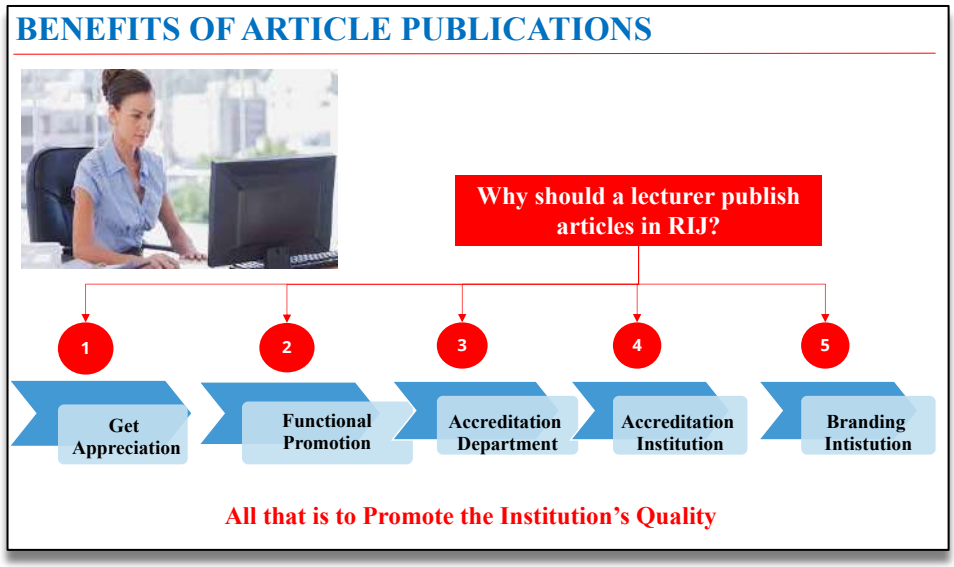

Figure 2.4. Benefits of article publication for lecturers and universities

2.6. Branding for Higher Education

The number of scientific articles produced by lecturers in Higher Education is very necessary for the accreditation of departments or Institutions. The productivity of scientific articles is one of the indicators of lecturer quality. Accreditation requires several scientific articles produced by lecturers per year who teach in their department. In addition, articles produced in a college will increase the branding of the University from the wider community.

Currently, people are smart in choosing universities for their children's schools. Superior accredited universities will get high recognition from the wider community. How many articles are produced by lecturers in a university becomes very important to support branding. Universities that are very productive of articles will also be known from all over the world so that they become world-class. Unlike the low-productive universities, it will only be a local class.

CHAPTER 3
VERB TENSES AND PREPOSITIONS

The use of verbs in manuscript articles should be a matter of concern. Wrong in using verbs, can make the meaning of the sentence will change. Chapter 3 will discuss the use of verbs in the abstract, introduction, methods, results and discussion, and conclusion.

3.1. Verb Tenses in Abstract

The use of verb form in the abstract varied greatly depending on the types of information discussed (Figure 3.1). Although it varies, the way to use verb forms in the abstract already has guidelines. We just follow the guidelines that exist in general.

Figure 3.1. How to use verb tenses in an abstract

The simple past, future tense, present tense, and present perfect tense will be discussed in the abstract implementation. The abstract article consisted of several parts including background, objectives, methods, results, conclusion, and recommendation/suggestion/implication. In each part of the abstract, we need to choose the right verb tenses so that the meaning of the sentence is not confusing for editors or reviewers. For more details, the use of verb tenses will be discussed in Table 3.1.

Table 3.1. Use of verb tenses in the abstract

No.	Type of information	Verb form	Examples
1.	Giving background details or statement of general fact, for stating the main point of a study, an overview of the topic being covered	Simple present (active or passive) tense, tentative verb and or modal auxiliaries	Rice **has become** a primary daily necessity for most Indonesian population. The upsurge in national rice production **can be done** by agricultural intensification through the application of compound fertilizer.
2.	Describing the aims of the study	Simple past tense	This study **aimed** to determine the optimum dose of NPK fertilizer, which **could provide** the highest rice yield of Ciherang varieties in Alluvial soil.
3.	Describing the methods	Simple past tense (active or passive)	This experiment **was** a single factor arranged in a completely randomized design and three times replications. The treatment of NPK fertilizer **consisted of** four doses, i.e., 0, 160, 320, and 480 kg ha^{-1}. The data observations **were analyzed** by using analysis of variance at 5% significance levels. The difference between the averages of the treatment **was compared** using Duncan′s new multiple range test at 5% significance levels.
4.	Reporting the findings of past results or observation	Simple past tense	The results of the research **showed** that the application of NPK fertilizer **could increase** the growth and yield of rice plants compared to only providing urea fertilizer. The optimum dose of compound NPK **was obtained** at 656 kg ha^{-1} with the maximum dry weight of grains of 4.26 tons ha^{-1} milled dry grain.

Table 3.1. Continued

5.	Stating the conclusion	Simple present (active or passive) tense/tentative verb and or modal auxiliaries	In conclusion, the NPK fertilizer interval **has not reached** the optimum dose in Alluvial soils for the Ciherang variety.
6.	Implications/ recommendations/ suggestions	Simple present (active or passive) tense/tentative verb and or modal auxiliaries	We **recommend** that the application of NPK Mutiara fertilizer with doses higher than 480 kg ha^{-1} **is required** for alluvial soils.

3.2. Verb Tenses in Introduction

As a writer, you must understand to distinguish the use of verb tenses in sentences. The use of verb tenses in sentences must be correct so as not to confuse others who read them. The three most frequently used tenses in academic writing, especially in the introduction can be seen in Figure 3.2.

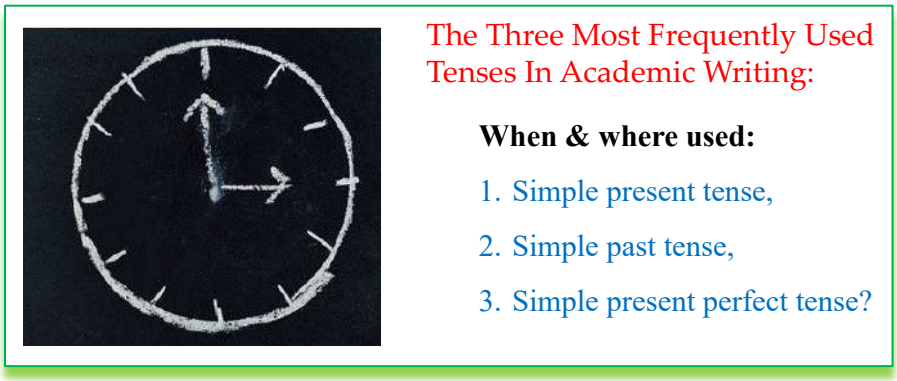

Figure 3.2. The most frequently used tenses in the introduction

When to use simple present, past tense, and present perfect tense depends on the type of information to be conveyed. For more details, the using verb tenses can be seen in Tables 3.2, 3.3, and 3.4.

Table 3.2. When to use the simple present tense

No.	When to use?	Examples
1.	Describe statement of general facts and truths, mainly in introductions to present background on the research topic, or ideas accepted today.	➢ The Reynolds number **provides** a measure of … The Reynolds number is an important dimensionless quantity in fluid mechanics. (It is considered a general truth). ➢ Most researchers **agree** that our species appeared in Africa
2.	Describe the contents of the paper or refer to figures, tables or graphs.	➢ Section 3 **presents** the results … ➢ Table 2 above **demonstrates** the success …..

Table 3.3. When to use the simple past tense

No.	When to use?	Examples
1.	Describe things that happened at a particular time in the past tense, so when reviewing the literature or previous studies, so use the past tense to discuss past work	➢ Smith and Olson (2009) **reported** that …….. ➢ The subjects in the first group **scored** higher, on average…… (Smith and Olson, 2009). ➢ Author A. (2017) **showed that** varied populations display similar patterns, but Author B **demonstrated** that patterns vary wildly.

Table 3.4. When to use the simple present perfect tense

No.	When to use?	Examples
1.	Describe events that are linked to the present or are continuing.	➢ Mobile phone use **has increased** over the past decade.
2.	Describe general findings when comparison has been done that are known to be true or still valid today	➢ Researchers **have used** this material to manufacture ……
3.	To express that research in a certain area is ongoing	➢ Other researchers **have described** similar processes in other environments.

3.3. Verb Tenses in Methods

The correct use of verb tenses in the methods section also needs to be considered so as not to cause writing errors. However, most of the verb tenses in this section use past tense as exemplified in Table 3.5.

Table 3.5. Use of verb tenses in the methods

No.	Type of information	Verb form	Examples
1.	Describing the methods	Simple past tense (active or passive)	➢ We **carried out** a series of field tests. ➢ A large number of samples **were tested** for fracturing.
2.	Describing the research activity	Simple past tense, present perfect tense	➢ The study **focused** on 2 main areas. ➢ The framework for life cycle analysis **has been developed**.
3.	General statement of formula	Simple present tense	➢ The shoot root ratio (SRR) of rice **is** a ratio of SDW (kg/m^2) and RDW (kg/m^2)
4.	Refer to equation	Simple present tense (passive or active)	➢ The formula for calculating the shoot root ratio **is represented** in Eq. 1. → One equation (in back sentence) ➢ Equation 1 **is** a formula to calculate the shoot root ratio. → One equation (in front sentence)

3.4. Verb Tenses in Results and Discussion

The use of proper verb tenses needs to be considered so that the manuscript is not quickly rejected by editors or reviewers. For more clearly, the type of information can be seen in Table 3.6.

Table 3.6. Use of verb tense in the results and discussions

No.	Information	Verb form	Examples
1.	Refer to Table	Simple present tense (passive/ active) or modal auxiliaries.	➢ The results of the correlation analysis **can be seen** in Table 1 → One table (in back sentence) ➢ The results of the correlation analysis **can be seen** in Table**s** 1 and 2 → Two or more tables in back sentence)

Table 3.6. Continued

			➢ Table 1 **is** the results of the correlation analysis → One table (in front sentence) ➢ Table**s** 1 and 2 **are** the results of the correlation analysis → Two or more table (in front sentence)
2.	Refer to Figure, or Grafic	Simple present tense (passive or active)	➢ The rice yield in different soil types **is presented** in Figure 1→ One figure (in back sentence) ➢ The rice yield in different soil types **is presented** in Figure**s** 1 and 2 → Two or more figure (in back sentence) ➢ Figure 1 **is** the rice yield in different soil types → One figure (in front sentence) ➢ Figure**s** 1 and 2 **are** the rice yield in different soil types → Two or more figure (in front sentence)
3.	Explain to refer the Tabel, Figure, and Grafic.	Simple present tense (active), was followed past tense	➢ Table 1 **shows** that the rice yield **was** not different between variety → One table (in front sentence) ➢ Table**s** 1 and 2 **show** that the rice yield **was** not different between variety → Two or more table (in front sentence) ➢ Figure 1 **explains** that there **were** not different on plant height → One figure → One figure (in front sentence) ➢ Figures 1 and 2 **explain** that there **were** not different on plant height → Two or more figure (in front sentence)
4.	Describe or discuss the results	Simple past tense	➢ GDW were significantly negatively correlated with LAI (-0.736**) and GDW (-0.776**), respectively → Parallel structure (using coordinating conjugations ➢ The weeds **were** greedy for environmental factors, but without waterlogging, weed growth **was** most robust → Parallel structure (using coordinating conjugations)

3.5. Verb Tenses in Conclusion

The verb tenses used in this conclusion are quite varied. However, you must understand the type of information conveyed. More details can be seen in Table 3.8.

Table 3.7. Use of verb tenses in the conclusion

Type of information	Verb form	Examples
Stating the conclusion	Simple present tense (active)/ tentative verb and or modal auxiliaries	➢ The research findings **explain** that dose of 250 kg/ha urea **provide** the maximal rice yield. ➢ The research findings **show** that waterlogging period of 1-30 DAP **can minimize** the weed-rice competition and **increase** the rice yield.
Explaining the implications of your findings.	Simple present (active or passive) tense/ tentative verb and or modal auxiliaries	➢ Furthermore, it **can be recommended** that further research be carried out on the effect of … ➢ It **is highly recommended** to be practiced as cultural weed control in rice cultivation. ➢ We **recommend** that the application of cow urine with a concentration higher than 80% **is required** in mustard cultivation.

3.6. Prepositions

1) Transition and phrases (prepositions) words connected ideas, sentences, and paragraphs.
2) It's all to help in the logical flow of ideas as it signals the relationship between sentences and paragraphs.
3) In prose, matter is supported and conditioned not only by the order of matter (position) but by the connectors (prepositions) that signify order, relationships, and displacement.
4) In addition, pronouns act as a link when used to refer to nouns in the preceding sentence.
5) The repetition of keywords and phrases as well as the use of synonyms will echo important words. Both serve to establish a relationship with the previous sentence.

Some of the more commonly used connectives are listed below. Note especially how these connections function to develop, relate, connect, and move ideas (Table 3.8).

Table 3.8. Use of prepositions and pronouns

No.	Type of signal	Example
1.	To signal addition of ideas	And, also, besides, further, furthermore, too, moreover, in addition, in addition to, in addition this (that), then, of equal importance, equally important, another
2.	To signal time	Next, afterward, finally, later, last, lastly, at last, now, subsequently, then, when, soon, thereafter, to this time, after a short time, the next week (month), a minute later, in the meantime, meanwhile, on the following day, at length, ultimately, presently
3.	To signal order or sequence	First, second, third, fouth, finally, hence, next, then, from here on, to begin with, last of all, after, before, as soon as, in the end, gradually, in turn/in turns, in turns off
4.	To signify space and place	Above, behind, below, beyond, here, there, to the right (left), nearby, opposite, on the other side, in the background, directly ahead, along the wall, as you turn right, at the tip, across the hall, at this point, adjacent to
5.	To signal an example	for example, to illustrate, for instance, to be specific, such as, moreover, furthermore, just as important, similarly, in the same way
6.	To show results	as a result, hence, henceforward (henceforth), so, accordingly, as a consequence, consequently, thus (so), thus far, since, therefore, for this reason, because of this, for this, according to
7.	To signal purpose	to this end, for this purpose, with this in mind, for this reason, for these reasons
8.	To signal comparison	Like, in the same (like) manner or way, similary
9.	To indicate contrast	But, in contrast, conversely, however, still, even still, nevertheless, nonetheless, yet, and yet, on the other hand, of course, on the contrary, or, in spite of this, actually, a year ago, now, notwithstanding, for all that, strangely enough, ironically, in any case
10.	To signal alternatives, exceptions, and objections	Although (the), even though, though, while, despite (off), despite this, to be sure, it is true, true, I grant, granted, I admit, admittedly, doubtless, I concede, regardless

Table 3.8. Continued

11.	To dispute	it isn't true that, people are wrong who say that, deny that, be that as it may, by the same token, no doubt, we often hear it said, many people claim, many people suppose, it used to be thought, in any case
12.	To intensify	above all, first and foremost, importantly, again, to be sure, indeed, in fact, in turns out, as a matter of fact, as I have said, as has been noted
13.	To summarize or repeat	in summary, to sum up, to repeat, briefly, in short, finally, on the whole, therefore, as I have said, in conclusion, as you can see

For example:

1) Text in Indonesian

Periode penggenangan 1-15 dan 1-30 DAP dapat mengurangi pertumbuhan gulma dan memberi kesempatan tanaman padi untuk tumbuh lebih baik. Di sisi lain**,** periode genangan air 1-30 DAP dapat meningkatkan LAI, dan SRR lebih maksimal. Pada kenyataannya, pertumbuhan gulma paling kuat pada tanah tanpa genangan air, kemudian menyebabkan penurunan LAI padi pada semua jenis tanah, terutama di pantai berpasir dan regosol. Namun, periode penggenangan 1-15 dan 1-30 DAP di tanah latosol menyebabkan SRR lebih tinggi dibandingkan tanpa penggenangan. Akibatnya, perlakuan pengenangan dapat meningkatkan SRR. Pada kondisi tertentu, jika tidak terjadi persaingan gulma, maka tanaman padi lebih terkonsentrasi untuk meningkatkan pertumbuhan tunas daripada akarnya. Oleh karena itu, hal tersebut akan menyebabkan SRR lebih tinggi. Sebaliknya, gulma mengalami pertumbuhan yang cepat tanpa tergenang air, sehingga tanaman padi tertekan perkembangannya.

2) Text in English

Waterlogging periods of 1–15 and 1–30 DAP **could decrease** weed growth and **give** the rice crops a chance to grow better. On the other hand, waterlogging period of 1–30 DAP **could increase** the LAI, and SRR more maximal. In reality**,** weed growth **was most robust** on soil without waterlogging, it then **caused** a decrease in rice LAI on all of the soil types, especially in coastal sandy and regosol. However, waterlogging periods of 1–15 and 1–30 DAP in the latosol soil **caused** higher SRR compared to those without waterlogging. Consequently, the waterlogging treatment **could increase** the SRR. In certain conditions, if it **did not occur** weed competition,

then the rice crops **were more concentrated** on improving the growth of the shoot than the root. Therefore, it **would cause** the SRR to be higher. On the contrary, weeds **experienced** rapid growth without waterlogging, so the rice crops **were depressed** in their development.

CHAPTER 4
ARTICLE MANUSCRIPT

4.1. Title

The research title is a statement or reflection that contains the entire content of a study related to the object to be researched, the goals and objectives to be achieved, and the scope of the research. The title of the article is a concise and clear statement that summarizes the main idea of the study. The title will be seen first by journal editors, reviewers, and readers when they want to read your article. It is also the only information that will be seen in the database or search engine query. A good title should contain a few words that describe the characteristics or aims of the research article.

A good title has some characteristics: should be short clear, specific, catchy, informative, and not too general, (2). Limited to 8-15 words or must not be more than 120 characters, (3). Relevant to the subject, (4). In a single phrase, (5). Correct grammar and proper capitalization (tentative), and (6). Avoid abbreviations and formulae.

The title functions in the research article are (1). Captivate reviewers' attention, (2). State contributions in an appropriate manner, (3). Differentiate from other titles, and (4). Provide the best info for electronic search engines to find your articles.

The stages of how to make an attractive title, are namely: (1). Collect relevant information but clear. A good title can attract the attention of busy readers to take their time, (2). Use striking keywords. You should choose interesting keywords to steal the reader's attention and place them at the beginning of the title. (3). Choose a noun phrase or question. Statement titles are only suitable for articles that answer one specific question and present a no-complex answer. Use the title as a question, if there is no complex answer. (4). Avoid ambiguity in noun phrases (more than one meaning).

Differences in theme, topic, and title of research:

The difference in theme, topic, and title, namely:

1) The research theme is the main idea, subject, or topic and sometimes repeatedly appears in scientific work. Themes can consist of one word, two words, or more, for example: 'Maximizing rice yield'. The research theme is a general and broad subject matter, so it needs to be elaborated again. The general and broad nature should therefore be narrowed down to a research topic.
2) The research topic is the subject matter that will be identified, solved, elaborated, and studied further in the research. The research topic is a description of a problem that is still general in nature and its scope can be narrowed to the title of the study.

3) The research title is a specific description (reflecting the content of scientific papers), clear and not general in nature of a problem.

The title is part of a more detailed topic. Wide coverage of theme, topic, and title can be seen in Figure 4.1.

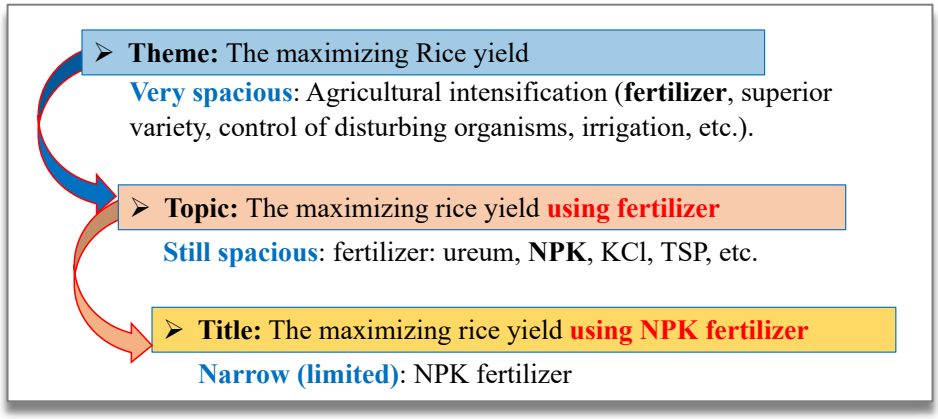

Figure 4.1. Differences in theme, topic, and title

Figure 4.1 explains the different notions of theme, topic, and title. At the same time, it describes the scope that has been narrowed and clear compared to the theme and topic.

Therefore, the creation of the title of the research article in Figure 5.1 can be explained as follows.

1. Choose a keyword that striking at the beginning of the title: **Maximizing** (significance). Maximizing is a striking keyword.
2. Focus on the intended goals of the research: **Rice yield** (objective). Rice yield is a noun phrase.
3. Describe the methods used for the research: **Using NPK fertilizer** (method)
4. Reconstruction of research titles:

Maximizing	Rice Yield	Using NPK Fertilizer
Significance	Objective	Method

4.2. Affiliation

Author's name:

The author's name is without title. The first author is the author who has contributed the most to research and is placed first on the list of authors. Part of the list of author names in one article manuscript is attempted to come from universities or other countries. The author who handles most of the creation and improvement of article manuscripts is placed first as the first author and at the same time as a correspondence author. Place the order of second, third, and so on authors after the first author. Place a co-author with a lot of experience writing

articles in the last order, for this example: Siti Fairuz Yusoff (like the example below but there are no fixed rules).

There are no standard rules governing the corresponding author's position n the list of article authors, who can be the first author or co-author.

Affiliation:

The author's affiliation (author's home institution) consisted of *Department, Faculty, University, city and zip code, and country* (some are even asked to include an email from each author).

Correspondence author:

As the corresponding author is given an asterisk (*) before the word "Correspondence author" and accompanied by the author's mailing or email address. The correspondence author does not have to be the first author, but the author that handles all communication or improvement of the article manuscript during the publication process. Communication about article revisions and final decisions will only be communicated by correspondence author email. The correspondence author is the author who is most responsible for the quality of the paper and becomes a correspondence for others who want to ask questions about his paper after it is published. There is no standard rule to adjust the position of correspondence author in the list of paper authors, so it can be first author, second author, or last author.

For example:

Paiman[1,*], Muhammad Ansar[2], Fani Ardiani[3] and Siti Fairuz Yussof[4]

[1)]Department of Agrotechnology, Faculty of Agriculture, Universitas PGRI Yogyakarta, Yogyakarta 55182, Indonesia.
[2)]Department of Agrotechnology, Faculty of Agriculture, Universitas Tadulako, Palu 94118, Indonesia.
[3)]Department of Agrotechnology, Faculty of Agriculture, Institut Pertanian Stiper, Yogyakarta 55281, Indonesia.
[4)]Department of Agricultural Science, Faculty of Technical and Vocational, Universiti Pendidikan Sultan Idris, Tanjong Malim 35900, Perak, Malaysia.

**Correspondence email: paiman@upy.ac.id*

4.3. Abstract

An abstract is a summary of a research article, thesis, dissertation, review, conference proceedings, or in-depth analysis on a particular subject and is often used to help readers quickly understand the paper's purpose (Anonymous, 2023). The abstract is important. The abstract is the shop window of your article. The abstract is a summary of the whole paper (single paragraph). Will be read first by

the reviewer, and must be high quality (not contain: references, citations, table, and figure). Single words or phrases represent key concepts.

Before writing an article, you should see an example of an abstract article published by the journal to be addressed and need to pay attention to the abstract format. The abstract is an important summary of the entire scientific paper which includes: background (tentative), objectives, methods, results, and conclusions.

Abstract function among others, namely: 1). Help readers find what they're looking for, 2). Determine the level of interest of other authors in your work, 3). Help researchers find papers relevant to their work, 4). Help people decide whether to read the whole thing or not (without wasting time), and 5). To optimize your search engine more → click by Google.

A concise and factual abstract of no more than 250 words is required. It reports concisely on the main findings of the research. To this end, the abstract is structured in five parts: 1). Context: which presents the background and the issues, 2). Objective: explains the objectives of the research, 3). Methods: provides a brief overview of the material and methods used, 4). Results: presents the main results using quantitative facts whenever possible, and 5). The interpretation of those results, and 5). Conclusion: highlights the novelty (main findings) of those results and 6). Recommendations/suggestions/implications for science, policy, and practice.

There are many models of how to write abstract formats. The structure of the abstract depends on the journal to be addressed.

1) **Model 1:** Abstract structure consists of a short background, objective, aims, methods, results, conclusion, implications/recommendation/suggestion, and is presented separately.

   Abstract

   Short background:

   Rice **has become** a primary daily necessity for most Indonesian population. The upsurge in national rice production **can be done** by agricultural intensification through the application of compound fertilizer.

   Objectives:

   This study **aimed** to determine the optimum dose of NPK fertilizer, which **could provide** the highest rice yield of Ciherang varieties in Alluvial soil.

   Methods:

   This experiment **was** a single factor arranged in a completely randomized design and three times replications. The treatment of NPK fertilizer **consisted of** four doses, i.e., 0, 160, 320, and 480 kg ha^{-1}. The data observations **were analyzed** using analysis of variance at 5% significance levels. The difference between the averages of the treatment **was compared** using Duncan′s new multiple range test at 5% significance levels.

Results:

The results of the research **showed** that the application of NPK fertilizer **could increase** the growth and yield of rice plants compared to only providing urea fertilizer. The optimum dose of compound NPK **was obtained** at 656 kg ha^{-1} with the maximum dry weight of grains of 4.26 tons ha^{-1} milled dry grain.

Conclusion:

In conclusion, the NPK fertilizer interval **has not reached** the optimum dose in Alluvial soils for the Ciherang variety.

Recommendation:

We **recommend** that the application of NPK Mutiara fertilizer with doses higher than 480 kg ha^{-1} **is required** for alluvial soils.

2) **Model 2**: Model 1 can be arranged in one paragraph.

Abstract

Rice **has become** a primary daily necessity for most Indonesian population. The upsurge in national rice production **can be done** by agricultural intensification through the application of compound fertilizer. This study **aimed** to determine the optimum dose of NPK fertilizer, which **could provide** the highest rice yield of Ciherang varieties in Alluvial soil. This experiment **was** a single factor arranged in a completely randomized design and three times replications. The treatment of NPK fertilizer **consisted of** four doses, i.e., 0, 160, 320, and 480 kg ha^{-1}. The data observations **were analyzed** using analysis of variance at 5% significance levels. The difference between the averages of the treatment **was compared** using Duncan′s new multiple range test at 5% significance levels. The results of the research **showed** that the application of NPK fertilizer **could increase** the growth and yield of rice plants compared to only providing urea fertilizer. The optimum dose of compound NPK **was obtained** at 656 kg ha^{-1} with the maximum dry weight of grains of 4.26 tons ha^{-1} milled dry grain. In conclusion, the NPK fertilizer interval **has not reached** the optimum dose in Alluvial soils for the Ciherang variety. We **recommend** that the application of NPK Mutiara fertilizer with doses higher than 480 kg ha^{-1} **is required** for alluvial soils.

3) **Model 3:** Using model 2, but without short background.

Abstract

This study **aimed** to determine the optimum dose of NPK fertilizer, which **could** provide the highest rice yield of Ciherang varieties in Alluvial soil. This experiment **was** a single factor arranged in a completely randomized design and three times replications. The treatment of NPK fertilizer **consisted of** four doses, i.e., 0, 160, 320, and 480 kg ha^{-1}. The data observations **were analyzed**

using analysis of variance at 5% significance levels. The difference between the averages of the treatment **was compared** using Duncan's new multiple range test at 5% significance levels. The results of the research **showed** that the application of NPK fertilizer **could increase** the growth and yield of rice plants compared to only providing urea fertilizer. The optimum dose of compound NPK **was obtained** at 656 kg ha^{-1} with the maximum dry weight of grains of 4.26 tons ha^{-1} milled dry grain. In conclusion, the NPK fertilizer interval **has not reached** the optimum dose in Alluvial soils for the Ciherang variety. We **recommend** that the application of NPK Mutiara fertilizer with doses higher than 480 kg ha^{-1} **is required** for alluvial soils.

4) **Model 4:** Using model 3, but the first sentence in the paragraph is indented into seven characters.

Abstract

This study **aimed** to determine the optimum dose of NPK fertilizer, which **could provide** the highest rice yield of Ciherang varieties in Alluvial soil. This experiment **was** a single factor arranged in a completely randomized design and three times replications. The treatment of NPK fertilizer **consisted of** four doses, i.e., 0, 160, 320, and 480 kg ha^{-1}. The data observations **were analyzed** using analysis of variance at 5% significance levels. The difference between the averages of the treatment **was compared** using Duncan's new multiple range test at 5% significance levels. The results of the research **showed** that the application of NPK fertilizer **could increase** the growth and yield of rice plants compared to only providing urea fertilizer. The optimum dose of compound NPK **was obtained** at 656 kg ha^{-1} with the maximum dry weight of grains of 4.26 tons ha^{-1} milled dry grain. In conclusion, the NPK fertilizer interval **has not reached** the optimum dose in Alluvial soils for the Ciherang variety. We **recommend** that the application of NPK Mutiara fertilizer with doses higher than 480 kg ha^{-1} **is required** for alluvial soils.

The variation of verb tenses in the abstract:

1. This study **aimed** to determine the effect of plant spacing on the quality parameter of sprouting broccoli.
2. These studies **aimed** to investigate the effects of planting density and different patterns of seed spacing on thrips density and injury.
3. The objective of the study **was** to evaluate the effect of furrow and plant spacing and their interaction on yield and water use efficiency of maize.
4. The aims of this study **were**: (i) to evaluate the biomass production for energy generation; and (ii) to determine the leaf area index, solar radiation interception, and mean annual increment of three perennial woody crops *Eucalyptus grandis*, *Mimosa scabrella,* and *Ateleia glazioviana*, grown under four planting spacings in Southern Brazil.

4.4. Keywords

Keywords were used for indexing your paper (important for online searching). Keywords are a tool to help indexers and search engines find relevant papers for you. Keywords will make it easier for database search engines to find your articles in cyberspace viewers.

Keywords should be listed in *alphabetical order* (capitalized each word or beginning words or all lowercase) and separated with semicolons (;) or comma (,) or point (·) or (-) → many variations. Avoiding general and plural terms and multiple concepts (avoid, for example, *'and', 'of'*). Choose *important* and *relevant keywords* that researchers in the field will be searching for, so that your paper will appear in a database search. Avoid words with a *broad meaning*, and should *differ from words mentioned* in the title. Don't use *words* from the journal name (it is implicit in the topic). The scientific or systematic names of plants and fungi, etc. → should be written in italics. e.i., *Oryza sativa.*

How to choose the keywords, if the title article is "**Maximizing the Rice Yield Using NPK Fertilizer**". The relevant keywords for the title above were Ciherang variety, NPK fertilizer, rice yield, optimum dose, and soil types. The procedure for writing keywords in the abstract is adjusted to alphabetical order. Some examples are shown as follows:

Keywords writing in several model:

1) **Model 1:** All keywords begin with a lowercase letter, except the name of variety, animal, tool, etc., separated with semicolons, commas, points, or strips and ending with no period.

   For examples:
   a. **Keywords**: Ciherang variety; NPK fertilizer; optimum dose; rice yield; soil types
   b. **Keywords**: Ciherang variety, NPK fertilizer, optimum dose, rice yield, soil types
   c. **Keywords**: Ciherang variety · NPK fertilizer · optimum dose · rice yield · soil types
   d. **Keywords**: Ciherang variety - NPK fertilizer - optimum dose - rice yield - soil types

2) **Model 2:** Only beginning keywords use uppercase letters, separated with semicolons, commas, points, or strips, and ending with a period.

   For examples:
   a. **Keywords**: Ciherang variety; NPK fertilizer; optimum dose; rice yield; soil types.
   b. **Keywords**: Ciherang variety, NPK fertilizer, optimum dose, rice yield, soil types.

c. **Keywords**: Ciherang variety · NPK fertilizer · optimum dose · rice yield · soil types.
d. **Keywords**: Ciherang variety - NPK fertilizer - optimum dose - rice yield - soil types.

3) **Model 3:** It begins with a capital letter at the beginning of each keyword, separated with semicolons, commas, points, or strips, and ends without a period.

For examples:

a. **Keywords**: Ciherang variety; NPK fertilizer; Optimum dose; Rice yield; Soil types
b. **Keywords**: Ciherang variety, NPK fertilizer, Optimum dose, Rice yield, Soil types
c. **Keywords**: Ciherang variety · NPK fertilizer · Optimum dose · Rice yield · Soil types
d. **Keywords**: Ciherang variety - NPK fertilizer - Optimum dose - Rice yield - Soil types

4) **Model 4:** Keywords are separated into keys and words, beginning with a capital letter at the beginning of each keyword, separated with semicolons, commas, points, or strips, and ending without a period.

For examples:

a. **Key words**: Ciherang variety; NPK fertilizer; Optimum dose; Rice yield; Soil types
b. **Key words**: Ciherang variety, NPK fertilizer, Optimum dose, Rice yield, Soil types
c. **Key words**: Ciherang variety · NPK fertilizer · Optimum dose · Rice yield · Soil types
d. **Key words**: Ciherang variety - NPK fertilizer - Optimum dose - Rice yield - Soil types

The keywords function in the article research:

1. To find as much information about relevant articles in the database as possible to support the topic you will write.
2. Make it easier for readers to find the manuscript of the article you have written.
3. To increase the number of people reading your manuscript, and the possibility of generating more citations.

The keywords can be used to search the database to get a lot of literature that supports your topic. With the help of several tools from Connectedpapers.com, Scopus.com, Publish or perish, ScienceDirect.com, etc., some literature can be easily found. As an illustration, the process of searching literature with these keywords can be seen in Figure 4.2.

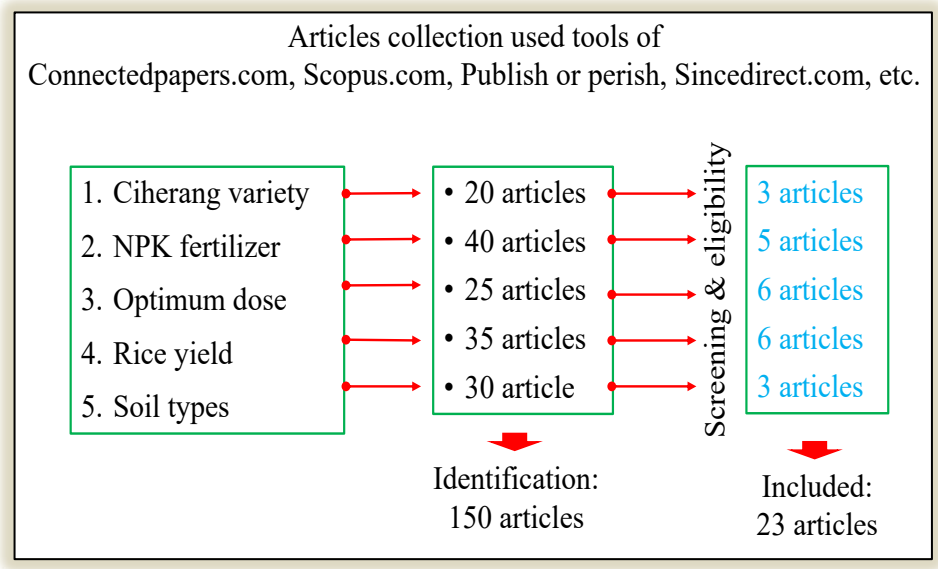

Figure 4.2. Utilization of keywords to download literature in the database

Figure 4.2 explains that using five keywords can be used to download as many as 150 articles. However, not every downloaded article is relevant to the chosen topic. There are only 23 articles that are relevant and support the selected topic.

4.5. Introduction

4.5.1. Handling insert or edit citations

4.5.1.1. Insert, edit, and merge citations in the text

HOW TO INSERT, EDIT, AND MERGE CITATIONS

In general, there are several types of citation references in the article text, namely: American Political Science Association, American Psychological Association 7th edition, American Sociological Association 6th edition, Chicago Manual of Style 17th edition (author-date), Cite Them Right 10th edition – Harvard, IEEE, Modern Humanities Research Association 3rd edition (note with bibliography, Modern Language Association 8th edition, Nature, Vancouver, and More styles.

1). **Use a style of IEEE**

In the following example, we're using the style of IEEE with the Mendeley.com application. Usually, when you first cite references to your article manuscript as shown in Table 4.1. The citation is not perfect, so it needs to be improved to make it more informative.

Table 4.1. Insert citation use of IEEE before edited

No.	Position	Original sentences
1.	If insert citation in front of the sentences.	[1] Hybrid varieties had a much higher weed competitiveness index than Inbrida. [2][3][4] The production difference depends on each variety's characteristics.
2.	If insert citation at the back of the sentences.	Hybrid varieties had a much higher weed competitiveness index than Inbrida [1]. The production difference depends on each variety's characteristics [2][3][4].

Table 4.1 explains placing citation references at the beginning and end of sentences using the style of IEEE. Citations located at the beginning and end of sentences must be edited (types 1 and 2) as shown in Tables 4.2 and 4.3.

Table 4.2. Insert and merge citation use of IEEE (type 1) after edited

No.	Position	Sentences have been edited
1.	If insert citation in front of the sentences.	Research results by Ahmed et al. [1], hybrid varieties had a much higher weed competitiveness index than Inbrida. According to Nestor et al. [2]; Ibrahim and Adel [3]; Johnson [4], the production difference depends on each variety's characteristics.
		Ahmed et al. [1] stated that hybrid varieties had a much higher weed competitiveness index than Inbrida. Nestor et al. [2]; Ibrahim and Adel [3]; Johson [4] explained that the production difference depends on each variety's characteristics.
2.	If insert of citations at the back of the sentences.	Hybrid varieties had a much higher weed competitiveness index than Inbrida [1]. The production difference depends on each variety's characteristics [2-4].

Table 4.3. Insert and merge citation use of IEEE (type 2) after edited

No.	Position	Sentences have been edited
1.	If insert citation in front of the sentences.	Research results by Ahmed *et al*. [1], hybrid varieties had a much higher weed competitiveness index than Inbrida. According to Nestor *et al*. [2]; Ibrahim and Adel [3]; Johnson [4], the production difference depends on each variety's characteristics.
		Ahmed et al. [1] stated that hybrid varieties had a much higher weed competitiveness index than Inbrida. Nestor *et al*. [2]; Ibrahim and Adel [3]; Johson [4] explained that the production difference depends on each variety's characteristics.
2.	If insert citation at the back of the sentences.	Hybrid varieties had a much higher weed competitiveness index than Inbrida [1]. The production difference depends on each variety's characteristics [2-4].

2). **Use a style of American Psychological Association 7th edition**

In the following example, we're using the style of the American Psychological Association 7th edition with the Mendeley.com application. Usually, when you first cite references to your article manuscript as shown in Table 4.4. The citation needs to be revised, so it needs to be improved.

Table 4.4. Insert citation use of American Psychological Association 7th edition before edited

No.	Position	Original sentences
1.	If insert citation in front of the sentences.	(Ahmed et al., 2022) Hybrid varieties had a much higher weed competitiveness index than Inbrida. (Nestor et al., 2023)(Ibrahim and Adel, 2020)(Johnson, 2021) The production difference depends on each variety's characteristics.
2.	If insert citation at the back of the sentences.	Hybrid varieties had a much higher weed competitiveness index than Inbrida (Ahmed et al., 2022). The production difference depends on each variety's characteristics (Nestor et al., 2023)(Ibrahim and Adel, 2020)(Johson, 2021).

Table 4.4 explains placing citation references at the beginning and end of sentences using the style of American Psychological Association 7th edition. Citations located at the beginning and end of sentences must be edited (types 1 and 2) as shown in Table 4.5.

Table 4.5. Insert and merge citation use of American Psychological Association 7th edition (type 1) after edited

No.	Position	Sentences have been edited
1.	If insert citation in front of the sentences.	Research results by Ahmed et al. (2022), hybrid varieties had a much higher weed competitiveness index than Inbrida. According to Nestor et al. (2023); Ibrahim and Adel (2020); Johnson [2021], the production difference depends on each variety's characteristics.
		Ahmed et al. (2022) stated that hybrid varieties had a much higher weed competitiveness index than Inbrida. Nestor et al. (2023); Ibrahim and Adel (2020); Johson (2021) explained that the production difference depends on each variety's characteristics.
2.	If insert citation at the back of the sentences.	Hybrid varieties had a much higher weed competitiveness index than Inbrida (Ahmed et al., 2022). The production difference depends on each variety's characteristics (Nestor et al., 2023; Ibrahim and Adel, 2020; Johson, 2021).

Table 4.6. Insert and merge citation use of American Psychological Association 7th edition have been edited (type 2) after edited

No.	Position	Sentences have been edited
1.	If insert citation in front of the sentences.	Research results by Ahmed *et al*. (2022), hybrid varieties had a much higher weed competitiveness index than Inbrida. According to Nestor *et al*. (2023); Ibrahim and Adel (2020); Johnson [2021], the production difference depends on each variety's characteristics.
		Ahmed *et al*. (2022) stated that hybrid varieties had a much higher weed competitiveness index than Inbrida. Nestor *et al*. (2023); Ibrahim and Adel (2020); Johson (2021) explained that the production difference depends on each variety's characteristics.
2.	If insert citation at the back of the sentences.	Hybrid varieties had a much higher weed competitiveness index than Inbrida (Ahmed *et al*., 2022). The production difference depends on each variety's characteristics (Nestor *et al*., 2023; Ibrahim and Adel, 2020; Johson, 2021).

And there are still many types of citations as desired by the journal. Each journal has a different article template.

4.5.1.2. Steps of editing citations if the position at the front of the sentences

STEPS TO EDIT CITATION

1) Citation use style of American Psychological Association 7th edition with Mendeley.com application

   For example:

   (Ahmed et al., 2021) Hybrid varieties had a much higher weed competitiveness index than Inbrida.

   References:

   Ahmed, S., Alam, M. J., Hossain, A., Islam, A. K. M., Awan, T. H., Soufan, W., Qahtan, A. A., Okla, M. K., & Sabagh, A. E. (2021). Interactive effect of weeding regimes, rice cultivars, and seeding rates influence the rice-weed competition under dry direct-seeded conditions. *Sustainability (Switzerland)*, *13*(1), 1–15. https://doi.org/10.3390/su13010317

   How to edit citations with the style of American Psychological Association 7th edition on Mendeley.com?

   Guideline:

   Step 1: The author's name "Ahmed et al." is copied and placed in front of the opening bracket (Ahmed et al., 2021) and before the author's name is added "According to" at the beginning of the sentence and after the year is added a comma (,) or add said that after curly braces so that it becomes:

   - According to Ahmed et al. (Ahmed et al., 2021), hybrid varieties had a much higher weed competitiveness index than Inbrida.
   - Ahmed et al. (Ahmed et al., 2021) said that hybrid varieties had a much higher weed competitiveness index than Inbrida.

   Step 2: Click the author's name (Ahmed et al., 2021) in parentheses, click: References → click: Edit citation → click: Ahmed 2021 → check: Suppress author → Ok, so that it becomes:

   Result:

   - According to Ahmed et al. (2021), hybrid varieties had a much higher weed competitiveness index than Inbrida.
   - Ahmed et al. (2021) said that hybrid varieties had a much higher weed competitiveness index than Inbrida.

2) The citation uses the style of IEEE with the Mendeley.com application
   For example:
   [1] Hybrid varieties had a much higher weed competitiveness index than Inbrida.

References:

[1] S. Ahmed *et al.*, "Interactive effect of weeding regimes, rice cultivars, and seeding rates influence the rice-weed competition under dry direct-seeded condition," *Sustain.*, vol. 13, no. 1, pp. 1–15, 2021, doi: 10.3390/su13010317

How to edit citations with the style of IEEE. It is easier, just one step, namely:

Guideline:

The author's name "Ahmed et al." in References are copied and placed in front of curly braces [1] and before the author's name is added the word "According to" at the beginning of the sentence after curly braces are added comma (,), or add said that after curly braces so that it becomes:

Result:

- According to Ahmed et al. [1], hybrid varieties had a much higher weed competitiveness index than Inbrida.
- Ahmed et al. [1] said that hybrid varieties had a much higher weed competitiveness index than Inbrida.

4.5.2. Structure of the introduction

In general, the content of the article in the introduction section starts from the deduction to induction logic as in Figure 4.3.

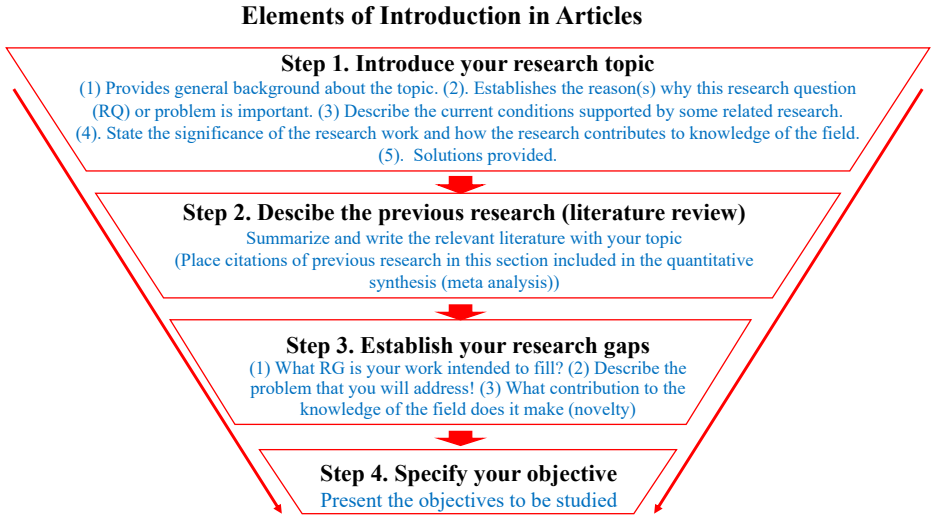

Figure 4.3. Elements of introduction in the research article

In this section of the introduction, the author used an article manuscript entitled:

The maximizing rice yield using NPK fertilizer

Step 1. Introduce your research topic

(1) Provides general background about the topic!

This background contains a description of the things behind the selection of the topic taken. What is the background of a study? A background is *not* a literature review. No one wants to read endless citations back-to-back in this section. You don't need to list all the papers you've read or all the work done in the past on this topic.

For example:

In 2060, the global population **is expected** to reach 10 billion, and the demand for staple food supplies particularly rice, increases accordingly. On the other side, rice production **relies** heavily on chemical fertilizers to meet the food demands of the increasing population. Rice **is** widely consumed as a veritable source of calories, and it **is** consumed by nearly half of the world's population. Likewise, In Indonesia, rice **is** a staple food for most of the Indonesian population.

(2). Establishes the reason(s) why this research problem (RP) or research question (RQ) is important

Definition:

- A research problem is a statement about an area (field) of concern, a condition to be corrected, a difficulty to eliminate, or a troubling question in scientific literature, theory, or practice that needs understanding and investigation. The purpose of this problem statement is to provide a clear and concise statement of the research problem.
- A research question is a statement made in the form of a question that seeks to study and explore the research problem. The purpose of a research question is to find answers to specific issues or research problems to address. The importance of developing research questions is that they can narrow down broad topics within a particular field of study. Research questions can be classified into quantitative, qualitative, or mixed research questions.

For example:

The demand for rice by the Indonesian population **continues** to grow from year to year [1-3]. Indonesia's rice import volume in January-November 2018 **surged** by 2.2 million tons compared to January-December 2017, which only **reached** 305.75 thousand tons [4]. The data **illustrates** that the national rice production **has not been able to** meet the needs of the Indonesian population. **Considering all of this evidence**, it **seems** that rice

cultivation in Indonesia **must be optimized** through the use of superior rice varieties.

(3). Establishes the reason(s) why this research problem (RP) or research question (RQ) is important

This section should describe the current state associated with the issue under investigation. For a more detailed explanation, there needs to be relevant literature support.

For example:

One of the Indonesian superior rice varieties **is** Ciherang. It **is** a new superior variety and **adaptable** to the Indonesian environment. The Ciherang varieties **have** advantages over other varieties. This variety **has** a profitable high yield and a taste that meets the demand of the market. The potential productivity of Ciherang **is** 6.0 to 8.5 tons ha^{-1} of the dry weight of grain. The crop age **is** 116 to 125 days after planting (DAP). In addition, this rice crop **is** resistant to brown planthopper biotype 3, bacterial left blight resistance, and brown planthopper biotype 2 [5].

(4). State the significance of the research work and how the research contributes to knowledge of the field.

It needs a significant statement of the research carried out and what is its contribution to the field of science.

For example:

However, to obtain a high yield, this rice variety **requires** the fulfillment of macro fertilizer such as NPK.

(5). Solutions provided.

It is necessary to convey the temporary solutions offered to solve the problems that occur.

For example:

Many choices of NPK fertilizers **have been** available in farm shops around farmers' environments.

Step 2. Describe the previous research (literature review)

(1) Paragraph transition

The paragraph structure in the background has been discussed, then paragraphs will be discussed in the literature review. Before discussing the paragraph structure in the review literature, it is necessary to have a transitional paragraph. This paragraph serves as a bridge to the next

paragraph. This paragraph serves to connect the discussion in the background and literature review. This section can be used in only one paragraph.

(2) Transition between paragraph

After the transition paragraph, then a paragraph discussion is carried out in the literature review. Each paragraph in the literature review has complementary and interlocking ideas. This section, it usually consists of several paragraphs. Therefore, transitions between paragraphs are needed to glue the links between paragraphs. These transitions between paragraphs serve as glue or cohesion between paragraphs and can be added at the beginning and end of paragraphs. The transition between paragraphs aims to make the article writing have a flowing flow and is easy to read. Transitions between paragraphs have different meanings from paragraph transitions. In addition, conjunctions are very likely to be used as a bridge between paragraphs in the introduction that is being compiled.

(3) Structure of literature review

It should also be noted, the sentences contained in one paragraph must be interrelated so that a good flow or continuity can be created. The structure partwork in the review literature starts from paragraphs that discuss theories or definitions that are still general (broad), then narrowed to research findings that can clarify the topic to be studied. Furthermore, the next paragraph can only be compiled research gaps.

Step 3. Describe the research gaps (RG)

(1) What RG is your work intended to fill?

- Explain why this topic needs to be addressed now. You can show problems with previous theories or research gaps in current ones. A good rationale will interest readers and show why they should read your paper.
- In this section, researchers are asked to summarize all literature reviews that have been used, namely what has been done by previous researchers. Next, the researcher is asked to make a statement about what the researcher has not done before. This section will produce novelty.

For example:

Research on the use of NPK Mutiara fertilizer **has been carried out** by previous researchers on rice plants. However, the optimum dose **found** still varies between 300-750 kg ha^{-1} and depends on the type of soil where rice is cultivated. In addition, research on the use of NPK Mutiara in Alluvial soil **has never been conducted**.

(2) Describe the problem that you will address!

Researchers can describe what they will address from this research.

For example:

This study entitled "Maximizing the rice yield using NPK fertilizer" **will only determine** the use of the optimum dose of NPK Mutiara fertilizer in Alluvial soil.

(3) What contribution to the knowledge of the field?

Researchers must be able to explain what the contributions of this research are to their field.

For example:

Referring to the existing literature, knowledge about NPK fertilizer **has** significant implications in increasing the rice yield of the Ciherang variety. Therefore, this research **should be conducted** for the cultivation of Cihrerang variety rice in Alluvial soil.

Step 4. Specify your objective

(1) Present the objectives to be studied

This study can use only one aim to be addressed. But research can also use more than one aim.

For example:

Therefore, this study **aimed** to determine the optimum dose of NPK Mutiara fertilizer, which **could provide** the highest rice yield of the Ciherang variety in Alluvial soil.

4.6. Methods

Theethode is the core part of the paper. In this section, the author needs to tell the activities or steps of applied research. The author must write a complete list of steps carried out from the time and place of research to data analysis. This is so that the editor or reviewer can understand the steps taken by the author from beginning to end.

Missing steps or flow will be confusing and will likely lead to early rejection of your manuscript. The method is part of the research to collect data. Data is an important source of information, so it needs to be used correctly.

4.6.1. Structure of the methods

The structure of the method in the article consists of several stages and can be shown in Table 4.4.

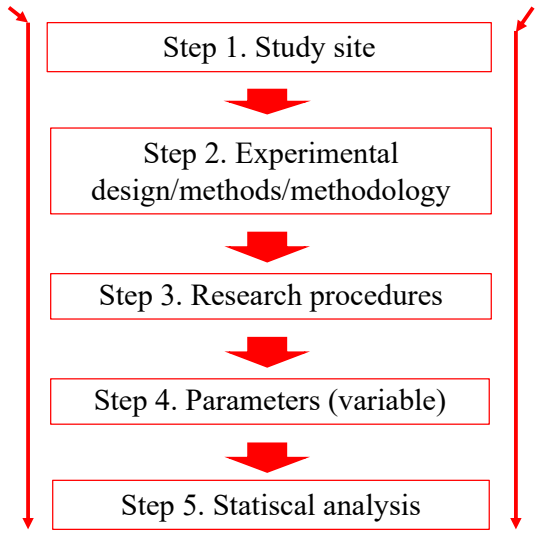

Figure 4.4. Structure of the method in the article

In this section of methods, the author uses an article manuscript entitled:

Minimizing weed competition through waterlogging in rice (*Oryza sativa*) under various soil types

Step 1: Study site

Describe all aspects of your study site (e.g., research time, place, temperature, elevation, precipitation, land use, etc.).

For example:

The research area **was conducted** from July to November 2019 in the greenhouse, Faculty of Agriculture, Universitas PGRI Yogyakarta, Ngestiharjo, Bantul, a Special Territory of Yogyakarta, Indonesia, having an elevation of 118 m above sea level in the position at S 7°33′–8°12′ and E 110°00′–110°50′. The average temperature and humidity of the air during the study **were** 34 °C and 60%, respectively.

Step 2. Experiment Design/Methods/Methodology

Describe the method in enough detail that another researcher could repeat your research exactly. Explain the experiment design that was used! What kinds of treatments were used? How many replications were used?

For example:

The research **was arranged** in a complete randomized design (CRD) factorial with three replications. The first factor **was** waterlogging, which consisted of three levels: without waterlogging, 1–15, and 1–30 DAP. The second factor **was** soil types, which consisted of four types: latosol, coastal sandy, volcanic, and regosol. Therefore, the experiment **needed** as many as 36 wooden boxes as sample plots.

Step 3. Research procedures

How to take sampling? Explain the materials and tools that were used! Explain how the research can be done!

For example:

The soil used **was** the former paddy fields from 0-20 cm soil depth. The sampling of soil types **was taken** from three districts: Kulonprogo, Sleman, and Bantul, in a special territory of Yogyakarta. The rice nurseries **were carried out** in plastic boxes of 25 × 30 × 10 cm (width, length, high) for germination. The soil media **used** a mixture of soil and cow manure (1:1). The Ciherang variety was used in this study. **First**, the rice seeds **were spread** and **covered** with 0.2-0.4 cm soil. The seeds **would germinate** for four days after spreading (DAS) in the media. And so on.

Step 4. Parameters (variables)

What variables are observed? How to observe the variables? What are the tools' names used (standards of SI)?

For example:

The weed observation **was carried out** on the weed species that grew on the soil surface around rice clumps 60 days after planting (DAP). The variable of weed **was observed** by weed dry weight (WDW). The observation of rice **was done** by collecting the variable, including leaf area index (LAI), shoot dry weight (SDW), root dry weight (RDW), and harvest (HI) index, in sample plots at 104 DAP. The WDW, shoots dry weight (SDW), roots dry weight (RDW), and GDW **were dried** in Binder FED 53–UL Forced Convection Drying Oven for 48 hours at a temperature of 80 °C or until constant weight. The Ohaus PA214 Pioneer Analytical Balance **was used** to measure the WDW, SDW, RDW, and GDW. The Portable Laser Leaf Area Meter CI–202 **was used** for measuring the leaf areas (cm^2). The SDW **was** total from the dry weight of the stem, leaf, and panicle.

Step 5. Statistical analysis

What statistical tests were used? Mention the software applications that were used.

For example:

Observational data **were analyzed** by the analysis of variance (ANOVA) at 5% significant levels (Gomez and Gomez, 1984) with IBM SPSS Statistic 23. In addition, the difference between the treatment averages **was compared** using Duncan's new multiple range tests (DMRT) at 5% significant levels.

4.6.2. How do you write the equation?

REFER TO EQUATION

For example:

- The shoot root ratio (SRR) of rice **is** between SDW (kg/m^2) and RDW (kg/m^2) ratio. The formula for calculating the SRR **is represented** in Eq. 1.

$$SRR = \frac{SDW}{RDW} \qquad \ldots \text{(Eq. 1)}$$

- The economic yield (EY) of rice **is** in the form of GDW (kg/m^2). The biological yield (BY) of rice **is** total from GDW, SDW, and RDW (kg/m^2). The harvest index (HI) **is** the economic and biological yield ratio. Equation 2 **is** the formula for calculating the HI.

$$HI = \frac{EY}{BY} \qquad \ldots \text{(Eq. 2)}$$

- A paper containing several equations should be identified with a number in parentheses (Eq. 1). For equations or illustrations, just use **Eq. 1** or **Eqs. 1** and **2.** If it is placed at the end of a sentence. **Equation 1,** or **Equations 1** and **2**. If it is placed at the front of the sentence.

4.7. Results and Discussions

The results of the article are sections that represent the core findings of a study derived from the method. This part presents the findings in a logical order (without bias) and interpretation of the research results of the authors. In addition, prepare readers to interpret and evaluate themselves if they are not satisfied with the author's interpretation. The main purpose of the hasil section is to break down the data into sentences that show its significance to the research question.

The discussion is the most difficult part to write. In this section, the author must explain the true meaning of the research data without being too long. In this section, the author also should not hide facts or reasons. In addition, the author should not repeat presenting the results of the study. The objectives of the discussion are: (1). Present the principles, relationships, and generalizations shown by the results of the study. (2). Show how the results of the research are agreed or not with previously published articles. (3) Mendinquisition of theoretical implications of research results as well as practical applications. (4).

Clearly state the conclusion. (5). Assess the evidence for each conclusion. (6) Menddiscuss the importance of research results.

Some points that must be considered in writing results and discussions, namely:

1. What do your research results relate to the research problem or questions (RP/RQ) or objectives outlined in the introduction section?
2. Describes what the findings mean in each research result, and are supported by relevant data.
3. What do you find from the research, then provide supporting (agree) or contradictory arguments (why?) or offer new things for an interesting discussion (make a preposition)?
4. Present an argument with the most recent references (from journals published (Q1-Q2) in the last 5 years).
5. Improve the discussion with the conclusions that you make yourself at the end, as a comment from you for each research result that you get.
6. Is there any novelty that can be found in this research? In this detailed discussion section, novelties will be found in the research.

4.7.1. Structure of the results, discussion, and conclusion

In general, the elements of results, discussions, and conclusions can be seen ini Figure 4.5.

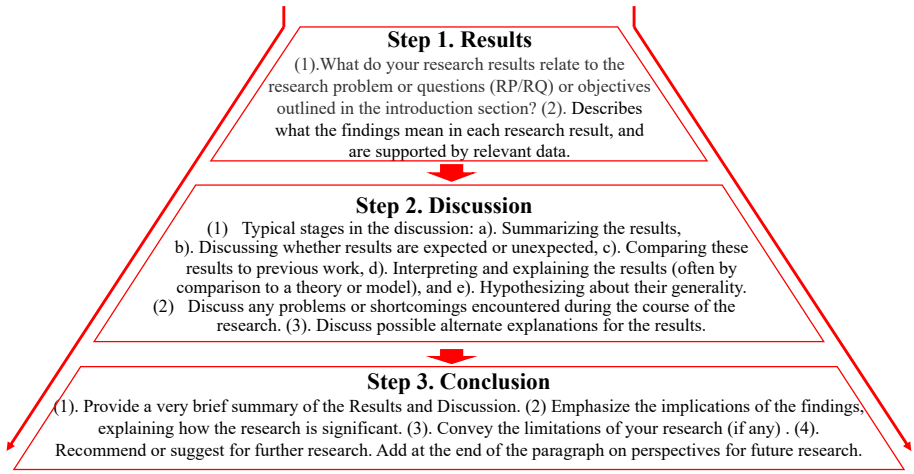

Figure 4.5. Elements of results, discussions, and conclusions

In this section of results, discussions, and conclusions, the author uses an article manuscript entitled:

Minimizing weed competition through waterlogging in rice (*Oryza sativa)* under various soil types

Step 1. Results

(1) What do your research results relate to the research problem or questions (RP/RQ) or objectives outlined in the introduction section?

For example:

Research problem:

Until now, there has been no research about the effect of waterlogging period on weed suppression in lowland rice.

Research results:

A waterlogging period of 1-30 DAP can minimize the weed competition and increase the rice yield.

(2) Describe what the findings mean in each research result, and are supported by relevant data.

For example:

Waterlogging of 1–30 DAP could inhibit the WDW and increase the LAI, SRR, GDW, and HI in different soil types. Waterlogging period of 1-30 DAP gave the highest GDW in latosol (7.5 t/ha), then decreased in volcanic (6.0 t/ha), regosol (5.9 t/ha), and the lowest in coastal sandy (4.8 t/ha).

Refer to Table and Figure

Tables and Figures are placed in the text after they are referenced. Each image must be titled (figure caption) at the bottom of the image (left or center edge) and numbered in Arabic numerals followed by the image title. Each table must be titled a table (table caption) and numbered in Arabic numerals at the top of the table followed by the table title (left or center edge). An example is shown in Tables 4.7 and 4.8.

The images in the text should be guaranteed to print clearly (font size, resolution, and line size printed are clear). Figures, tables, and diagrams/schematics should be placed in columns between text or if they are too large to be placed in the center of the page. The table should not contain vertical lines, but in certain journals, it is required. Horizontal lines are allowed but only the essentials.

Images placed on the manuscript should not be blurred. Images created from Excel or photos need to be increased in resolution so that they appear brighter and clearer. One of the tools that can be used is convert town (https://convert.town/image-dpi). An example is shown in Figure 4.6, 4.7, and 4.8.

REFER TO TABLE

Type 1:

The correlation analysis was done on the relationship between weed dry weight (WDW), leaf area index (LAI), shoot root ratio (SRR), grain dry weight

(GDW), and harvest index (HI). The results of the correlation analysis **can be seen** in Table 4.7. → (at the end of the sentence)

Table 4.7. The results of the correlation analysis

Variable		LAI	SRR	GDW	HI
WDW	Pearson Correlation	-.736**	-.548ns	-.776**	-.576ns
	Sig. (2-tailed)	.006	.065	.003	.050
	N	12	12	12	12

Remarks: ** = Correlation **is** significant at P = 0.01 level of probability (2-tailed), and ns = correlation **is** not significant at P = 0.05 level of probability.

Table 4.7 (at the front of the sentence) **shows** that GDW **was** significantly negatively correlated with LAI (-0.736**) and GDW (-0.776**), respectively, but not significantly with SRR (-0.548ns) and HI (-0.576ns). Growing weeds **was followed** by a decrease in LAI and GDW.

Type 2:

The correlation analysis **was done** on the relationship between weed dry weight (WDW), leaf area index (LAI), shoot root ratio (SRR), grain dry weight (GDW), and harvest index (HI). Table 4.8 (at the front of the sentence) **shows** the results of the correlation analysis between weed growth and rice growth and yield.

Table 4.8. The results of the correlation analysis

Variable		LAI	SRR	GDW	HI
WDW	Pearson Correlation	-.736**	-.548ns	-.776**	-.576ns
	Sig. (2-tailed)	.006	.065	.003	.050
	N	12	12	12	12

Remarks: ** = Correlation **is** significant at P = 0.01 level of probability (2-tailed), and ns = correlation **is** not significant at P = 0.05 level of probability.

GDW **was** significantly negatively correlated with LAI (-0.736**) and GDW (-0.776**), respectively, but not significantly with SRR (-0.548ns) and HI (-0.576ns). Growing weeds **was followed** by a decrease in LAI and GDW (Table 4.8). → (at the end of the sentence and in parentheses)

REFER TO FIGURE OR GRAPHIC

Type 1:

The effect of waterlogging on the performance of the weed-rice competition in all three treatments **showed** a significant difference in Latosol soil. Differences in weed growth **can be seen** in Figure 4.6. → (at the end of the sentence)

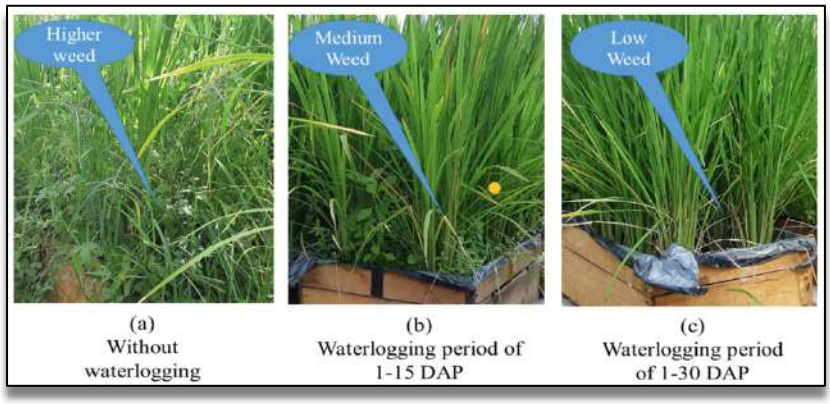

Figure 4.6. The effect of waterlogging on the weed-rice competition

Figure 4.6 **explains** (at the front of the sentence) that weed and rice performances **were** very different. Without waterlogging **showed** that weed growth **was** very strong (a). Treatment of 1-15 DAP waterlogging indicated medium weed growth (b). Finally, low weed growth occurred in waterlogging of 1-30 DAP (c).

Type 2:

The effect of waterlogging on the performance of the weed-rice competition in all three treatments **showed** a significant difference in Latosol soil. Differences in weed growth **can be seen** in Figure 4.7. → (at the end of the sentence)

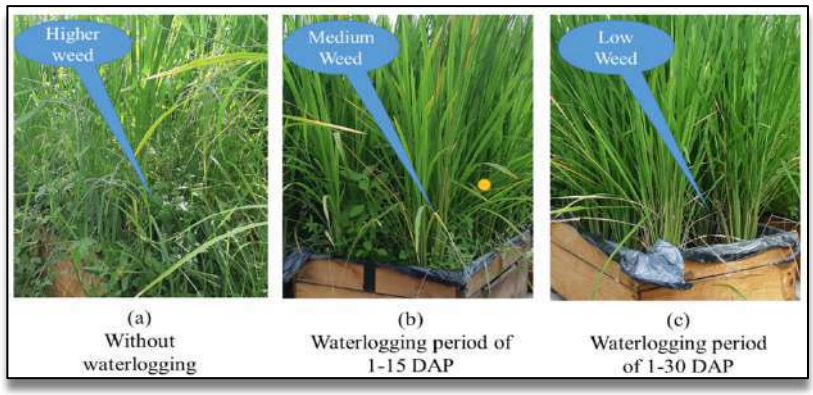

Figure 4.7. The effect of waterlogging on the weed-rice competition

Fig. 4.7 **explains** (at the front of the sentence) that weed and rice performances **were** very different. Without waterlogging **showed** that weed growth **was** very strong (a). Treatment of 1-15 DAP waterlogging indicated medium weed growth (b). Finally, low weed growth occurred in waterlogging of 1-30 DAP (c).

Type 3:

The effect of waterlogging on the performance of the weed-rice competition in all three treatments **showed** a significant difference in Latosol soil (Figure 4.8). → (at the end of the sentence and in parentheses)

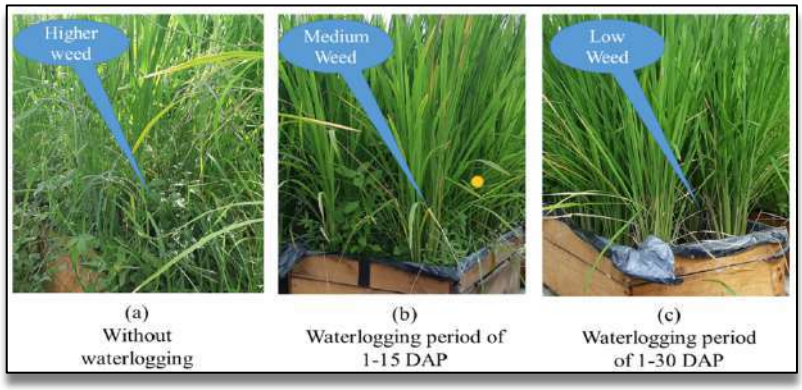

Figure 4.8. The effect of waterlogging on the weed-rice competition.

Weed and rice performances **were** very different. Without waterlogging **showed** that weed growth **was** very strong (a). Treatment of 1-15 DAP waterlogging indicated medium weed growth (b). Finally, low weed growth occurred in waterlogging of 1-30 DAP (c) (Figure 4.8). → (at the end of the sentence and in parentheses)

Step 2. Discussion

In discussion, avoid: (1). Presenting results that are never discussed; (2). Presenting discussion that does not relate to any of the results; (3). Presenting results and discussion in chronological order rather than logical order; (4). Ignoring results that do not support the conclusions; and (5). Concluding results without logical arguments to back them up.

Discussion checklist:

(1) Typical stages in the discussion:

a). Summarizing the results,
b). Discussing whether results are expected or unexpected,
c). Comparing these results to previous research,
d). Interpreting and explaining the results (often by comparison to a theory or model),
e). Hypothesizing about their generality.

For example:

[Summary of results] The optimal LAI in waterlogging of 1-30 DAP could support the grain dry weight (GDW). The carbohydrates for the grain filling (stored capacity) could be maximally processed. [Results expected] GDW higher was obtained at the waterlogging period of 1-30 DAP than 1-15 DAP in different soil types, especially in the latosol soil (0.75 kg/m^2 or 7.5 t/ha). The results of this study were higher than [previous research] the average potential of Ciherang rice yields, as high as 5-7 t/ha (Sastro et al., 2021). However, [Comparation of a theory] waterlogging can create low oxygen (O2) and anaerobic conditions and induce secondary weed dormancy (Fennimore, 2017) so that weed seed germination is inhibited. [Generality] Waterlogging for a longer time can suppress weeds and increase rice yields.

(2) Discuss any problems or shortcomings encountered during the course of the research.

For example:

In reality, waterlogging of 1-30 DAP is not able to fully suppress weed growth. Certain weed seeds that are tolerant of anaerobic conditions are still able to germinate and grow well.

(3) Discuss possible alternate explanations for the results.

For example:

Manual weed control must still be done so that competition between rice and weeds can be avoided.

4.8. Conclusion

The conclusion is the last paragraph of your article which is summarized the research results and discussion. The conclusions should summarize the results of the research discussed throughout your work.

There are four main aspects to the conclusion, namely:

1) Present global and specific conclusions, related to objectives:

   Example:

   - *The study had described……*
   - *This research could be concluded that .....*

2) Delivering research contributions to the development of science in their fields (novelty):

   Example:

   - *The research findings show that … or…. We find that…*
   - *This research can be applied ……*

3) Convey the limitations of your research (if any):

Example:

- *The study has limitations in …… because it focused on the ……*
- *Our study is limited in ……*

4) Recommend or suggest further research. Add at the end of the paragraph on perspectives for future research.

Example:

- *To gain significant results whether the ……*
- *For future research, ……*

In conclusion, avoid: 1). Repeating the abstract; repeating background information from the introduction, 2). Introducing new evidence or new arguments not found in the results and discussion, 3). Repeating the arguments made in the results and discussion, and 4). Failing to address all of the research questions set out in the introduction.

Conclusion checklist:

(1). Provide a very brief summary of the results and discussion (using past tense).

Example:

This research **could be concluded** that waterlogging could inhibit weed seed germination and growth in lowland rice. In addition, waterlogging **could reduce** weed numbers in RS but not in LS. Waterlogging of 1-30 DAP **inhibited** weed dry weight higher than 1-15 DAP in both soil types. Waterlogging of 1-30 DAP **decreased** the weed dry weight by 87.2% in LS and 97.3% in RS than without waterlogging.

(2). Delivering research contributions to the development of science in their fields (novelty) (using the present tense).

Example:

The research findings **show** that a waterlogging period of 1-30 DAP effectively **inhibits** weed seed germination and growth in RS, but a waterlogging period in LS **can extend**.

(3). Recommend or suggest further research. Add at the end of the paragraph on perspectives for future research (using the present tense or modal auxiliary).

Example:

According to the results of this study, we **recommend** that treatment of waterlogging period of 1-30 DAP **can be applied** for weed control in lowland rice.

After combining from three items of the checklist above, into:

This research **could conclude** that [Summary of the results and discussion] waterlogging could inhibit weed seed germination and growth in lowland rice. In addition, waterlogging **could reduce** weed numbers in RS but not in LS. Waterlogging of 1-30 DAP **inhibited** weed dry weight higher than 1-15 DAP in both soil types. Waterlogging of 1-30 DAP **decreased** the weed dry weight by 87.2% in LS and 97.3% in RS than without waterlogging. Waterlogging **could change** the composition and dominance of weed species. [Novelty] The research findings **show** that a waterlogging period of 1-30 DAP effectively **inhibits** weed seed germination and growth in RS, but a waterlogging period in LS **can extend**. [Recommendation] According to the results of this study, we **recommend** that treatment of waterlogging period of 1-30 DAP **can be applied** for weed control in lowland rice.

4.9. References

Noteworthy, the structure of references in each journal varies greatly. The writing format must be adjusted to the intended journal. In this section, the highest frequency of errors occurs.

Several structures of writing references:

1) **Journal article** → Authors. (Year). Article title. Name of the journal. Vol.(issue), page
2) **Journal article in press** → Authors. (in press). Article title. Name of the journal.
3) **Book** → Authors. (Year). Book title. Press City: Press.
4) **Conference paper** → Authors. (Year). Article title. In: Name of proceedings. City, Country. Page.
5) **Internet source** → Authors. (Year). Download time. Web link.

Type 1:

1. **Journal article**

   Al-Atabi, M.T.; Chin, S.B.; and Luo, X.Y. (2005). Flow structures in tubes with segmental baffles. *Journal of Flow Visualization and Image Processing*, 45(2), 1412-1420.

2. **Journal article in press** → Authors. (in press). Article title. Name of the journal.

   Al-Atabi, M.T.; Chin, S.B.; and Luo, X.Y. (in press). Flow visualization in tubes with segmental baffles. *Journal of Visualization*.

3. **Book** → Authors. (Year). Book title. Press City: Press.

   Roberson, J.A.; and Crowe, C.T. (1997). *Engineering fluid mechanics (6th ed.)*. New York: John Wiley and Sons Inc.

4. **Conference paper** → Authors. (Year). Article title. In: Name of proceedings. City, Country. Page.

   Al-Atabi, M.T.; Chin, S.B.; and Luo, X.Y. (2004). An experimental study of the flow in an idealized human cystic duct. In: *Proceedings of the First Asian Pacific Conference on Biomechanics*. Osaka, Japan. pp. 33-34.

5. **Internet Source** → Authors. (Year). Time of article download. Web link.

   Author, A.B. (2000). *This is how to cite an internet reference*. Retrieved October 5, 2000, from http://www.author.com.

Type 2:

1. **Journal article**

   Al-Atabi, M. T., Chin, S. B. and Luo, X. Y. (2005). Flow structures in tubes with segmental baffles. *Journal of Flow Visualization and Image Processing.* 45: 1412-1420.

2. **Journal article in press**

   Al-Atabi, M. T., Chin, S. B. and Luo, X. Y. (in press). Flow visualization in tubes with segmental baffles. *Journal of Visualization*.

3. **Book**

   Roberson, J. A. and Crowe, C. T. (1997). *Engineering fluid mechanics (6th ed.)*. New York: John Wiley and Sons Inc.

4. **Conference paper**

   Al-Atabi, M. T., Chin, S. B. and Luo, X. Y. (2004). An experimental study of the flow in an idealised human cystic duct. In: *Proceedings of the First Asian Pacific Conference on Biomechanics*. Osaka, Japan, pp. 33-34.

5. **Internet Source**

   Author, A. B. (2000). *This is how to cite an internet reference*. Retrieved October 5, 2000, from http://www.author.com.

Type 3:

1. **Journal article**

   Al-Atabi MT, Chin SB and Luo XY (2005) Flow structures in tubes with segmental baffles. Journal of Flow Visualization and Image Processing, 45(2): 1412-1420.

2. **Journal article in press**

   Al-Atabi MT, Chin SB and Luo XY (in press) Flow visualization in tubes with segmental baffles. Journal of Visualization.

3. **Book**

   Roberson JA and Crowe CT (1997) Engineering fluid mechanics (6th ed.). New York: John Wiley and Sons Inc.

4. **Conference paper**

   Al-Atabi MT, Chin SB and Luo XY (2004) An experimental study of the flow in an idealized human cystic duct. In: Proceedings of the First Asian Pacific Conference on Biomechanics. Osaka, Japan. pp. 33-34.

5. **Internet Source**

   Author AB (2000) This is how to cite an internet reference. Retrieved October 5, 2000, from http://www.author.com.

CHAPTER 5
SUPPLEMENTARY DATA

5.1. Acknowledgments

Must mention a quick thanks to the fund providers, supporters, etc.: 1). People who helped you obtain funding for your project, 2). You can thank the people who contributed to your paper in writing and proofreading, 3). You are grateful to your funding agency or the institution that gave you the grant, and 4). Reviewers and editors (especially in the revised manuscript)

Example 1:

Acknowledgments. We thank the support Institute of Research and Community Service of Universitas PGRI Yogyakarta**,** which has provided financial assistance for this research.

Example 2:

Acknowledgments

We acknowledge the Institute of Research and Community Service of Universitas PGRI Yogyakarta for financial support.

Example 2:

Acknowledgments

We thank David Brand for technical assistance and graduate students of the Environmental Plant Physiology Lab at Mississippi State University for their support during data collection. This article is a contribution from the Department of Plant and Soil Sciences, Mississippi State University, Mississippi Agricultural, and Forestry Experiment Station.

5.2. Abbreviations

Abbreviations that have been written or used in the text must be written again, as shown in the following example.

Example 1:

Abbreviations

ANOVA	:	Analysis of Variance
DAS	:	Days After Sowing
DMRT	:	Duncan's New Multiple Range Test
PC	:	Foot Candle
PE	:	Polyethylene
PM	:	Post Meridiem

RCBD	:	Randominized Complete Block Design
WIT	:	Western Indonesia Time
WUE	:	Water Use Efficiency

5.3. Author Contributions

The contribution of each author is listed in this section. More details can be seen in the following example.

Example 1:

Author Contributions:

1. Conceptualization: Paiman; Muhammad Ansar; Fani Ardiani; and Siti Fairuz Yussof;
2. Methodology, Paiman, and Fani Ardani;
3. Software and formal analysis, Paiman and Fani Ardani;
4. Validation: Paiman; Muhammad Ansar; Fani Ardiani.; and Siti Fairuz Yussof;
5. Writing-Original Draft Preparation: Paiman;
6. Writing-Review & Editing: Paiman, Muhammad Ansar; Fani Ardiani; and Siti Fairuz Yussof;
7. Supervision: Paiman; and Fani Ardiani;
8. Funding Acquisition: Paiman;
9. All authors have read and agreed to the published version of the manuscript.

Example 2:

Author Contributions: Conceptualization, K.R.R.; Methodology, K.R.R., C.W., F.A.A.; Software and formal analysis, C.W.; Investigation, K.R.R. C.W.; Resources, K.R.R.; Data curation, K.R.R. and C.W.; Writing-original draft preparation, C.W.; Writing-review & editing, L.J.K., W.B.H., B.R.G., and K.R.R.; Supervision, K.R.R.; Project administration, K.R.R.; Funding aquisition, K.R.R., J.T.I, L.J.K., B.R.G.

5.4. Declaration of Competing Interest

A conflict of interest is a situation in which a person or organization is involved in multiple interests, financial or otherwise, and serving one interest could involve working against another.

Example 1:

Conflict of interest (COI)

The authors declare that they have no conflict of interest.

Example 2:

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

5.5. Source of Fundings

Research grants from funding agencies (please give the research funder and the grant number) and/or research support (including salaries, equipment, supplies, reimbursement for attending symposia, and other expenses) by organizations that may gain or lose financially through the publication of this manuscript. There are four basic types of funding sources, namely government, private industry, foundations, and professional organizations.

Example 1:

Source of fundings

Not available

Example 2:

Source of fundings

The author(s) received no financial support for this article's research, authorship, and/or publication.

Example 3:

Source of fundings

This research was funded by the Mississippi Soybean Promotion Board and the National Institute of Food and Agriculture, 2016-34263-25763 and MIS 171720.

5.6. Supplementary Materials

Example 1:

Supplementary materials: The following are available online at http://www.mdpi.com/2073-4395/9/12/836/s1, Figure S1: Relationships between soil moisture and vegetative growth components measured at 18 and 30 DAS. (A and B) plant height, (C and D) node numbers, (E and F) leaf area, Figure S2: Relationships between soil moisture and biomass components measured at 18 and 30 DAS. (A and B) leaf weight, (C and D) stem weight, (E and F) root weight, (G and H) total weight, Figure S3: Relationships between soil moisture and root growth parameters measured at 18 and 30 DAS. (A and B) root length, (C and D) root surface area, (E and F) root diameter, (G and H) root volume, Figure S4: Relationships between soil moisture and root developmental parameters

measured at 18 and 30 DAS. (A and B) root tips, (C and D) root forks, (E and F) root crossings, Figure S5: Relationships between soil moisture and photosynthetic parameters measured at 18 and 30 DAS. (A and B) photosynthesis, (C and D) stomatal conductance, (E and F) internal to external CO2 concentration, and (G and H) transpiration, Figure S6: Relationships between soil moisture and gas exchange parameters measured at 18 and 30DAS. (A and B) water use efficiency, (C and D) electron transport rate, and (E and F) chlorophyll fluorescence.

5.7. Copyright agreement (if required)

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CHAPTER 6
MANUSCRIPT SUBMISSION

6.1. Journal Destination

Before submitting a manuscript article to a reputable international journal, you should identify the destination journal. Authors must ensure that the journal is still indexed by Scopus or WOS or not discontinued. In addition, consideration is needed to be considered namely journal quartile (Q), journal template, publication fee, publication period per year, and number of articles per publication. It also needs to be ensured the intended journal is not a predatory journal. The characteristic of predatory journals is that there is no review or revision process, the publication process is very fast with a large number of articles per issue (Prahmana, 2022).

Factors to consider when choosing a journal for your manuscript publication:

1) Journal reputation. Find reputable international journals in accordance with the field of science and science.
2) Scope and relevance. Choose a journal that has the same scope and subject matter as your research and can be seen on the journal web.
3) Impact factor. Consider the impact factor of the journal to be selected. The impact factor is a measure of the average citation of papers published in journals and can be seen in Scopus or SJR. Choose journals that have an impact on the research community.
4) Peer review process. A rigorous peer review process shows the quality and validity of the published manuscript. Look for journals that have strong peer reviews.
5) Publication period. Journals have publication periods from slow to fast (2, 3, 4, and 6 in one year) and can be viewed on the journal's web.
6) Guidelines and formatting. See the guidelines and formatting on the journal's website. Make sure your manuscript is in accordance with the specific guidelines of the selected journal.
7) Type of published article. Pay attention to the types of articles that can be published in web journals (research or review articles or both).

6.2. Use the Journal Finder

Find the right journal to publish your manuscript. Choose tools about journal finder by entering the title and abstract of the paper and keywords.

1) **Elsevier Journal Finder**

   This tool can help you to find the most suitable journal to publish your manuscript. You simply enter the title and abstract of the paper to find the appropriate journal for your research. Link web: https://journalfinder.elsevier.com/ and the Elsevier Journal Finder page can be seen in Figure 6.1.

Figure 6.1. Elsevier Journal Finder page

2) **Wiley Journal Finder**

This tool can help you to explore more than 1,600 Wiley journals. You simply enter the title and abstract of your paper, then the search engine will suggest journals that are relevant to your paper. Link web: https://journalfinder.wiley.com/search?type=match and the Wiley Journal Finder page can be seen in Figure 6.2.

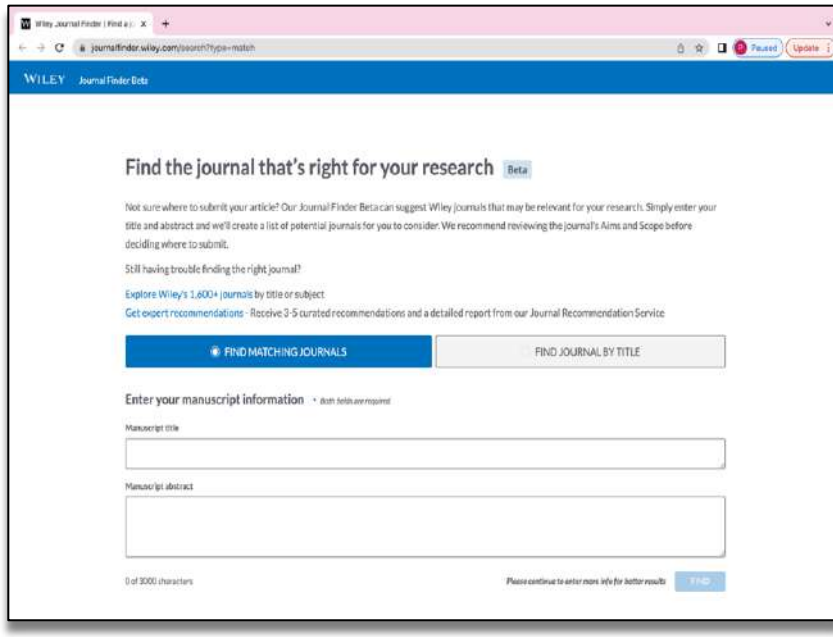

Figure 6.2. Wiley Journal Finder page

3) **Springer Journal Suggester**

Masukkan detail manuscript anda untuk melihat daftar jurnal yang paling cocok untuk penelitian anda. Teknologi pencocokan jurnal akan menemukan jurnal yang relevan berdasarkan detail manuskrip anda. Anda dengan mudah membandingkan jurnal yang relevan untuk menemukan termpat terbaik untuk publikasi. Link web: https://journalsuggester.springer.com/ dan laman Springer Journal Suggester dapat dilihat pada Gambar 6.3.

Figure 6.3. Springer Journal Finder page

4) **Taylor & Francis Journal Suggester**

This artificial intelligence tool will help you to find the best journal of your manuscript. You can simply paste the full abstract of the article and click 'Suggested journal phrases' to see a brief description of the journal. Link web: https://authorservices.taylorandfrancis.com/publishing-your-research/choosing-a-journal/journal-suggester/ and the Taylor & Francis Journal Suggester page can be seen in Figure 6.4.

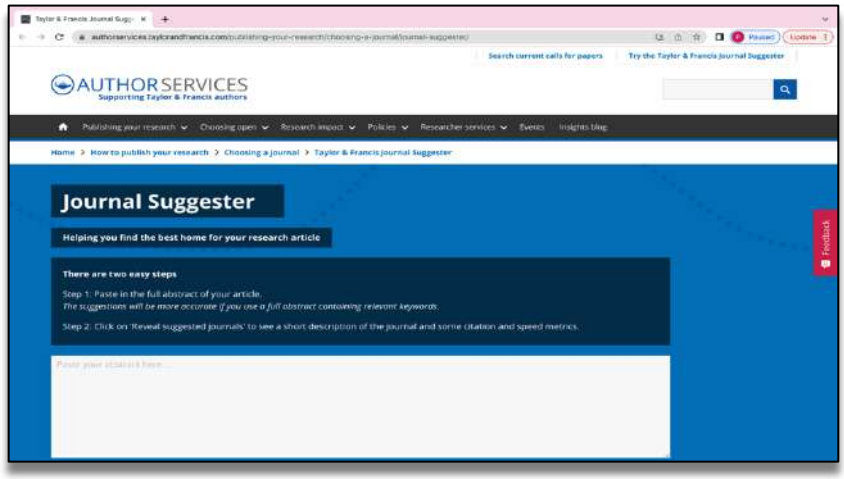

Figure 6.4. Taylor & Francis Journal Suggester page

5) **MDPI Journal Finder**

This search tool uses advanced technology to match research papers with MDPI journals, and can find the most suitable journal for your paper. Link web: https://www.mdpi.com/about/journalselector and the MDPI Journal Suggester page can be seen in Figure 6.5.

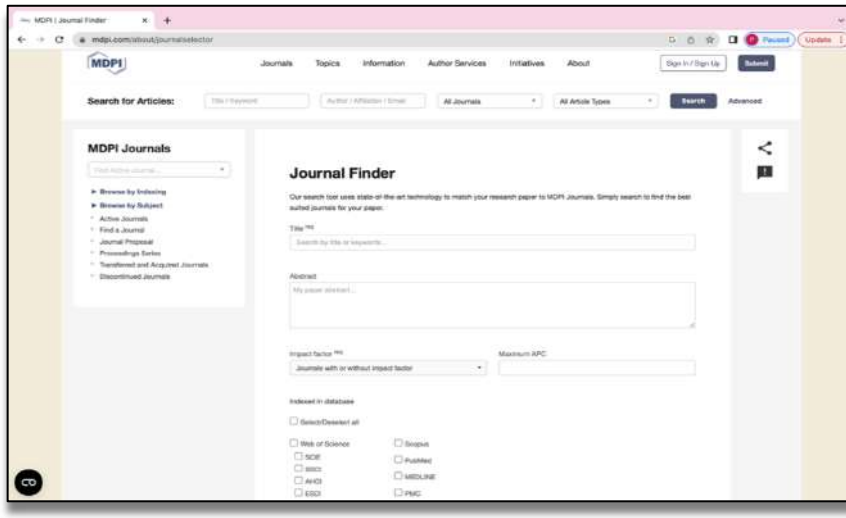

Figure 6.5. MDPI Journal Finder page

6) **Scopus.com**

Secara manual, pencarian journal tujuan dapat dilakukan melalui link web Scopus.com: https://www.scopus.com/home.uri. Scopus.com page can be seen in Figure 6.6.

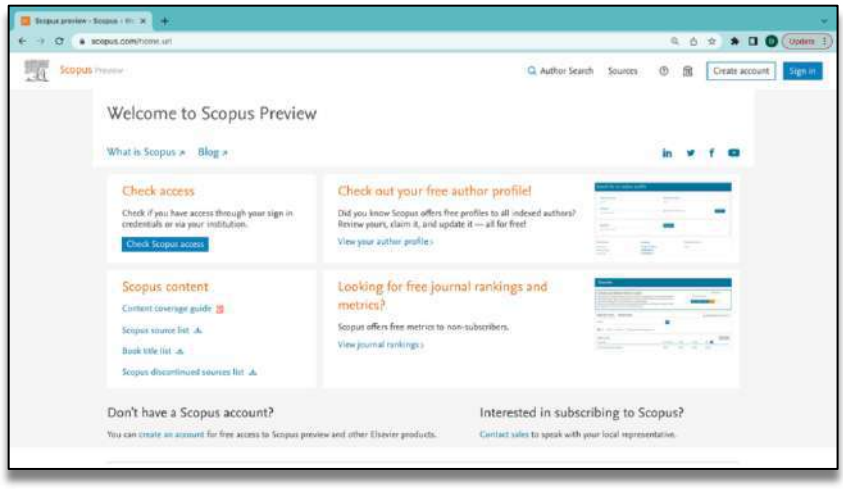

Figure 6.6. Scopus.com page

Avoid choosing a discontinued journal (for example link web: https://www.scopus.com/sourceid/19700201140#tabs=2). Look at the source details as shown in Figure 6.7.

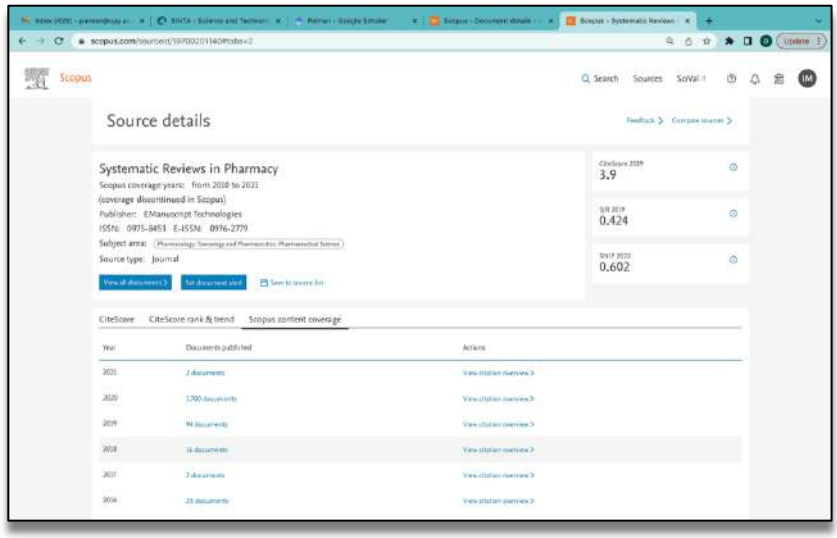

Figure 6.7. Source details in Scopus.com

Figure 6.7 shows that in the source details, it writes Scopus coverage: from 2000 to 2021 (coverage discontinued in Scopus). Why discontinued? Scopus content coverage shows that in 2019 it only published 94 documents, but in 2020 it was 1,700 documents. This shows an increase in the number of articles published unnaturally.

6.3. Manuscript Preparation

There are two ways to submit a manuscript article, namely via the system or email. If you submit through the system, then the first step must first register in the system. Furthermore, in the next stage, you can just log in. Data that needs to be prepared when logging in include the author's name, affiliation, author email (tentative), Orchid ID (tentative), Scopus ID (tentative), list of reviewers' potential, cover letter, and manuscript. If through a journal email, you only prepare manuscript articles and cover letters.

Before submitting, it is necessary to pay attention to the submission instructions for authors on the web journal. Also, we need to look at the scope that has been determined by the journal and its template. Do not force the manuscript submission so that the manuscript is not rejected.

Figure 6.8 shows the requirements that must be read before submitting a manuscript to the journal. Next, you can open the following journal web link: https://www.aloki.hu/

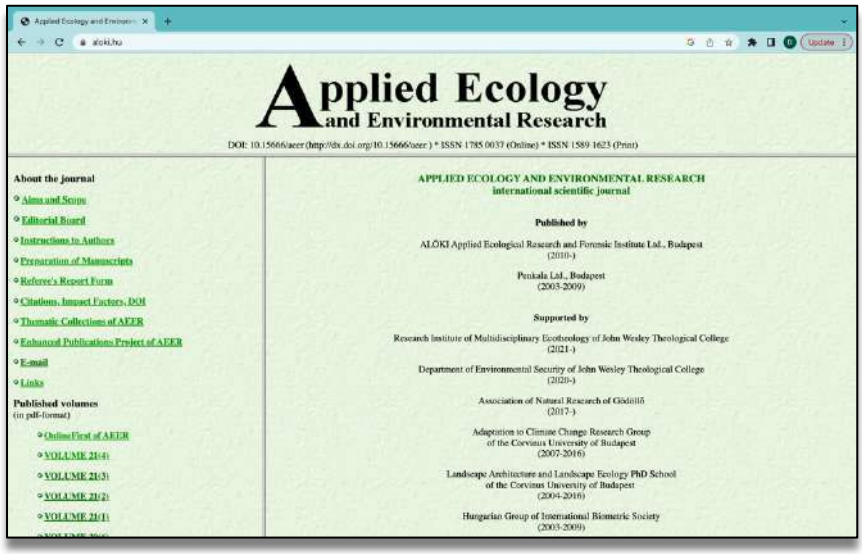

Figure 6.8. Page of Applied Ecology and Environmental Research (AEER)

6.4. List of Authors

Preferably, the number of authors on the manuscript is more than one and less than seven people. Often found the number of authors in one manuscript is more than 10 people. Certain journals have limited the number of authors in one manuscript.

Data authors that need to be prepared are full name, affiliation, and email as shown in Table 6.1.

Table 6.1. List of author's name

No.	Full name	Affiliation	Email
1.	Paiman	Department of Agrotechnology, Faculty of Agriculture, Universitas PGRI Yogyakarta, Yogyakarta 55182, Indonesia	paiman@upy.ac.id
2.	Edo Hendrawan	Department of Agrotechnology, Faculty of Agriculture, Universitas PGRI Yogyakarta, Yogyakarta 55182, Indonesia	edohendrawan1812 @gmail.com

6.5. List of reviewers

Look for authors who have many articles published in Scopus or Web of Science (WOS) and are experienced as reviewers.

For example:

Table 6.2. List of reviewer's potential

No.	Title & Full Name	Full Affiliation	Email
1.	Dr. Asilah A. Mutalib	Department of Agricultural Science, Faculty of Technical and Vocational, Universiti Pendidikan Sultan Idris, 35900, Tanjung Malim, Perak, Malaysia	asilah@ftv.upsi.edu.my
2.	Dr. Ir. Muhammad Ansar, MP.	Department of Agrotechnology, Faculty of Agriculture, Universitas Tadulako, Palu 94118, Indonesia	ansharpasigai@gmail.com
3.	Dr. Ir. Ahmad Fathul Aziez, MP.	Department of Agrotechnology, Faculty of Agriculture, Universitas Tunas Pembangunan, Surakarta 57139, Indonesia	achmad.aziez@yahoo.com
4	Dr. Siti Fairuz Yussof	Department of Agricultural Science, Faculty of Technical and Vocational, Universiti Pendidikan Sultan Idris, 35900, Tanjung Malim, Perak, Malaysia	yuezyusoff@gmail.com

6.6. Cover Letter for Submission

This cover letter is simply copied and pasted on the journal email page. Next, the manuscript is attached to this email page.

Example of cover letter:

COVER LETTER OF SUBMISSION

To Applied Ecology and Environmental Research (AEER)

Dear Editor,

I would like to send an original article entitled: **THE ROLE OF ALLIUM EXTRACTS IN STIMULATING RICE GROWTH** for Applied Ecology and Environmental Research to consider. I confirm that this work is genuine and has not been published elsewhere, nor is it considered for publication elsewhere. We believe and hope that this manuscript is worthy of publication by Applied Ecology and Environmental Research. We are interested in publishing articles in this journal because it has an excellent reputation, so it is a matter of pride if published in Applied Ecology and Environmental Research. Here I attach the manuscript.

Thank you
Best regards,

Paiman
Universitas PGRI Yogyakarta, Indonesia

6.7. Manuscript for Submission

THE ROLE OF ALLIUM EXTRACTS IN STIMULATING RICE GROWTH

PAIMAN[1*] – HENDRAWAN E.[2]

[1,2]*Department of Agrotechnology, Faculty of Agriculture, Universitas PGRI Yogyakarta, Yogyakarta 55182, Indonesia*
(Phone: +62-821-3439-1616 and +62-882-1564-7136)

[*]*Corresponding author*
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Abstract. The demand for rice always increases from year to year. However, rice production in 2021 decreased by 0.45% more than in 2020. Therefore, production needs to be improved again to meet national food self-sufficiency. One of the innovations to increase growth is utilizing natural plant growth regulators (PGR) derived from Allium extracts. This study aimed to find the one of best types of Allium extract that can stimulate rice growth. The research was a single factor arranged in a complete randomized design (CRD) and three replications. The treatments consisted of four types i.e., control (without treatment), shallot (*Allium ascalonicum* L.), garlic (*Allium sativum* L.), and onion (*Allium cepa* L.). Each type of Allium extract used a concentration of 20%. The research results showed

that the Allium extract types did not significantly stimulate seed germination and seedlings' growth, except for seedlings' height. The shallot and garlic extracts inhibited the seedlings' dry weight. The Allium extract types can stimulate to increase in the shoot dry weight clump^{-1}. Application of shallot extract could cause the highest grain dry weight clump^{-1}. The study findings show that the shallot and garlic extract harms the seed germination and seedlings' growth, except for onion extract. However, the shallot extract is a type of Allium that can stimulate rice growth. Therefore, we recommend that the shallot extract type is better for stimulating growth in rice cultivation.

Keywords: Allium extract, rice, shallot, garlic, onion, phytohormone

Introduction

The rice plant produces rice as a staple food in the Indonesian population. Optimal rice growth can support maximum yields. Therefore, one attempt to stimulate plant growth regulators (PGR) through growth hormones. PGR in the form of natural can modify or control through physiological action, growth, and maturation of plants. The PGR produced in the plant is called plant hormone or phytohormone.

However, synthetic hormones are very expensive; alternatively, use natural PGR of the Allium extract. Allium bulbs contain auxins (IAA), gibberellin acid (GA), and cytokinins. IAA and GA hormones can play a role in stimulating rice growth. However, it is not yet known what type of Allium extracts can be used to stimulate rice growth.

The demand for rice has increased from year to year. However, rice production in 2021 decreased by 0.45% more than in 2020 (BPS, 2021). At the end of 10 years, the area dan production of rice has been declining as much as 1.8% and 1.6%, respectively (Pudjiastuti et al., 2021). Rice production can be increased again to maintain national food security. Therefore, it was necessary to have a solution. Using Allium extract at certain concentrations can increase rice production.

During this time, a rice intensification system was implemented to obtain higher production, optimal use of labor and capital, input costs, and the need for less water (Toungos, 2018). In addition, rice production in Indonesia has been carried out through five farming programs, i.e., superior seed selection, good tillage, proper fertilization, pest and plant disease control, and good irrigation.

PGR is a natural and synthetic compound that can modify or control plants through the action of physiological growth and maturation. Phytohormones are produced as compounds in the plant's body (Ogunyale et al., 2014). Phytohormones are compounds needed in small amounts but can majorly affect growth and production. For example, IAA, GA, and zeatin (cytokinin) are growth-promoting hormones, while abscisic acid (ABA), ethylene, and phenolic compounds as growth-inhibiting hormones (Agustina et al., 2010). These phytohormones are capable of being produced by plants, one of which is from the

Alliaceae family (Wen et al., 2021). The following literature review will be discussed in more detail three types of Allium extract, i.e., shallot, garlic, and onion which were most likely to contain phytohormones.

Shallot bulbs (*Allium ascalonicum* L.) contained PGR, i.e., IAA and cytokinins. However, an excessive concentration of shallot extract will inhibit plant growth. The IAA is a hormone that can affect plant growth: height growth, number of leaves, chlorophyll content, root gain, and stem diameter (Patma et al., 2013). In addition, shallot contains the hormones of IAA and GA, so shallot extract can help seed germination and the growth of roots and shoots (Salsabila et al., 2021).

The highest concentration of IAA in shallots was found in bulbs (5.376 mg kg^{-1}), decreased in roots (3.314 mg kg^{-1}), and lowest in leaves (1.006 mg kg^{-1}). The results showed that the IAA content was the highest in shallot var. Bima (6.014 mg kg^{-1}) than var. Maja, Mentes, Pancasona, and Trisula (Sopha and Hartanto, 2021). A concentration of 20% shallot extract most effectively increased the live cuttings percentage (%), but a concentration of 10% significantly affected the leaves number in *Mucuna bracteata* D.C (Prameswari and Pratomo, 2021). Shallots contain GA_3, IAA, ABA, and zeatin (Dahab et al., 2018), and are effective for increasing germination, fresh weight, and dry weight of melon plants. In addition, shallot extracts had the potential to be a source of organic hormones (Yunindanova et al., 2018).

The phytohormone content in garlic (*Allium sativum* L.) was higher than shallot, i.e., GA_3 (2.719 mg 100 g^{-1}), IAA (0.0312 mg 100 g^{-1}), ABA (0.3138 mg 100 g^{-1}), and zeatin (0.0149 mg 100 g^{-1}) (Dahab et al., 2018). Garlic extract contained enzymes and more than 200 other chemical compounds. Garlic contained vitamins, minerals, flavonoids, ascorbic acid, sulfur, iodine, and some amino acids. Sulfur had an important role in the fruiting process of various fruit crops (Al-hadethi., 2016).

Garlic contained a high level of phenolic compounds (Griffiths et al., 2002). Flavonoids were the main phenolic in garlic bulbs. It can be classified into various sub-classes: flavones, flavanones, flavonols, isoflavones, flavanonols, flavonols, flavanols, chalcones, and anthocyanins (Perez-Gregorio et al., 2010). The results showed that the application of garlic extract could result in a marked reduction in nodulation in the roots, plant height, leaf area, and root development of arrears (*Vigna unguiculata*) and peanuts (*Arachis hypogea*) than control (Adeleke, 2019).

Many organosulfur compounds were found in onions (*Allium cepa* L.). Diallyl sulfide, diallyl monosulfide, disulfide, trisulfide, and tetrasulfide were the main onion compounds. Onions were considered an excellent source of flavonoids from the polyphenol family. Flavonols were a sub-class of flavonoids (Pareek et al., 2017). Red and yellow cultivar onions contained polyphenols in the form of gallic acid, ferulic acid, and quercetin. Red cultivar onions showed better antioxidant activity than yellow cultivars. Higher polyphenol and flavonoid content was also associated with higher antioxidant activity (Cheng et al., 2013).

Onions contained vitamins (A, B_1, B_2, and C, nicotinic acid, and pantothenic acid). The essential substances such as protein, calcium, phosphorus, potassium, Fe, Al, Cu, Zn, Mn, and I were found in onion. In addition, onions contained phenolic compounds, namely, phenolic acids and flavonoids that can act as natural antioxidants, anti-carcinogens, and anti-microbial agents (Akbudak et al., 2018). Yellow cultivars accumulated N, P, K, Mg, Fe, Mn, Zn, Cu, and reducing sugars in much larger quantities than red cultivars. Red cultivars contained much more significant amounts of sugar and vitamin C than yellow cultivars (Jurgiel-Malecka et al., 2015). Therefore, a concentration of 20% onion extract can be recommended to stimulate early flowering with a higher percentage of success. There was an improvement in the quality of higher yields by regulating the metabolism of amino acids, including proline and indole, and the activity of catalase and hydrogen peroxide in apple flower buds (El-yazal and Rady, 2014).

Based on the literature review previous studies have shown that shallot and garlic extract contained growth-promoting hormones (IAA, GA, cytokinins) and inhibitors (ABA) of plants, as well as phenolic compounds. The use of shallot and garlic extract at a concentration of 20% positively affected the seed germination of melon, flower cuttings, flower buds of apples, and legumes. However, there was not enough information about the effect of Allium extract on the growth and yield of rice. Study in the application of shallot, garlic, and onion extracts has never been tried on seed germination, growth, and yield of rice. Not yet known type of Allium extract that can increase the growth and yield of rice. Therefore, it was necessary to research the application of Allium extract in rice cultivation. Therefore, this study aimed to find the one of best types of Allium extract that can stimulate growth in rice cultivation.

Materials and methods

Study area

The study was conducted from December 2021 to April 2022. The experimental site was conducted in the greenhouse, Faculty of Agriculture, Universitas PGRI Yogyakarta, Bantul Regency, Yogyakarta Special Region. The height of the study site was 118 m above sea level (m ASL) and located at the 8°30'-7°20' South latitude and 109°40'-111°0' East longitude.

Materials and Tools

The materials used were latosol soil, cow manure, polybags, paper, mica plastic labels, rice seeds, germination plastic tub, water, shallot, garlic, and onion. The equipment used were a hoe, sickle, ruler, blender, filter paper, soil sieve, measuring pipette, mineral water bottle volume of 1 L, pyrex measuring cup

volume of 500 mL, chlorophyll meter CCM-200 plus, oven, digital scales model DS-880, and manual scales capacity of 30 kg.

Experimental design

This study was carried out in two stages of experiments. The first was about seed germination and seedling growth of rice, and the second was about rice growth and yield. The study was a single factor arranged in a complete randomized design (CRD) and three replications. The treatments consisted of four types, i.e., control (without treatment), shallot (*Allium ascalonicum* L.), garlic (*Allium sativum* L.), and onion (*Allium cepa* L.). Each type of Allium extract used a concentration of 20%.

Research procedures

How to make each Allium extract at 20% concentration. First, the bulbs' fresh weight of 100 g was put in the blender, and 200 mL of water was added for extraction. Next, the shallot extract was fed into the Erlenmeyer tube for a centrifuge for 10 minutes at a speed of 500 rpm. The resulting shallot extract was poured into a measuring cup and added the water up to a volume of 500 mL. After that, the extract was filtered with filter paper. The liquid that escaped from the sieve was used as a phytohormone. Next, the liquid of the solution was fermented for seven days.

Latosol soil as a planting medium was taken from the top-soil layer at a depth of 0-20 cm. The soil was dredged, then crushed with a hoe to a uniform grain, and filtered with a soil sieve of 2 × 2 cm. The seed germination test required 30 plastic tubs with a size of 30 cm (length) × 25 cm (width) × 5 cm (height). Each germination plastic tub was filled with 1 kg of soil, and the soil surface was flat. For the second experiment, 90 polybags in 40 × 35 cm were needed, each filled with 10 kg of soil. Polybags were placed on a table located inside the greenhouse building. The rice seed used in this study was Padjajaran Agritan variety.

The first experiment was done by randomizing all germination plastic tubs filled with soil. Randomization was carried out at once against the entire treatment. Next, the treatment label of the mica plastic, with the help of bamboo sticks, was plugged into the planting medium on the germination plastic tub. In the same method, randomization was carried out in the second experiment on all polybags.

The first experiment was carried out by scattering as many as 20 rice seeds in each germination plastic tub above the soil surface in water-saturated conditions. However, the preparation of the second experiment was carried out on wooden box germination of 50 × 80 cm and filled with a mixture of soil and manure in a ratio of 1:1. Rice seeds were stocked over the soil medium in water-saturated conditions. Seedlings ready were planted into polybags at the age of 18 days after sowing (DAS).

For the first experiment, the application of Allium extract was as much as 2 mL per plastic tub germination evenly above the soil surface. Each treatment was

given simultaneously when stocking seeds. Likewise, for the second experiment, the treatment of Allium extract, as much as 2 mL polybag^{-1} evenly above the soil surface, was carried out simultaneously at the time of planting. The plant spacing between seedlings in polybags was 25 × 25 cm. One rice seedling was planted in the middle of the soil surface inside the polybag. Seedlings were planted at a depth of 2 cm. The overall need was as many as 90 seedlings.

The water availability in the first experiment was kept in field capacity until ten days after planting (DAP). However, in the second experiment, water was always maintained at 2 cm from the soil surface daily at 1-105 DAP. The recommended dose of fertilizer was 225 kg ha^{-1} urea and 225 kg ha^{-1} NPK Phonska 15-15-15 for rice cultivation. Fertilization was carried out in two stages. The first application was 40% of the recommended dose at 14 DAP. The second application was as much as 60% of the recommended dose at the age of 35 DAP. Wbeed control was carried out twice during the study. Pest control was carried out twice during flowering using Dursban pesticides. Rice harvesting was carried out at 105 DAP when the grains matured physiologically (95% turned yellow).

Measurement and Parameter

For the first experiment, the rate and power of germination were observed from the 1st to the 10th day, while the seedling's height and dry weight were observed at 10 DAS. For the second experiment, plant growth was observed at 40 DAP including the tillers number, plant height, and shoot dry weight, while grain dry weight was observed at 105 DAP

Statistical analysis

Observational data were analyzed by analysis of variance at 5% significance level. To determine the difference between treatments, Duncan's new multiple distance test (DMRT) was used at 5% significance level (Gomez and Gomez, 1984).

Results

Effect of Allium Extract Types on the Seed Germination and Seedling Growth

The research results in the first experiment showed that Allium extract types did not significantly affect the rate and power of germination. Still, it affected the seedlings' height and dry weight. The results of multiple comparisons with DMRT at the 5% significance level on seed germination and seedlings' growth can be seen in *Table 1*.

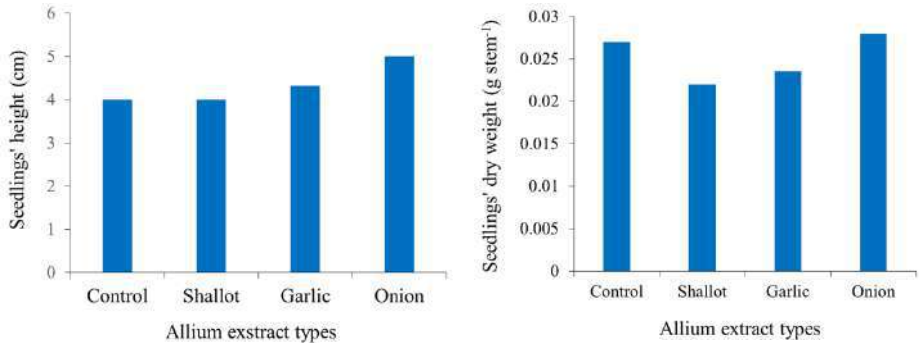
Table 1 explains that the Allium extract types did not significantly affect the rate and power of germination. However, the onion extract application can increase the seedlings' height and greatly differ from shallot and garlic extracts or control. The treatment of shallot and garlic extracts caused the seedlings' dry weight to be lower than the control and onion. Shallot and garlic extracts

application inhibited the seedlings' growth of rice. For more details, the effect of Allium extract types on the height and dry weight of seedlings can be seen in *Figures 1a* and *1b*.

***Table 1**. Effect of Allium extracts types on seed germination and Seedlings' growth at 10 DAS*

Allium extract type	Germination rate	Germination power (%)	Seedlings' height (cm)	Seedlings' dry weight (g stem^{-1})
Control	3.19 a	98.33 a	4.00 b	0.54 a
Shallot	2.96 a	91.67 a	4.00 b	0.44 b
Garlic	2.93 a	90.00 a	4.33 b	0.47 b
Onion	3.32 a	98.33 a	5.00 a	0.56 a

Remarks: The number followed by the same character in a column is not significantly different based on DMRT at 5% significant level.



(a) (b)

***Figure 1**. Application of Allium extract on the seedlings' height (a) and seedlings' dry weight (b)*

Figure 1a explains that onion extract could increase the seedlings' height of rice. But on the contrary, the application of shallot and garlic extract could not increase the seedling's height. *Figure 1b* explains that applying shallot and garlic caused a decrease in the seedlings' dry weight of rice, while onion application did not affect the seedlings' dry weight of rice.

Effect of Allium Extract Types on the Growth and Yield of Rice

The research results in the second experiment showed that the type of Allium extract did not significantly affect the tiller's number and plant height, but it affected the shoot and grain dry weight. The results of multiple comparisons with DMRT at a 5% significance level on the growth and yield of rice can be seen in *Table 2*.

Table 2 explains that the Allium extract types could increase the shoot dry weight and be significantly different from the garlic extract, but was not significantly different from the onion extract. On the other hand, the shallot extract application could increase the grain dry weight clump^{-1} and be significantly different from the garlic and onion extract. The effect of Allium extract types on the dry weight of the shoot and grain can be seen in Figure 2.

***Table 2**. Effect of Allium extracts types on the growth and yield of rice*

Allium extract type	Tillers number (stem clump^{-1})	Plant height (cm)	Shoot dry weight (g clump^{-1})	Grain dry weight (g clump^{-1})
Control	8.44 a	75.67 a	24.28 b	20.64 b
Shallot	9.78 a	84.22 a	42.89 a	31.10 a
Garlic	10.11 a	75.44 a	27.00 b	22.35 b
Onion	9.11 a	77.67 a	35.61 ab	16.83 b

Remarks: The number followed by the same character in a column is not significantly different based on DMRT at 5% significant level.

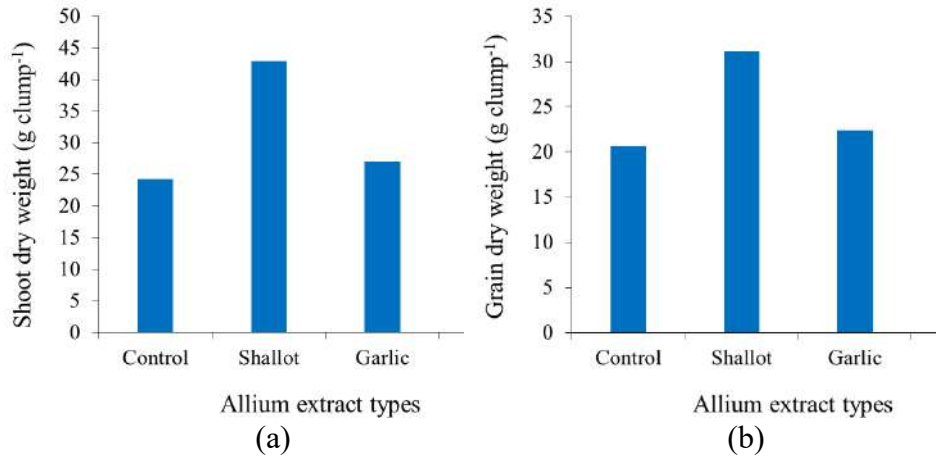


***Figure 2**. Application of Allium extract on shoot dry weight (a) and grain dry weight (b)*

Figure 2 explains that giving shallot extract could increase the shoot and grain dry weight of rice, while garlic and onion did not.

Discussion

Allium extract has a bad effect on rice seed germination. The application of shallot and garlic extract inhibits the growth of dry weight of seedlings. Shallot and garlic extract contained high phenolic compounds so can interfere with the initial of seedlings growth. Seed germination was sufficiently stimulated by the PGR contained in it. Seed germination did not require additional PGR from organic material.

The rate germination, power germination, and seedlings' height did not require the additional external phytohormones from shallot and garlic extract, but required onion extract. The addition of shallot extract and garlic did not increase the seedlings' height of rice. Conversely, onion extract can increase the vertical growth of rice seedlings. The application of Allium extract will increase the concentration of IAA in the rice seed and will inhibit it because the content becomes excessive. According to Lee et al. (2022), poor seed germination and inhibition of seedling growth due to excessive accumulation of IAA.

Shallot and garlic extract contained phytohormones, especially GA. GA compounds were considered negative regulators of innate immunity in rice crops (Yang et al., 2013). The GA content in rice seeds was enough to support their seed germination. The GA could diffuse into the aleurone layer and initiate signaling synthesizing amylase and other hydrolytic enzymes. Then, hydrolytic enzymes secreted into the endosperm and hydrolyzed food reserves. Next, the hydrolytic enzymes will hydrolyze starch, lipids, hemicellulose proteins, polyphosphates, and other stored materials into simpler forms that are available to the embryo (Ali and Elozeiri, 2017).

Not all types of Allium extracts have a significant effect on rice growth and yield. Garlic and onion extracts were not effective for increasing the dry weight of shoot and grain, while shallot was effective. Adding external phytohormones to the soil media effectively optimized the shoot's dry weight. Besides, the shallot extract application could significantly increase the grain dry weight. The content of IAA in shallot could stimulate the growth of rice plants. According to Sopha and Hartanto (2021), shallot bulb tissue contained higher IAA concentrations than leaves and roots.

The IAA is a common auxin form that participates in plant growth and development. The sources of IAA can come from organic material. Shallot bulbs can produce natural hormones, namely IAA. The IAA played a role in stimulating plant growth, such as enlargement, elongation, cell division, affected nucleic acid metabolism, and plant metabolism (Pamungkas and Puspitasari, 2018). Auxin affected some aspects of the plant development (Wang et al., 2018). The use of IAA contained in Allium extract, especially in shallot has a good role in increasing plant growth.

The use of exogenous auxin in the right concentration increased the yield of dry matter in plants (Sosnowski et al., 2023). Therefore, the IAA of shallot can be used to stimulate the growth and yield of rice. However, the shallot extract has

been shown to increase the shoot and grain dry weight of rice higher than garlic extract.

Based on the discussion above, it can be affirmed that Allium extract is better used to support plant growth of rice than in nurseries. Shallot bulb extract supports rice growth better than garlic and onion.

Conclusion

The research results and discussion above showed that the Allium extract did not significantly stimulate seed germination and seedlings' growth, except for seedlings' height. The shallot and garlic extracts inhibited the seedlings' dry weight. The shallot extract can stimulate to increase the shoot dry weight of rice. The application of shallot and garlic extract harms seed germination and seedlings' growth, except for onion extract. Application of shallot extract could cause the highest grain dry weight clump^{-1}. The study findings show that the shallot and garlic extract harms the seed germination and seedlings' growth, except for onion extract. However, the shallot extract is a type of Allium that can stimulate rice growth. Therefore, we recommend that the shallot extract application is better for stimulating growth in rice cultivation.

Acknowledgments. We thank the Institute for Research and Community Service, Universitas PGRI Yogyakarta, which has given permission and support for research funds. We would also like to thank the Faculty of Agriculture, Universitas PGRI Yogyakarta, which has provided loans for facilities in the form of laboratories and equipment for research.

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6.8. Proof of Manuscript Submission

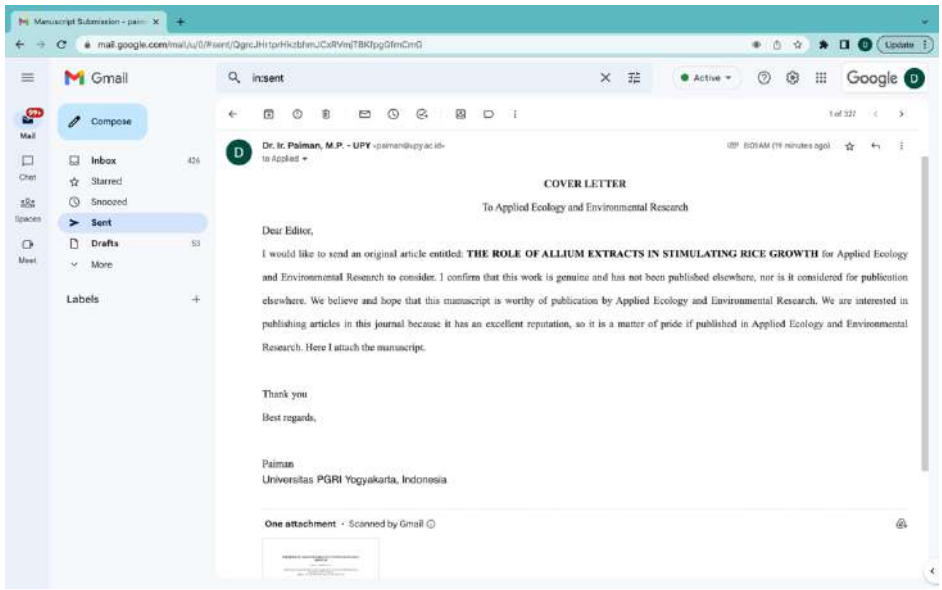

Figure 6.9. Proof of manuscript submission

CHAPTER 7
MANUSCRIPT REVISION

7.1. Manuscript improvements

After the manuscript is submitted to the journal, the next two weeks to one month will get a response from the journal editor. There are two possible responses: rejected or revised (minor or major). As discussed here is a manuscript that needs major revision. Next, the author is allowed to correct for two weeks after notification and subsequently re-submission.

In the following, we give an example of a manuscript that requires major revision. We have submitted this manuscript to the journal: Applied Ecology and Environmental Research (AEER).

7.2. Comments to Authors

Extract of referee opinions and editorial suggestions for manuscript ref. 14540.

Unfortunately, this manuscript is not acceptable in its present form. A very detailed and documented major revision is suggested before resubmission.

The authors conducted two quite simple experiments in which the effects of some Allium extracts on the germination and development of rice were evaluated. The base concept is problematic because the authors proposed using extract of a field crop for promoting the growth of rice and the extracts were made from the main products but not from some by-products. Technologically it is hard to imagine that allium species would be harvested in fields just for making PGR for other field crops. The Materials and methods were not introduced in detail, and the numbers of biological and technological replications were not known. The discussion is not comparative and the authors refer to irrelevant literature many times.

7.2.1. Comments to Authors from the referee

1. Please take into consideration that national food self-sufficiency is a local problem but not a global one. The introduction presumed that the study could have local practical relevance.
2. The authors mentioned that synthetic PGRs and hormones are expensive, but efficiency would be the key factor in terms of applicability. The authors should involve some synthetic PGRs in the experiments and the effectiveness of the plant extracts should be evaluated in terms of the other products. It must be taken into consideration that onion cultivation is expensive and the extraction has some costs, therefore, it could be that the overall effectiveness of the synthetic hormones would be much better.
3. Please take care of writing the “gibberellic acid” correctly (line 30).

4. Adding a reference would be needed to confirm the following statement: “Using Allium extract at certain concentrations can increase rice production”.
5. The units presented in the Introduction should be harmonized for better comparability.
6. The authors confirmed in the Introduction that there is high variability in the active ingredient content of the varieties. The applied shallot, garlic, and onion genotypes need to be mentioned.
7. The authors did not quantify the active ingredient content of the extracts, but without this information, the study is not repeatable. The concentration of the PGRs in the extracts must be known for appropriate interpretation of the results.
8. The authors tested only one dose of extract and one time the extract was added to the plants in the second experiment. Testing the extract along a concentration gradient would be favorable and treating the plants also during the vegetation would be interesting.
9. The fertilizer dose should be indicated for one-kilogram soil.
10. The plant growth conditions were not described as well as the climate during the germination experiments.
11. The number of plants in each box needs to be presented as well as the number of biological and technical repetitions within the treatments.
12. The extract has no positive impact on germination.
13. It is not evident what the difference was between the germination rate and germination power. The germination rate data are extraordinarily low.
14. The information content of Fig. 1 and Table 1 as well and Fig. 2 and Table 2 are overlapping.
15. The results presented between lines 210 and 214 were previously introduced.
16. In the Abstract and M&M chapter please also mention the country of study.
17. The English throughout needs revision and careful proofreading.
18. There should be a photo included of the experimental culture or equipment in the M&M chapter if possible.

7.2.2. Editorial suggestions for manuscript corrections

The manuscript will need a very thorough revision. The style or grammar or both are incorrect in many cases. The mistakes involve the wrong usage of word order, verb form, style, and other minor misuses in various combinations.

Issues involved:

1. Line 8: “to find the one of best types” ‘one of the best types’ is the correct word order

2. Line 14: “did not significantly stimulate seed germination and seedlings' growth, except for seedlings' height.” it is a contradiction that it did not affect growth but affected height
3. Line 15: “inhibited the seedlings' dry weight” ‘decreased’ is more appropriate in this case than ‘inhibited’
4. Line 16: “The Allium extract types can stimulate to increase in the shoot dry weight clump^{-1}.”’to increase in the’ is not needed
5. Line 18: “except for onion extract” ‘but the onion extract does not’ is suggested to be used instead
6. Line 20: “We recommend that the shallot extract type is better for stimulating” ‘We recommend the shallot extract type for stimulating’
7. Line 24: “The rice plant produces rice as a staple food in the Indonesian population.” ‘which is a staple food for the Indonesian population’
8. Line 26: “Therefore, one attempt to stimulate plant growth regulators (PGR) through growth hormones.” a verb is missing from this sentence ‘an attempt has been made’ is suggested to be used
9. Line 26-27: “PGR in the form of natural can modify or control through physiological action, growth, and maturation of plants.” ‘PGR in its natural form can modify or control physiological actions, growth, and maturation of plants.’
10. Line 30: “alternatively, use natural PGR of the Allium extract.” ‘alternatively, natural PGR from Allium extracts is used.’
11. Line 34-35: “At the end of 10 years, the area dan production of rice has been declining as much as 1.8% and 1.6%, respectively “ this sentence should be clarified

7.3. Respond to All Issues

AN ITEMIZED RESPONSE SHEET

Table 7.1. Respond to all issue/referee opinions/editor suggestions

Comments to the Authors from referee:	Addres-sed (Y/N)	Reply/Action taken
1. Please take into consideration that national food self-sufficiency is a local problem but not a global one. The introduction presumed that the study could have local practical relevance.	Y	Thanks for the suggestion. We have added the word 'in Indonesia' in the introduction so that it shows the local problem.

Table 7.1. Continued

2. Please take into consideration that national food self-sufficiency is a local problem but not a global one. The introduction presumed that the study could have local practical relevance.	Y	Thanks for the suggestion. We have added the word 'in Indonesia' in the introduction so that it shows the local problem.
3. The authors mentioned that synthetic PGRs and hormones are expensive, but efficiency would be the key factor in terms of applicability. The authors should involve some synthetic PGRs in the experiments and the effectiveness of the plant extracts should be evaluated in terms of the other products. It must be taken into consideration that onion cultivation is expensive and the extraction has some costs, therefore, it could be that the overall effectiveness of the synthetic hormones would be much better.	Y	Thank you. The idea of using these natural PGRs came about when we saw that many shallot and garlic crops were abundant and unsalable. We want to utilize PGRs as natural substitutes synthetically. The referee's advice is very good. We will conduct further experiments using synthetic PGRs comparator.
4. Please take care of writing the "gibberellic acid" correctly (line 30).	Y	Thanks for the correction. The word gibberellin acid has been edited to "gibberellic acid"
5. Adding a reference would be needed to confirm the following statement: "Using Allium extract at certain concentrations can increase rice production"	Y	We've been trying to add information about specific concentrations that can increase rice production, but haven't found any. Using a concentration of 20%, we found in the seed germination of melon, the flower cuttings and buds of apples, legumes, *Ixora coccinea,* and *Arenga pinnata.*
6. The units presented in the Introduction should be harmonised for better comparability.	Y	Thank you, the units in the introduction have been harmonised.

Table 7.1. Continued

7. The authors confirmed in the Introduction that there is high variability in the active ingredient content of the varieties. The applied shallot, garlic and onion genotypes need to be mentioned.	Y	The content of the active ingredients of the Allium genotype is quite varied and has already been mentioned in the introduction.
8. The authors did not quantify the active ingredient content of the extracts, but without this information, the study is not repeatable. The concentration of the PGRs in the extracts must be known for appropriate interpretation of the results.	Y	The authors only refer to the active ingredient content of Allium extract from the results of previous studies. For future research, researchers will measure the active ingredients of the extract themselves.
9. The authors tested only one dose of extract and one time the extract was added to the plants in the second experiment. Testing the extract along a concentration gradient would be favourable and treating the plants also during the vegetation would be interesting.	Y	Thank you. The authors only used one concentration of Allium extract, which is 20% (the result of previous studies) at a dose of 2 mL per clump. The use of doses per hectare and the frequency of application of extracts during plant growth need to be further investigated.
10. The fertilizer dose should be indicated for one-kilogram soil.	Y	We have added it to the manuscript: The dose of urea fertilizer and NPK Phonska is: 0.08 g for one-kilogram soil, respectively in research procedure section.
11. The plant growth conditions were not described as well as the climate during the germination experiments.	Y	We add the temperature and humidity conditions of the greenhouse room to the study area: During the study showed the average air temperature and humidity were 33 ºC and 60%, respectively.

Table 7.1. Continued

12. The number of plants in each box needs to be presented as well as the number of biological and technical repetitions within the treatments.	Y	We have added suggestions in the experiment design section: In the first experiment, only one sample was used for each repetition so that a total of 12 plastic germination baths were needed. While in the second experiment, each repetition consisted of six samples so that in total 72 polybags were needed.
13. The extract has no positive impact on germination	Y	The three types of Allium extract have no effect on the rate and power of germination.
14. It is not evident what the difference was between the germination rate and germination power. The germination rate data are extraordinarily low.	Y	Differences in understanding: Germinated seeds are characterized by the rice buds have emerged to the surface of the soil up to 2 cm high. Germination rate is calculated from germinated seeds from the first observation day to the last day, and describes the vigor of seeds. The smaller the germination rate means the faster it germinates. Germination is calculated from the number of seeds that have germinated normally, and explains about seed viability. The greater the percentage that germinates means that the seeds are more viable.
15. The information content of Fig. 1 and Table 1 as well and Fig. 2 and Table 2 are overlapping.	Y	Thank you. We have corrected it to: *Figure 2a* and *2b* show that application of shallot extract gave higher shoot and grain dry weight of rice.

Table 7.1. Continued

16. The results presented between lines 210 and 214 were previously introduced.	Y	Thanks for the correction. Explanations of Figures 1a and 1b are changed to: *Figure 1a* shows that application of onion extract was effectively stimulating the seedlings' height of rice. *Figure 1b* shows that applying shallot, garlic, and onion extract were not effectively stimulating the seedlings' dry weight of rice
17. In the Abstract and M&M chapter please also mention the country of study.	Y	Country where research has been added to the Abstract and M&M, namely: Indonesia.
18. The English throughout needs revision and careful proofreading.	Y	Thanks for the advice. We have corrected errors from pharaprase, verb tenses, and grammar.
19. There should be a photo included of the experimental culture or equipment in the M&M chapter if possible.		Photo of rice crops with Allium extract application at 105 DAP has been added in the M&M.
Issues involved (Editor suggestions)	**Addres-sed (Y/N)**	**Reply/Action taken**
1. Line 8: "to find the one of best types" 'one of the best types' is the correct word order.	Y	Thank you. In this study, we wanted to find one of the best types of Allium.
2. Line 14: "did not significantly stimulate seed germination and seedlings' growth, except for seedlings' height." it is a contradiction that it did not affect growth but affected height the first time.	Y	We correct the sentence to: 'significantly affected on seedlings' growth, especially for seedlings' height in the fist time'
3. Line 15: "inhibited the seedlings' dry weight" 'decreased' is more appropriate in this case than 'inhibited'.	Y	Thanks for the advice. We replace the word 'inhibited' with 'decreased'

Table 7.1. Continued

4. Line 16: “The Allium extract types can stimulate to increase in the shoot dry weight clump-1.”’to increase in the’ is not needed	Y	We have removed the word 'to increase in the'.
5. Line 18: “except for onion extract” ‘but the onion extract does not’ is suggested to be used instead.	Y	Thank you. We replace with sentences ’but the onion extract does not’
6. Line 20: “we recommend that the shallot extract type is better for stimulating” ‘we recommend the shallot extract type for stimulating’.	Y	Thank you. We replace with sentences ’we recommend the shallot extract type for stimulating’
7. Line 24: “The rice plant produces rice as a staple food in the Indonesian population.” ‘which is a staple food for the Indonesian population’	Y	Thank you. The word 'as', we changed to 'which is’
8. Line 26: “Therefore, one attempt to stimulate plant growth regulators (PGR) through growth hormones.” a verb is missing from this sentence ‘an attempt has been made’ is suggested to be used	Y	Thank you. The word 'one attempt', we changed to 'an attempt has been made’
9. Line 26-27: “PGR in the form of natural can modify or control through physiological action, growth, and maturation of plants.” ‘PGR in its natural form can modify or control physiological actions, growth, and maturation of plants.	Y	Thank you. Word of ’in the form of natural’ repalced with ’their natural form’
10. Line 30: “alternatively, use natural PGR of the Allium extract.” ‘alternatively, natural PGR from Allium extracts is used.’	Y	Thank you. ’alternatively, use natural PGR of the Allium extract, We change it to: alternatively, natural PGR from Allium extracts is used

Table 7.1. Continued

11. Line 34-35: "At the end of 10 years, the area dan production of rice has been declining as much as 1.8% and 1.6%, respectively "this sentence should be clarified	Y	Thank. In sentence, we change to 'Within the last 10 years (2010-2019)'.

7.4. Manuscript after Revised

THE ROLE OF ALLIUM EXTRACTS IN STIMULATING RICE GROWTH

AEER_14540

Abstract. In Indonesia, the demand for rice always increases from year to year. However, rice production in 2021 decreased by 0.45% more than in 2020. Therefore, production needs to be improved again to meet national food self-sufficiency. One of the innovations to increase growth is utilizing natural plant growth regulators (PGRs) derived from Allium extracts. This study aimed to find one of the best types of Allium extract that can stimulate rice growth. The experimental area was conducted in the greenhouse, Faculty of Agriculture, Universitas PGRI Yogyakarta, Bantul Regency, Yogyakarta Special Region, Indonesia. The research was a single factor arranged in a complete randomized design (CRD) and three replications. The treatments consisted of four types i.e., control (without treatment), shallot (*Allium ascalonicum* L.), garlic (*Allium sativum* L.), and onion (*Allium cepa* L.). Each type of Allium extract used a concentration of 20%. The research results showed that the Allium extract types significantly affected seedlings' growth, especially for seedlings' height for the first time. The shallot and garlic extracts decreased the seedlings' dry weight. The Allium extract types can stimulate shoot dry weight clump^{-1}. Application of shallot extract could cause the highest grain dry weight clump^{-1}. The study findings show that the shallot and garlic extract harms the seed germination and seedlings' growth, but the onion extract does not. However, the shallot extract is a type of Allium that can stimulate rice growth. Therefore, we recommend the shallot extract type for stimulating growth in rice cultivation.

Keywords: Allium extract, rice, shallot, garlic, onion, phytohormone

Introduction

The rice plant produces rice which is a staple food in the Indonesian population. Optimal rice growth can support maximum yields. Therefore, an attempt has been made to stimulate plant growth regulators (PGRs) through growth hormones. PGRs in their natural form can modify or control through

physiological action, growth, and maturation of plants. The PGR produced in the plant is called plant hormone or phytohormone.

However, synthetic hormones are very expensive; alternatively, natural PGR from Allium extracts is used. Allium bulbs contain auxins (IAA), gibberellic acid (GA), and cytokinins. IAA and GA hormones can play a role in stimulating rice growth. However, it is not yet known what type of Allium extracts can be used to stimulate rice growth.

In Indonesia, the demand for rice has increased from year to year. However, rice production in 2021 decreased by 0.45% more than in 2020 (BPS, 2021). Within the last 10 years (2010-2019), the area dan production of rice has been declining as much as 1.8% and 1.6%, respectively (Pudjiastuti et al., 2021). Rice production can be increased again to maintain national food security. Therefore, it is necessary to have a solution. Using Allium extract at certain concentrations can increase rice production.

During this time, a rice intensification system has been implemented to obtain higher production, optimal use of labor and capital, input costs, and the need for less water (Toungos, 2018). In addition, rice production in Indonesia has been carried out through five farming programs, i.e., superior seed selection, good tillage, proper fertilization, pest and plant disease control, and good irrigation.

PGRs are a natural and synthetic compound form that can modify or control plants through the action of physiological growth and maturation. Phytohormones are produced as compounds in the plant's body (Ogunyale et al., 2014). It is needed in small amounts but can majorly affect growth and production. For example, IAA, GA, and zeatin (cytokinin) are growth-promoting hormones, while abscisic acid (ABA), ethylene, and phenolic compounds as growth-inhibiting hormones (Agustina et al., 2010). These phytohormones are capable of being produced by plants. One of the family is from the Alliaceae (Wen et al., 2021). The following literature review will be discussed in more detail three types of Allium extract, i.e., shallot, garlic, and onion. The three types are most likely to contain phytohormones.

Shallot bulbs (*Allium ascalonicum* L.) contained PGR, i.e., IAA and cytokinins. However, an excessive concentration of shallot extract will inhibit plant growth. The IAA is a hormone that can affect plant growth: height growth, leaves number, chlorophyll content, root gain, and stem diameter of *Arenga pinnata* (Patma et al., 2013). In addition, shallot contains the hormones of IAA and GA, so shallot extract can help seed germination and growth of roots and shoots of *Ixora coccinea* (Salsabila et al., 2021).

The highest concentration of IAA in shallots was found in bulbs (5.376 mg kg^{-1}), decreased in roots (3.314 mg kg^{-1}), and lowest in leaves (1.006 mg kg^{-1}). The results showed that the IAA content was the highest in shallot var. Bima (6.014 mg kg^{-1}) than var. Maja, Mentes, Pancasona, and Trisula (Sopha and Hartanto, 2021). A concentration of 20% shallot extract most effectively increased the live cuttings percentage, but a concentration of 10% significantly affected the leaves number in *Mucuna bracteata* D.C (Prameswari and Pratomo,

2021). Shallots contain GA_3, IAA, ABA, and zeatin (Dahab et al., 2018), and are effective for increasing germination, fresh weight, and dry weight of melon plants. In addition, shallot extract has the potential to be a source of organic hormones (Yunindanova et al., 2018).

The phytohormone content in garlic (*Allium sativum* L.) was higher than shallot, i.e., GA_3 (2.719 mg 100 g^{-1}), IAA (0.0312 mg 100 g^{-1}), ABA (0.3138 mg 100 g^{-1}), and zeatin (0.0149 mg 100 g^{-1}) (Dahab et al., 2018). Garlic extract contained enzymes and more than 200 other chemical compounds. The garlic extract contained thiosulfate (307.66 ± 0.043 µM/g), flavonoids (64.33 ± 7.69 µg QE/g), and polyphenols (0.95 ± 0.011 mg GAE/g) as major compounds (Corbu et al., 2021). Garlic contained vitamins, minerals, flavonoids, ascorbic acid, sulfur, iodine, and some amino acids. Sulfur had an important role in the fruiting process of various fruit crops (Al-hadethi et al., 2016).

Garlic contains a high level of phenolic compounds (Griffiths et al., 2002). Flavonoids are the main phenolic in garlic bulbs. It can be classified into various sub-classes: flavones, flavanones, flavonols, isoflavones, flavanonols, flavonols, flavanols, chalcones, and anthocyanins (Perez-Gregorio et al., 2010). The application of garlic extract could result in a marked reduction in nodulation in the roots, plant height, leaf area, and root development of arrears (*Vigna unguiculata*) and peanuts (*Arachis hypogea*) than the control (Adeleke, 2019).

Many organosulfur compounds are found in onions (*Allium cepa* L.). Diallyl sulfide, diallyl monosulfide, disulfide, trisulfide, and tetrasulfide are the main onion compounds. Onions are considered an excellent source of flavonoids from the polyphenol family. Flavonols are a sub-class of flavonoids (Pareek et al., 2017). Red and yellow cultivar onions contain polyphenols in the form of gallic acid, ferulic acid, and quercetin. The research results showed that red-cultivar onions were better antioxidant activity than yellow cultivars. Higher polyphenol and flavonoid content was also associated with higher antioxidant activity (Cheng et al., 2013).

Onions contain vitamins (A, B_1, B_2, C, nicotinic acid, and pantothenic acid). The essential substances are protein, calcium, phosphorus, potassium, Fe, Al, Cu, Zn, Mn, and I. In addition, onions contain phenolic compounds, namely, phenolic acids and flavonoids that can act as natural antioxidants, anti-carcinogens, and anti-microbial agents (Akbudak et al., 2018). The research results showed that yellow cultivars accumulated N, P, K, Mg, Fe, Mn, Zn, Cu, and reducing sugars in much larger quantities than red cultivars. Red cultivars contained much more significant amounts of sugar and vitamin C than yellow cultivars (Jurgiel-Malecka et al., 2015). Therefore, a concentration of 20% onion extract can be recommended to stimulate early flowering with a higher percentage. There was an improvement in the quality of higher yields by regulating the metabolism of amino acids, including proline and indole, and the activity of catalase and hydrogen peroxide in apple flower buds (El-yazal and Rady, 2014).

Based on the literature review previous studies have shown that shallot and garlic extract contained growth-promoting hormones (IAA, GA, and cytokinin)

and inhibitors (ABA) of plants, as well as phenolic compounds. The application of shallot and garlic extract at a concentration of 20% positively affected the seed germination of melon, the flower cuttings, and the buds of apples and legumes. However, there was not enough information about the effect of Allium extract on the growth and yield of rice. Study in the application of shallot, garlic, and onion extracts has never been tried on seed germination, growth, and yield of rice. Not yet known type of Allium extract that can increase the growth and yield of rice. Therefore, it is necessary to research the application of Allium extract in rice cultivation. Therefore, this study aimed to find the one of best types of Allium extract that can stimulate rice growth.

Materials and methods

Study area

The study was conducted from December 2021 to April 2022. The experimental area was conducted in the greenhouse, Faculty of Agriculture, Universitas PGRI Yogyakarta, Bantul Regency, Yogyakarta Special Region, Indonesia. The height of the study site was 118 m above sea level (m ASL) and located at the 8°30'-7°20' South latitude and 109°40'-111°0' East longitude. The study showed the average air temperature and humidity were 33 ºC and 60%, respectively

Materials and Tools

The materials used were wooden box germination of 50 cm (width) × 80 cm (length) × 20 cm (height), latosol soil, cow manure, urea, and NPK Phonska, polybags in size of 40 cm (width) × 35 cm (height), paper, mica plastic labels, bamboo sticks of 50 cm (height), rice seed variety of Padjajaran Agritan, plastic tub germination with a size of 30 cm (length) × 25 cm (width) × 5 cm (height), water, shallot, garlic, and onion. The equipment used were a hoe, sickle, ruler, Philips Blender HR2115/01, filter paper, soil sieve of 2 × 2 cm, pipette volume of 10 mL, plastic bottle volume of 1 L, Erlenmeyer pyrex volume of 500 mL, oven Binder drying oven ED series, ACIS AD-i Series digital analytical balance, manual scales capacity of 30 kg, and grain moisture tester JV-001S.

Experimental design

This study was carried out in two stages of experiments. The first was about seed germination and seedling growth of rice, and the second was about rice growth and yield. The study was a single factor arranged in a complete randomized design (CRD) and three replications. The treatments consisted of four types, i.e., control (without treatment), shallot (*Allium ascalonicum* L.), garlic (*Allium sativum* L.), and onion (*Allium cepa* L.). Each type of Allium

extract used a concentration of 20%. In the first experiment, only one sample was used for each repetition so a total of 12 plastic germination baths were needed. While in the second experiment, each test consisted of six samples so in total 72 polybags were needed.

Research procedures

Processing steps of Allium extract at 20% concentration were followed. First, the bulbs' fresh weight of 100 g was put in a blender, and 200 mL of water was added for extraction. Next, the shallot extract was fed into the Erlenmeyer tube for a centrifuge for 10 minutes at a speed of 500 rpm. The resulting shallot extract was poured into a measuring cup and added the water up to a volume of 500 mL. After that, the extract was filtered with filter paper. The liquid that escaped from the sieve was used as a phytohormone. Next, the liquid of the solution was fermented for seven days in plastic bottles.

Latosol soil as a planting medium was taken from the top-soil layer at a depth of 0-20 cm. The soil was dredged, then crushed with a hoe to a uniform grain, and filtered with a soil sieve. In the first experiment, the seed germination test required 36 plastic tubs. Each germination plastic tub was filled with 1 kg of soil, and the soil surface was flat. For the second experiment, 90 polybags were needed, each filled with 10 kg of soil. Polybags were placed on a table located inside the greenhouse building. The Padjajaran Agritan variety was used in this study.

The first experiment was done by randomizing all germination plastic tubs filled with soil. Randomization was carried out at once against the all of treatments. Next, the treatment label used paper affixed to the outer wall of the germination plastic tub. Randomization was carried out in the second experiment on all polybags with the same method. Next, the treatment label used mica plastic with the help of bamboo sticks. Bamboo sticks were plugged into the center planting medium on the germination plastic tub.

The first experiment was carried out by scattering as many as 20 rice seeds per germination plastic tubs in above the soil surface in water-saturated conditions. In total, 240 rice seeds are needed. However, the preparation of the second experiment was carried out on wooden box germination and filled with a mixture of soil and manure in a ratio of 1:1. As many as 216 rice seeds were stocked over the soil medium in water-saturated conditions. Seedlings ready were planted into polybags at the age of 18 days after sowing (DAS). Rice seedlings as planting material are selected that have uniform growth.

For the first experiment, the application of Allium extract was as much as 2 mL per germination plastic tub evenly above the soil surface suitable for the treatment. Each treatment was given simultaneously when stocking seeds. Likewise, for the second experiment, the treatment of Allium extract, as much as 2 mL polybag^{-1} evenly above the soil surface, was carried out simultaneously at the time of planting. The plant spacing between seedlings in polybags was 25 × 25 cm. A rice seedling was planted in the middle of the soil surface inside the

polybag. Seedlings were planted at a depth of 2 cm. Each polybag only was planted one seedling, so the overall need was as many as 72 rice seedlings.

The water availability in the first experiment was kept in field capacity until ten days after planting (DAP). However, in the second experiment, water was always maintained at 2 cm from the soil surface daily at 1-105 DAP. The recommended dose of fertilizer was 225 kg ha-1 (or 0.08 g for one-kg soil) urea and 225 kg ha-1 (or 0.08 g for one-kg soil) NPK Phonska 15-15-15 for rice cultivation. Fertilization was carried out in two stages. The first application was 40% of the recommended dose at 14 DAP. The second application was as much as 60% of the recommended dose at the age of 35 DAP. Weed control was carried out twice during the study. Pest control was carried out twice during flowering using Dursban pesticides. Rice harvesting was carried out at 105 DAP when the grains matured physiologically (95% turned yellow).

The experiment culture of rice crops with Allium extract application at 105 DAP can be seen in *Figure 1*.

***Figure 1**. Photo of rice crops with Allium extract application at 105 DAP*

Measurement and Parameter

For the first experiment, the rate and power of germination were observed from the 1st to the 10th day, while the seedling's height and dry weight were observed at 10 DAS. Germinated seeds are counted and measured if shoots have appeared 2 cm above ground level in a germination plastic tub. The seedlings' height is calculated from the average of all seedlings that have grown, while the seedlings' dry weight is calculated from all seedlings that have grown per germination plastic tub. For the second experiment, plant growth was observed at 80 DAP including the tillers number and plant height, while shoot and grain dry weight was observed at 105 DAP. Measurement of rice growth and yield is carried out on all samples in each repeat, then the average per clump is calculated.

Seedlings and shoot dry weight were dried in an oven for 48 hours at 80°C or until the dry weight was constant. Grain dry weight was measured using the digital analytical balance after drying under sunlight until it reaches a seed moisture content of 14%.

Statistical analysis

Observational data were analyzed by analysis of variance at the 5% significance level. To determine the difference between treatments, Duncan's new multiple distance test (DMRT) was used at 5% significance level (Gomez and Gomez, 1984).

Results

Effect of Allium Extract Types on the Seed Germination and Seedling Growth

The research results in the first experiment showed that Allium extract types did not significantly affect the rate and power of germination. Still, it affected the seedlings' height and dry weight. The results of multiple comparisons with DMRT at a 5% significance level on seed germination and seedlings' growth can be seen in *Table 1*.

Table 1. *Effect of Allium extracts types on the seed germination on seedlings'*s' *growth at 10 DAS*

Allium extract type	**Germination rate**	**Germination power (%)**	**Seedlings' height (cm)**	**Seedlings' dry weight (g per germination plastic tub)**
Control	3.19 a	98.33 a	4.00 b	0.54 a
Shallot	2.96 a	91.67 a	4.00 b	0.44 b
Garlic	2.93 a	90.00 a	4.33 b	0.47 b
Onion	3.32 a	98.33 a	5.00 a	0.56 a

Remarks: The number followed by the same character in a column is not significantly different based on DMRT at 5% significant level.

Table 1 explains that the Allium extract types did not significantly affect the rate and power of germination. However, the onion extract application could increase the seedlings' height and greatly differ from shallot and garlic extracts or control. The treatment of shallot and garlic extracts caused the seedlings' dry weight to be lower than the control and onion. Shallot and garlic extracts application inhibited the seedlings' growth of rice. For more details, the effect of Allium extract types on the height and dry weight of seedlings can be seen in *Figure 1*.

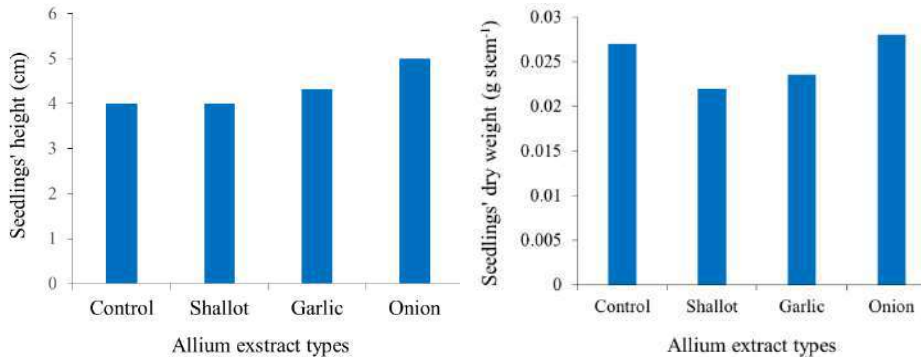

***Figure 2**. Application of Allium extract on the seedlings' height (a) and seedlings' dry weight (b)*

Figure 2a explains that the application of onion extract was effectively stimulating the seedlings' height of rice. *Figure bb* shows that applying shallot, garlic, and onion extract was not effectively stimulating the seedlings' dry weight of rice.

Effect of Allium Extract Types on the Growth and Yield of Rice

The research results in the second experiment showed that the type of Allium extract did not significantly affect the tiller's number and plant height, but it affected the shoot and grain dry weight. The results of multiple comparisons with DMRT at a 5% significance level on the growth and yield of rice can be seen in *Table 2*.

***Table 2**. Effect of Allium extracts types on the growth and yield of rice*

Allium extract type	Tillers number (stem clump^{-1})	Plant height (cm)	Shoot dry weight (g clump^{-1})	Grain dry weight (g clump^{-1})
Control	8.44 a	75.67 a	24.28 b	20.64 b
Shallot	9.78 a	84.22 a	42.89 a	31.10 a
Garlic	10.11 a	75.44 a	27.00 b	22.35 b
Onion	9.11 a	77.67 a	35.61 ab	16.83 b

Remarks: The number followed by the same character in a column is not significantly different based on DMRT at 5% significant level.

Table 2 explains that the Allium extract types could increase the shoot dry weight and be significantly different from the garlic extract, but was not significantly different from the onion extract. On the other hand, the shallot extract application could increase the grain dry weight clump^{-1} and be significantly different from the garlic and onion extract. The effect of Allium extract types on the dry weight of the shoot and grain can be seen in *Figure 3*.

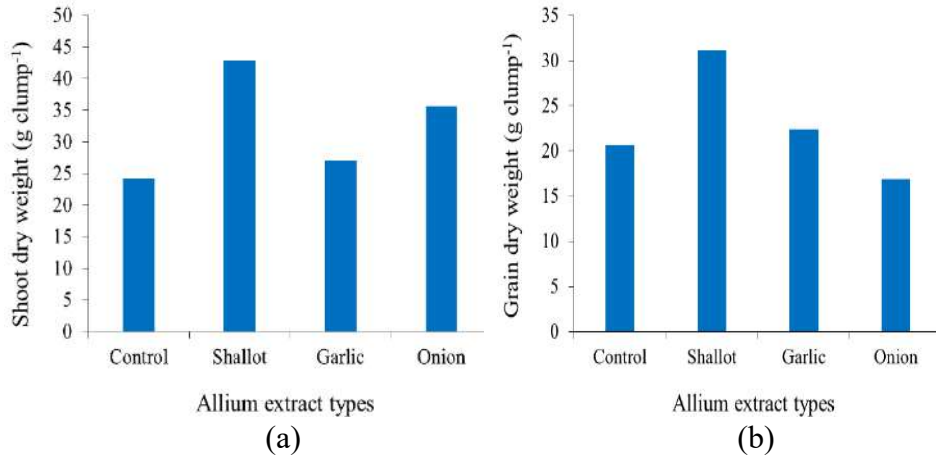

Figure 3. *Application of Allium extract on shoot dry weight (a) and grain dry weight (b)*

Figures 3a and *3b* explain that the application of shallot extract gave higher shoot and grain dry weight of rice.

Discussion

Allium extracts have a bad effect on rice seed germination. The application of shallot and garlic extract inhibits the growth of dry weight of seedlings. Shallot and garlic extract contained high phenolic compounds so can interfere with the initial of seedlings growth. Seed germination was sufficiently stimulated by the PGRs contained in it. Seed germination did not require additional PGRs from organic material.

The rate germination, power germination, and seedlings' height did not require the additional external phytohormones from shallot and garlic extract, but required onion extract. The addition of shallot extract and garlic did not increase the seedlings' height of rice. Conversely, onion extract can increase the vertical growth of rice seedlings. The application of Allium extract will increase the concentration of IAA in the rice seed and will inhibit it because the content becomes excessive. According to Lee et al. (2022), poor seed germination and inhibition of seedling growth due to excessive accumulation of IAA.

Shallot and garlic extract contained phytohormones, especially GA. The GA compounds were considered negative regulators of innate immunity in rice crops (Yang et al., 2013). The GA content in rice seeds was enough to support their seed germination. The GA could diffuse into the aleurone layer and initiate signaling synthesizing amylase and other hydrolytic enzymes. Then, hydrolytic enzymes secreted into the endosperm and hydrolyzed food reserves. Next, the hydrolytic enzymes will hydrolyze starch, lipids, hemicellulose proteins, polyphosphates, and other stored materials into simpler forms that are available to the embryo (Ali and Elozeiri, 2017).

Not all types of Allium extracts have a significant effect on rice growth and yield. Garlic and onion extracts were not effective for increasing the dry weight of shoot and grain, while shallot was effective. Adding external phytohormones to the soil media effectively optimized the shoot's dry weight. Besides, the shallot extract application could significantly increase the grain dry weight. The content of IAA in shallot could stimulate the growth of rice plants. According to Sopha and Hartanto (2021), shallot bulb tissue contained higher IAA concentrations than leaves and roots.

The IAA is a common auxin form that participates in plant growth and development. The sources of IAA can come from organic material. Shallot bulbs can produce natural hormones, namely IAA. The IAA played a role in stimulating plant growth, such as enlargement, elongation, cell division, affected nucleic acid metabolism, and plant metabolism (Pamungkas and Puspitasari, 2018). Auxin affected some aspects of the plant development (Wang et al., 2018). The use of IAA contained in Allium extract, especially in shallot has a good role in increasing plant growth.

The use of exogenous auxin in the right concentration increased the yield of dry matter in plants (Sosnowski et al., 2023). Therefore, the IAA of shallot can be used to stimulate the growth and yield of rice. However, the shallot extract has been shown to increase rice's shoot and grain dry weight higher than garlic extract.

Based on the discussion above, it can be affirmed that Allium extract is better used to support plant growth of rice than in nurseries. Shallot bulb extract supports rice growth better than garlic and onion.

Conclusion

The research results and discussion above showed that the significantly affected seedlings' growth, especially for seedlings' height the first time. The shallot and garlic extracts decreased the seedlings' dry weight. The shallot extract can stimulate to increase the shoot dry weight of rice. The application of shallot and garlic extract harms seed germination and seedlings' growth, except for onion extract. Application of shallot extract could cause the highest grain dry weight clump^{-1}. The study findings show that the shallot and garlic extract harms the seed germination and seedlings' growth, but the onion extract does not. However, the shallot extract is a type of Allium that can stimulate rice growth. Therefore, we recommend the shallot extract type for stimulating growth in rice cultivation.

Acknowledgments. We thank the –

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7.5. Cover Letter for Re-submission

COVER LETTER OF MANUSCRIPT REVISION
To Applied Ecology and Environmental Research (AEER)

Dear Editors,

Thanks for the correction of the manuscript entitled "**THE ROLE OF ALLIUM EXTRACTS IN STIMULATING RICE GROWTH**". We have improved the quality of English through the help of colleagues who work as proofread and the article has been carefully checked, including the usage of word order, verb form, and grammar or style. There are several changes and additional sentences in the manuscript according to the referee and editor's suggestions. Herewith I attach the required files. A revised paper with the highlights addressed all issues and required corrections/changes.

Best Regards

Paiman
Universitas PGRI Yogyakarta, Indonesia

7.6. Re-submission of Manuscript after Revised

A cover letter for the paper revised can be prepared in MS Word. Furthermore, the manuscript revision can be saved in PDF. The cover letter is copied and pasted via the correspondence email page, while the manuscript is attached and can be shown in Figure 7.1.

For example:

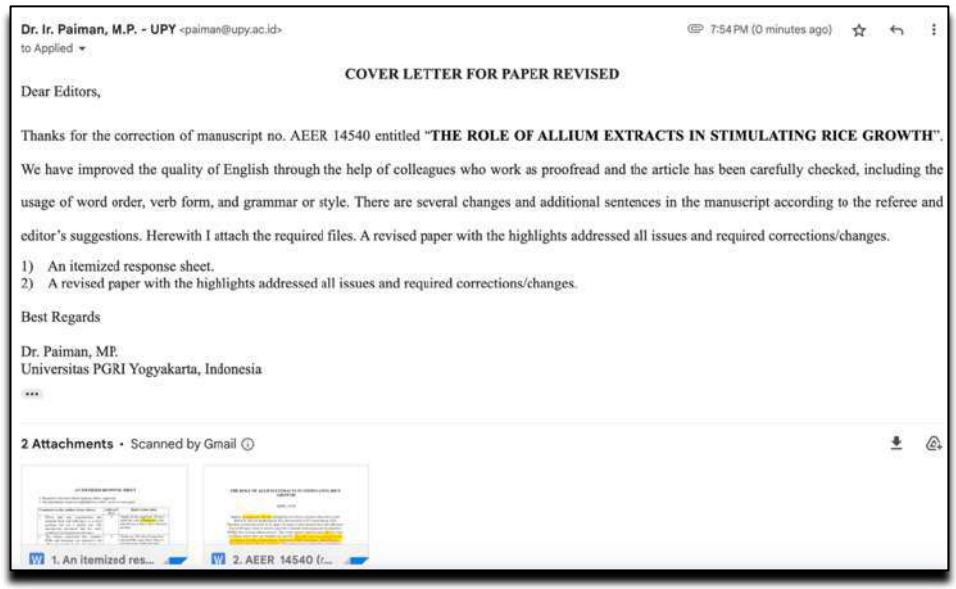
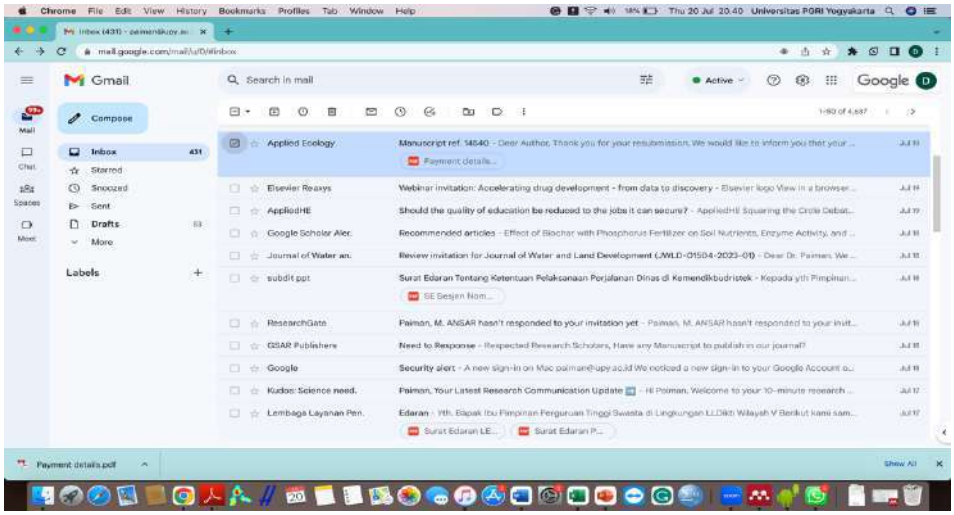


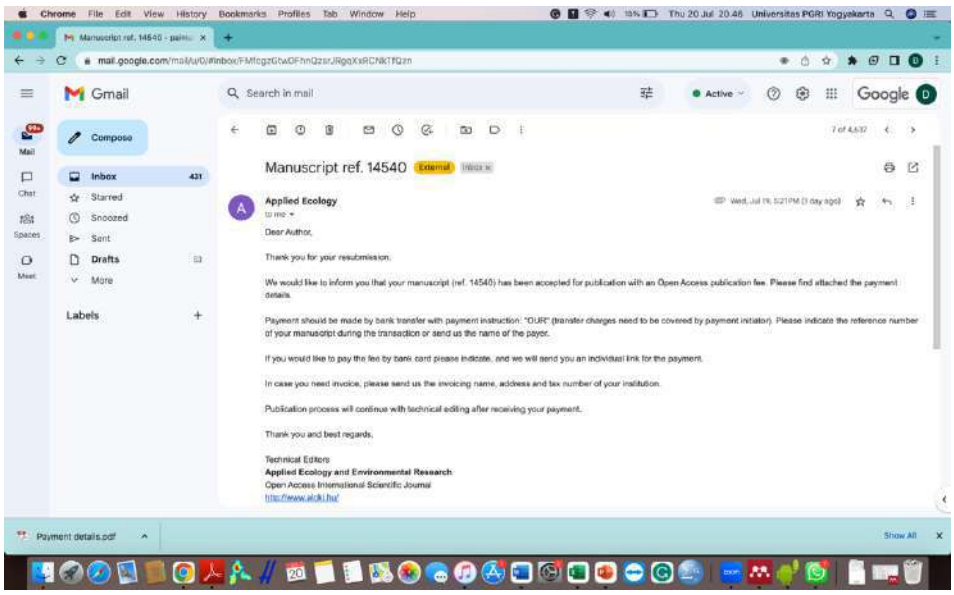
Figure 7.1. Cover letter for paper revised and attached manuscript

CHAPTER 8
ACCEPTANCE AND PUBLICATION

8.1. Acceptance

After the author re-submits the manuscript revision, the journal will notify about rejection or acceptance for publication by email correspondence. Furthermore, if the article is declared accepted, then the author is sent an invoice form for payment, such as the following example.





Invoices and payment fees are listed in the following example form.

PAYMENT DETAILS:

Name of Beneficiary (Recipient): Aloki Institute Ltd.
Postal Address of Beneficiary: Kassa utca 118., 1185 Budapest, Hungary
IBAN Code: HU53
International Bank Account Number (IBAN): HU53 1201 1265 0143 7534 0020 0001

Name of Bank: Raiffeisen Bank Zrt.
Postal Address of Bank: Váci út 116-118., 1133 Budapest, Hungary
SWIFT (BIC) Code: UBRTHUHB

Amount of Payment: 850 EUR

Payment should be made by bank transfer with Detailes of Charges: „OUR":
All transfer fees are covered by payer.

Please indicate the reference number of your manuscript.

8.2. Cover Letter for Payment

After the author receives an email for payment of publication fees (invoices) from the journal, payment will immediately be made through the bank or mobile banking to the bank appointed by the journal. Here's an example of a cover letter.

CONFIRMATION OF PAYMENT FOR ARTICLE PUBLICATION

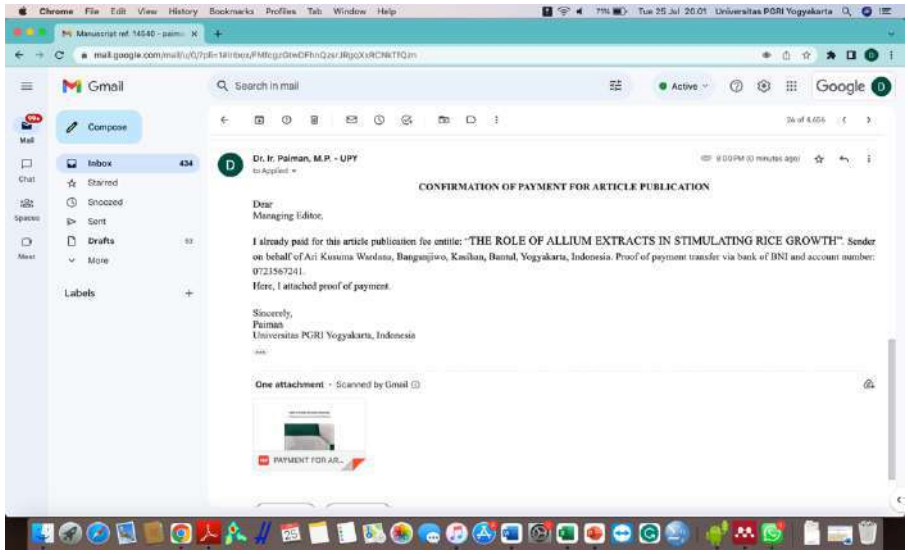
Dear
Managing Editor,

I already paid for this article publication fee entitled: "THE ROLE OF ALLIUM EXTRACTS IN STIMULATING RICE GROWTH". Sender on behalf of Ari Kusuma Wardana, Bangunjiwo, Kasihan, Bantul, Yogyakarta, Indonesia. Proof of payment transfer via bank of BNI and account number: 0723567241.
Here, I attached proof of payment.

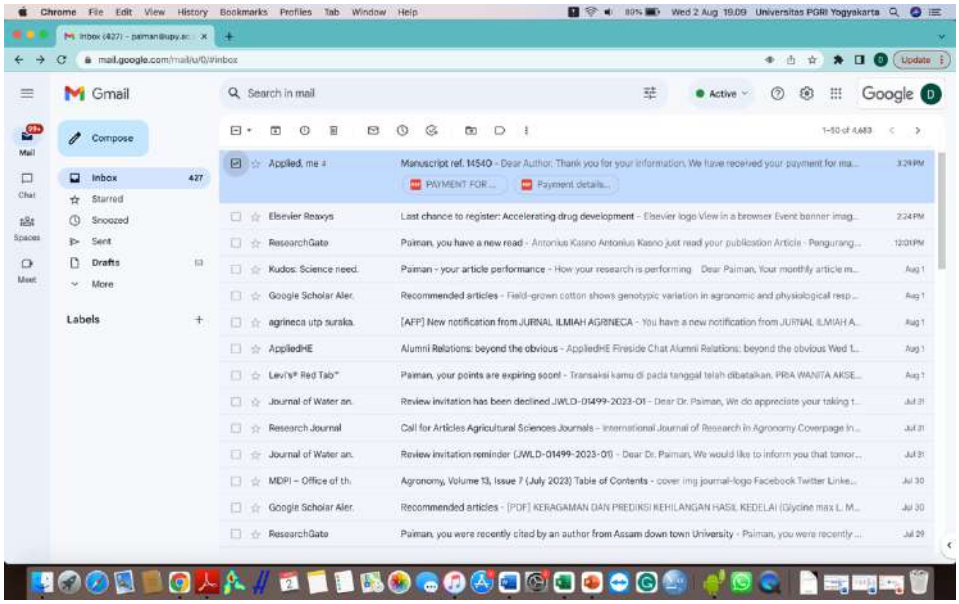
Sincerely,
Paiman
Universitas PGRI Yogyakarta, Indonesia

If the author has made a payment, it is necessary to notify the journal via correspondence journal email by attaching proof of payment, such as the following example.

Proof of payment through email journal (25 July 2023)

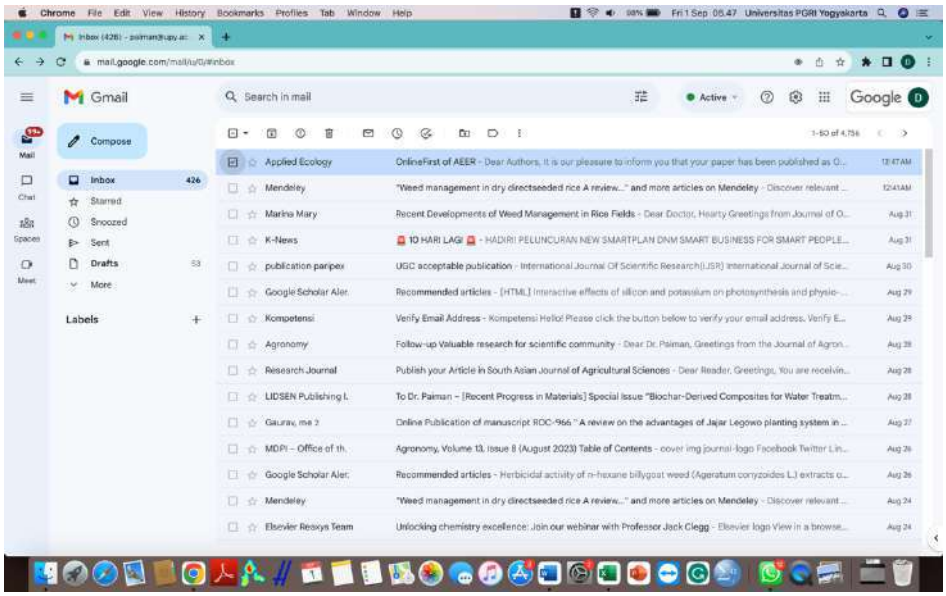


Payment response from journal (2 Agustus 2023)



8.3. Article Publication

After payment is made to the bank designated by the journal, the manuscript will be edited (finalized) and published by the journal. Next, the author will be notified of the publication time.

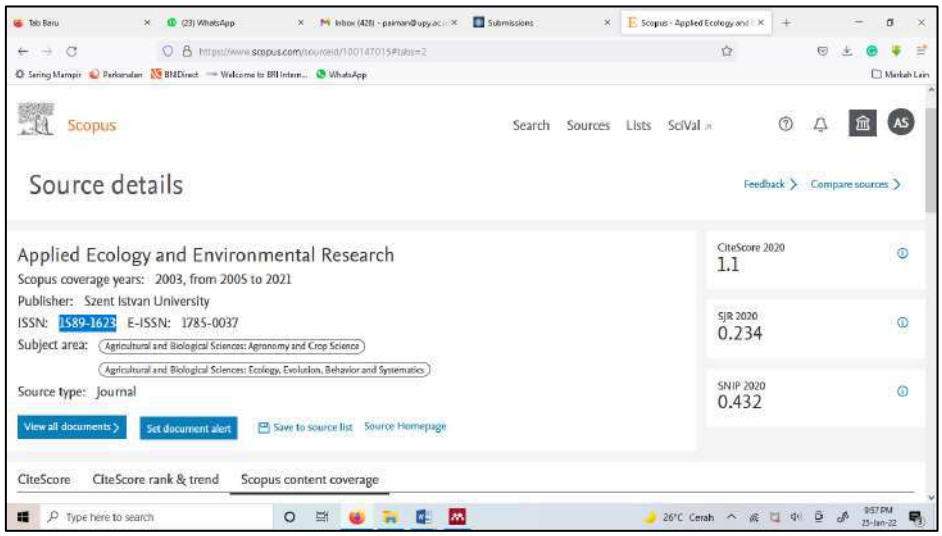


CHAPTER 9
CORRESPONDENCE HISTORY

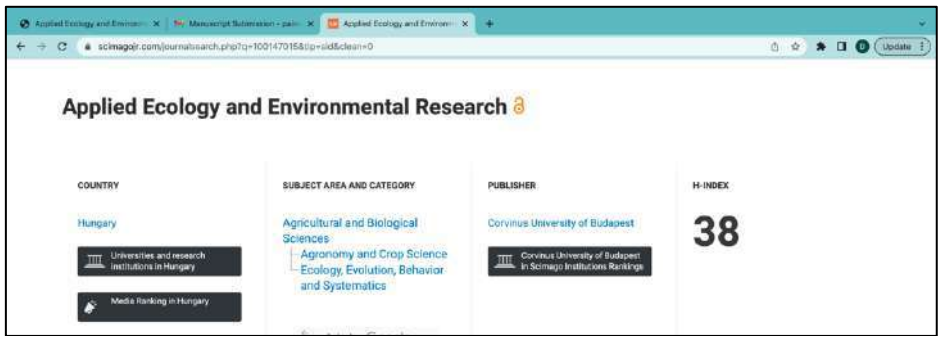
Correspondents are writers who handle manuscript improvements and correspondence. Record all correspondence processes between authors and journal editors until publication.

9.1. Information of Journal Destination

9.1.1. Link Web SJR Journal
https://www.scopus.com/sourceid/100147015#tabs=2

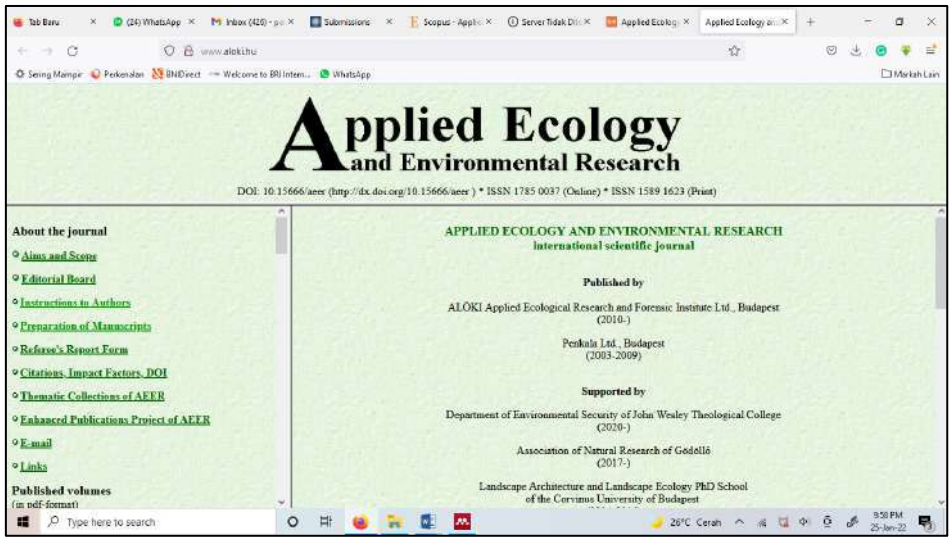


9.1.2. Link Web H-Index Journal
https://www.scimagojr.com/journalsearch.php?q=100147015&tip=sid&clean=0



9.1.3. Link Web Pubisher Journal

http://www.aloki.hu/



9.2. Manuscript Submission (May 14, 2023)

9.2.1. Cover Letter of Manuscript Submission

COVER LETTER

To Applied Ecology and Environmental Research

Dear Editor,

I would like to send an original article entitled: **THE ROLE OF ALLIUM EXTRACTS IN STIMULATING RICE GROWTH** for Applied Ecology and Environmental Research to consider. I confirm that this work is genuine and has not been published elsewhere, nor is it considered for publication elsewhere. We believe and hope that this manuscript is worthy of publication by Applied Ecology and Environmental Research. We are interested in publishing articles in this journal because it has an excellent reputation, so it is a matter of pride if published in Applied Ecology and Environmental Research. Here I attach the manuscript.

Thank you
Best regards,

Paiman
Universitas PGRI Yogyakarta, Indonesia

9.2.2. Manuscript for Submission

THE ROLE OF ALLIUM EXTRACTS IN STIMULATING RICE GROWTH

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Abstract. The demand for rice always increases from year to year. However, rice production in 2021 decreased by 0.45% more than in 2020. Therefore, production needs to be improved again to meet national food self-sufficiency. One of the innovations to increase growth is utilizing natural plant growth regulators (PGR) derived from Allium extracts. This study aimed to find the one of best types of Allium extract that can stimulate rice growth. The research was a single factor arranged in a complete randomized design (CRD) and three replications. The treatments consisted of four types i.e., control (without treatment), shallot (*Allium ascalonicum* L.), garlic (*Allium sativum* L.), and onion (*Allium cepa* L.). Each type of Allium extract used a concentration of 20%. The research results showed that the Allium extract types did not significantly stimulate seed germination and seedlings' growth, except for seedlings' height. The shallot and garlic extracts inhibited the seedlings' dry weight. The Allium extract types can stimulate to increase in the shoot dry weight clump^{-1}. Application of shallot extract could cause the highest grain dry weight clump^{-1}. The study findings show that the shallot and garlic extract harms the seed germination and seedlings' growth, except for onion extract. However, the shallot extract is a type of Allium that can stimulate rice growth. Therefore, we recommend that the shallot extract type is better for stimulating growth in rice cultivation.

Keywords: Allium extract, rice, shallot, garlic, onion, phytohormone

Introduction

The rice plant produces rice as a staple food in the Indonesian population. Optimal rice growth can support maximum yields. Therefore, one attempt to stimulate plant growth regulators (PGR) through growth hormones. PGR in the form of natural can modify or control through physiological action, growth, and maturation of plants. The PGR produced in the plant is called plant hormone or phytohormone.

However, synthetic hormones are very expensive; alternatively, use natural PGR of the Allium extract. Allium bulbs contain auxins (IAA), gibberellin acid (GA), and cytokinins. IAA and GA hormones can play a role in stimulating rice growth. However, it is not yet known what type of Allium extracts can be used to stimulate rice growth.

The demand for rice has increased from year to year. However, rice production in 2021 decreased by 0.45% more than in 2020 (BPS, 2021). At the end of 10 years, the area dan production of rice has been declining as much as 1.8% and 1.6%, respectively (Pudjiastuti et al., 2021). Rice production can be increased again to maintain national food security. Therefore, it was necessary to have a solution. Using Allium extract at certain concentrations can increase rice production.

During this time, a rice intensification system was implemented to obtain higher production, optimal use of labor and capital, input costs, and the need for less water (Toungos, 2018). In addition, rice production in Indonesia has been carried out through five farming programs, i.e., superior seed selection, good tillage, proper fertilization, pest and plant disease control, and good irrigation.

PGR is a natural and synthetic compound that can modify or control plants through the action of physiological growth and maturation. Phytohormones are produced as compounds in the plant's body (Ogunyale et al., 2014). Phytohormones are compounds needed in small amounts but can majorly affect growth and production. For example, IAA, GA, and zeatin (cytokinin) are growth-promoting hormones, while abscisic acid (ABA), ethylene, and phenolic compounds as growth-inhibiting hormones (Agustina et al., 2010). These phytohormones are capable of being produced by plants, one of which is from the Alliaceae family (Wen et al., 2021). The following literature review will be discussed in more detail three types of Allium extract, i.e., shallot, garlic, and onion which were most likely to contain phytohormones.

Shallot bulbs (*Allium ascalonicum* L.) contained PGR, i.e., IAA and cytokinins. However, an excessive concentration of shallot extract will inhibit plant growth. The IAA is a hormone that can affect plant growth: height growth, number of leaves, chlorophyll content, root gain, and stem diameter (Patma et al., 2013). In addition, shallot contains the hormones of IAA and GA, so shallot extract can help seed germination and the growth of roots and shoots (Salsabila et al., 2021).

The highest concentration of IAA in shallots was found in bulbs (5.376 mg kg^{-1}), decreased in roots (3.314 mg kg^{-1}), and lowest in leaves (1.006 mg kg^{-1}). The results showed that the IAA content was the highest in shallot var. Bima (6.014 mg kg^{-1}) than var. Maja, Mentes, Pancasona, and Trisula (Sopha and Hartanto, 2021). A concentration of 20% shallot extract most effectively increased the live cuttings percentage (%), but a concentration of 10% significantly affected the leaves number in *Mucuna bracteata* D.C (Prameswari and Pratomo, 2021). Shallots contain GA_3, IAA, ABA, and zeatin (Dahab et al., 2018), and are effective for increasing germination, fresh weight, and dry weight

of melon plants. In addition, shallot extracts had the potential to be a source of organic hormones (Yunindanova et al., 2018).

The phytohormone content in garlic (*Allium sativum* L.) was higher than shallot, i.e., GA_3 (2.719 mg 100 g^{-1}), IAA (0.0312 mg 100 g^{-1}), ABA (0.3138 mg 100 g^{-1}), and zeatin (0.0149 mg 100 g^{-1}) (Dahab et al., 2018). Garlic extract contained enzymes and more than 200 other chemical compounds. Garlic contained vitamins, minerals, flavonoids, ascorbic acid, sulfur, iodine, and some amino acids. Sulfur had an important role in the fruiting process of various fruit crops (Al-hadethi et al., 2016).

Garlic contained a high level of phenolic compounds (Griffiths et al., 2002). Flavonoids were the main phenolic in garlic bulbs. It can be classified into various sub-classes: flavones, flavanones, flavonols, isoflavones, flavanonols, flavonols, flavanols, chalcones, and anthocyanins (Perez-Gregorio et al., 2010). The results showed that the application of garlic extract could result in a marked reduction in nodulation in the roots, plant height, leaf area, and root development of arrears (*Vigna unguiculata*) and peanuts (*Arachis hypogea*) than control (Adeleke, 2019).

Many organosulfur compounds were found in onions (*Allium cepa* L.). Diallyl sulfide, diallyl monosulfide, disulfide, trisulfide, and tetrasulfide were the main onion compounds. Onions were considered an excellent source of flavonoids from the polyphenol family. Flavonols were a sub-class of flavonoids (Pareek et al., 2017). Red and yellow cultivar onions contained polyphenols in the form of gallic acid, ferulic acid, and quercetin. Red cultivar onions showed better antioxidant activity than yellow cultivars. Higher polyphenol and flavonoid content was also associated with higher antioxidant activity (Cheng et al., 2013).

Onions contained vitamins (A, B_1, B_2, and C, nicotinic acid, and pantothenic acid). The essential substances such as protein, calcium, phosphorus, potassium, Fe, Al, Cu, Zn, Mn, and I were found in onion. In addition, onions contained phenolic compounds, namely, phenolic acids and flavonoids that can act as natural antioxidants, anti-carcinogens, and anti-microbial agents (Akbudak et al., 2018). Yellow cultivars accumulated N, P, K, Mg, Fe, Mn, Zn, Cu, and reducing sugars in much larger quantities than red cultivars. Red cultivars contained much more significant amounts of sugar and vitamin C than yellow cultivars (Jurgiel-Malecka et al., 2015). Therefore, a concentration of 20% onion extract can be recommended to stimulate early flowering with a higher percentage of success. There was an improvement in the quality of higher yields by regulating the metabolism of amino acids, including proline and indole, and the activity of catalase and hydrogen peroxide in apple flower buds (El-yazal and Rady, 2014).

Based on the literature review previous studies have shown that shallot and garlic extract contained growth-promoting hormones (IAA, GA, cytokinins) and inhibitors (ABA) of plants, as well as phenolic compounds. The use of shallot and garlic extract at a concentration of 20% positively affected the seed germination of melon, flower cuttings, flower buds of apples, and legumes. However, there was not enough information about the effect of Allium extract on

the growth and yield of rice. Study in the application of shallot, garlic, and onion extracts has never been tried on seed germination, growth, and yield of rice. Not yet known type of Allium extract that can increase the growth and yield of rice. Therefore, it was necessary to research the application of Allium extract in rice cultivation. Therefore, this study aimed to find the one of best types of Allium extract that can stimulate growth in rice cultivation.

Materials and methods

Study area

The study was conducted from December 2021 to April 2022. The experimental site was conducted in the greenhouse, Faculty of Agriculture, Universitas PGRI Yogyakarta, Bantul Regency, Yogyakarta Special Region. The height of the study site was 118 m above sea level (m ASL) and located at the 8°30'-7°20' South latitude and 109°40'-111°0' East longitude.

Materials and Tools

The materials used were latosol soil, cow manure, polybags, paper, mica plastic labels, rice seeds, germination plastic tub, water, shallot, garlic, and onion. The equipment used were a hoe, sickle, ruler, blender, filter paper, soil sieve, measuring pipette, mineral water bottle volume of 1 L, pyrex measuring cup volume of 500 mL, chlorophyll meter CCM-200 plus, oven, digital scales model DS-880, and manual scales capacity of 30 kg.

Experimental design

This study was carried out in two stages of experiments. The first was about seed germination and seedling growth of rice, and the second was about rice growth and yield. The study was a single factor arranged in a complete randomized design (CRD) and three replications. The treatments consisted of four types, i.e., control (without treatment), shallot (*Allium ascalonicum* L.), garlic (*Allium sativum* L.), and onion (*Allium cepa* L.). Each type of Allium extract used a concentration of 20%.

Research procedures

How to make each Allium extract at 20% concentration. First, the bulbs' fresh weight of 100 g was put in the blender, and 200 mL of water was added for extraction. Next, the shallot extract was fed into the Erlenmeyer tube for a centrifuge for 10 minutes at a speed of 500 rpm. The resulting shallot extract was poured into a measuring cup and added the water up to a volume of 500 mL. After that, the extract was filtered with filter paper. The liquid that escaped from the sieve was used as a phytohormone. Next, the liquid of the solution was fermented for seven days.

Latosol soil as a planting medium was taken from the top-soil layer at a depth of 0-20 cm. The soil was dredged, then crushed with a hoe to a uniform grain, and filtered with a soil sieve of 2 cm × 2 cm. The seed germination test required 30 plastic tubs with a size of 30 cm (length) × 25 cm (width) × 5 cm (height). Each germination plastic tub was filled with 1 kg of soil, and the soil surface was flat. For the second experiment, 90 polybags in 40 cm × 35 cm were needed, each filled with 10 kg of soil. Polybags were placed on a table located inside the greenhouse building. The rice seed used in this study was Padjajaran Agritan variety.

The first experiment was done by randomizing all germination plastic tubs filled with soil. Randomization was carried out at once against the entire treatment. Next, the treatment label of the mica plastic, with the help of bamboo sticks, was plugged into the planting medium on the germination plastic tub. In the same method, randomization was carried out in the second experiment on all polybags.

The first experiment was carried out by scattering as many as 20 rice seeds in each germination plastic tub above the soil surface in water-saturated conditions. However, the preparation of the second experiment was carried out on wooden box germination of 50 cm × 80 cm and filled with a mixture of soil and manure in a ratio of 1:1. Rice seeds were stocked over the soil medium in water-saturated conditions. Seedlings ready were planted into polybags at the age of 18 days after sowing (DAS).

For the first experiment, the application of Allium extract was as much as 2 mL per plastic tub germination evenly above the soil surface. Each treatment was given simultaneously when stocking seeds. Likewise, for the second experiment, the treatment of Allium extract, as much as 2 mL polybag-1 evenly above the soil surface, was carried out simultaneously at the time of planting. The plant spacing between seedlings in polybags was 25 cm × 25 cm. One rice seedling was planted in the middle of the soil surface inside the polybag. Seedlings were planted at a depth of 2 cm. The overall need was as many as 90 seedlings.

The water availability in the first experiment was kept in field capacity until ten days after planting (DAP). However, in the second experiment, water was always maintained at 2 cm from the soil surface daily at 1-105 DAP. The recommended dose of fertilizer was 225 kg ha-1 urea and 225 kg ha-1 NPK Phonska 15-15-15 for rice cultivation. Fertilization was carried out in two stages. The first application was 40% of the recommended dose at 14 DAP. The second application was as much as 60% of the recommended dose at the age of 35 DAP. Wbeed control was carried out twice during the study. Pest control was carried out twice during flowering using Dursban pesticides. Rice harvesting was carried out at 105 DAP when the grains matured physiologically (95% turned yellow).

Measurement and Parameter

For the first experiment, the rate and power of germination were observed from the 1st to the 10th day, while the seedling's height and dry weight were observed at 10 DAS. For the second experiment, plant growth was observed at 40 DAP including the tillers number, plant height, and shoot dry weight, while grain dry weight was observed at 105 DAP

Statistical analysis

Observational data were analyzed by analysis of variance at the 5% significance level. To determine the difference between treatments, Duncan's new multiple distance test (DMRT) was used at 5% significance level (Gomez and Gomez, 1984).

Results

Effect of Allium Extract Types on the Seed Germination and Seedling Growth

The research results in the first experiment showed that Allium extract types did not significantly affect the rate and power of germination. Still, it affected the seedlings' height and dry weight. The results of multiple comparisons with DMRT at the 5% significance level on seed germination and seedlings' growth can be seen in *Table 1*.

Table 1*. Effect of Allium extracts types on the seed germination and seedlings' growth at 10 DAS*

Allium extract type	Germination rate	Germination power (%)	Seedlings' height (cm)	Seedlings' dry weight (g stem^{-1})
Control	3.19 a	98.33 a	4.00 b	0.54 a
Shallot	2.96 a	91.67 a	4.00 b	0.44 b
Garlic	2.93 a	90.00 a	4.33 b	0.47 b
Onion	3.32 a	98.33 a	5.00 a	0.56 a

Remarks: The number followed by the same character in a column is not significantly different based on DMRT at 5% significant level.

Table 1 explains that the Allium extract types did not significantly affect the rate and power of germination. However, the onion extract application can increase the seedlings' height and greatly differ from shallot and garlic extracts or control. The treatment of shallot and garlic extracts caused the seedlings' dry weight to be lower than the control and onion. Shallot and garlic extracts application inhibited the seedlings' growth of rice. For more details, the effect of Allium extract types on the height and dry weight of seedlings can be seen in *Figures 1a* and *1b*.

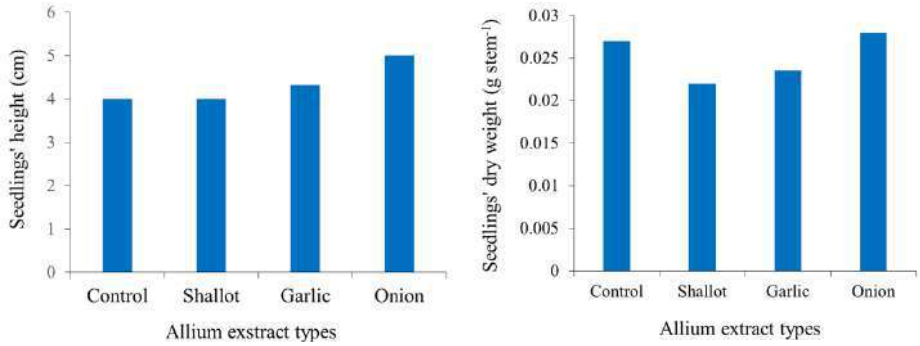

Figure 1. *Application of Allium extract on the seedlings' height (a) and seedlings' dry weight (b)*

Figure 1a explains that onion extract could increase the seedlings' height of rice. But on the contrary, the application of shallot and garlic extract could not increase the seedling's height. *Figure 1b* shows that applying shallot and garlic caused a decrease in the seedlings' dry weight of rice, while onion application did not affect the seedlings' dry weight of rice.

Effect of Allium Extract Types on the Growth and Yield of Rice

The research results in the second experiment showed that the type of Allium extract did not significantly affect the tiller's number and plant height, but it affected the shoot and grain dry weight. The results of multiple comparisons with DMRT at the 5% significance level on the growth and yield of rice can be seen in *Table 2*.

Table 2. *Effect of Allium extracts types on the growth and yield of rice*

Allium extract type	Tillers number (stem clump^{-1})	Plant height (cm)	Shoot dry weight (g clump^{-1})	Grain dry weight (g clump^{-1})
Control	8.44 a	75.67 a	24.28 b	20.64 b
Shallot	9.78 a	84.22 a	42.89 a	31.10 a
Garlic	10.11 a	75.44 a	27.00 b	22.35 b
Onion	9.11 a	77.67 a	35.61 ab	16.83 b

Remarks: The number followed by the same character in a column is not significantly different based on DMRT at 5% significant level.

Table 2 explains that the Allium extract types could increase the shoot dry weight and be significantly different from the garlic extract, but was not significantly different from the onion extract. On the other hand, the shallot extract application could increase the grain dry weight clump^{-1} and be

significantly different from the garlic and onion extract. The effect of Allium extract types on the dry weight of the shoot and grain can be seen in Figure 2.

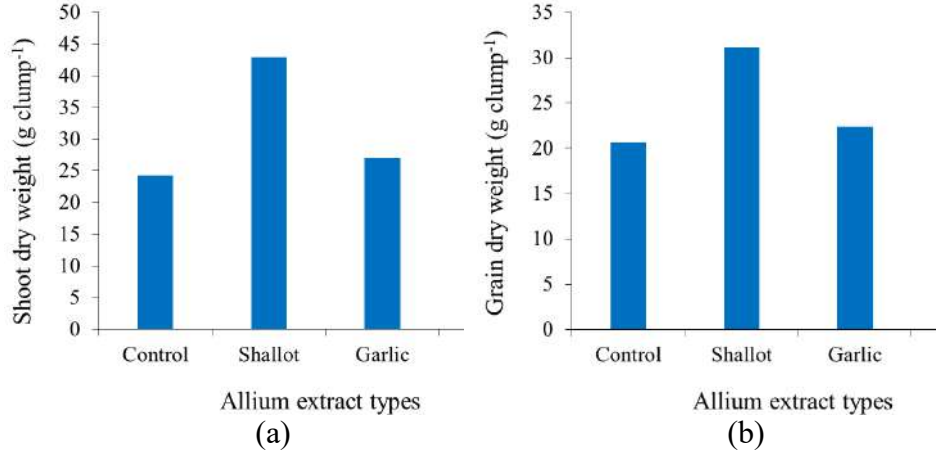

***Figure 2**. Application of Allium extract on shoot dry weight (a) and grain dry weight (b)*

Figure 2 explains that giving shallot extract could increase the shoot and grain dry weight of rice, while garlic and onion did not.

Discussion

Allium extract has a bad effect on rice seed germination. The application of shallot and garlic extract inhibits the growth of dry weight of seedlings. Shallot and garlic extract contained high phenolic compounds so can interfere with the initial of seedlings growth. Seed germination was sufficiently stimulated by the PGR contained in it. Seed germination did not require additional PGR from organic material.

The rate germination, power germination, and seedlings' height did not require the additional external phytohormones from shallot and garlic extract, but required onion extract. The addition of shallot extract and garlic did not increase the seedlings' height of rice. Conversely, onion extract can increase the vertical growth of rice seedlings. The application of Allium extract will increase the concentration of IAA in the rice seed and will inhibit it because the content becomes excessive. According to Lee et al. (2022), poor seed germination and inhibition of seedling growth due to excessive accumulation of IAA.

Shallot and garlic extract contained phytohormones, especially GA. GA compounds were considered negative regulators of innate immunity in rice crops (Yang et al., 2013). The GA content in rice seeds was enough to support their seed germination. The GA could diffuse into the aleurone layer and initiate signaling synthesizing amylase and other hydrolytic enzymes. Then, hydrolytic enzymes secreted into the endosperm and hydrolyzed food reserves. Next, the hydrolytic enzymes will hydrolyze starch, lipids, hemicellulose proteins,

polyphosphates, and other stored materials into simpler forms that are available to the embryo (Ali and Elozeiri, 2017).

Not all types of Allium extracts have a significant effect on rice growth and yield. Garlic and onion extracts were not effective for increasing the dry weight of shoot and grain, while shallot was effective. Adding external phytohormones to the soil media effectively optimized the shoot's dry weight. Besides, the shallot extract application could significantly increase the grain dry weight. The content of IAA in shallot could stimulate the growth of rice plants. According to Sopha and Hartanto (2021), shallot bulb tissue contained higher IAA concentrations than leaves and roots.

The IAA is a common auxin form that participates in plant growth and development. The sources of IAA can come from organic material. Shallot bulbs can produce natural hormones, namely IAA. The IAA played a role in stimulating plant growth, such as enlargement, elongation, cell division, affected nucleic acid metabolism, and plant metabolism (Pamungkas and Puspitasari, 2018). Auxin affected some aspects of the plant development (Wang et al., 2018). The use of IAA contained in Allium extract, especially in shallot has a good role in increasing plant growth.

The use of exogenous auxin in the right concentration increased the yield of dry matter in plants (Sosnowski et al., 2023). Therefore, the IAA of shallot can be used to stimulate the growth and yield of rice. However, the shallot extract has been shown to increase the shoot and grain dry weight of rice higher than garlic extract.

Based on the discussion above, it can be affirmed that Allium extract is better used to support plant growth of rice than in nurseries. Shallot bulb extract supports rice growth better than garlic and onion.

Conclusion

The research results and discussion above showed that the Allium extract did not significantly stimulate seed germination and seedlings' growth, except for seedlings' height. The shallot and garlic extracts inhibited the seedlings' dry weight. The shallot extract can stimulate to increase the shoot dry weight of rice. The application of shallot and garlic extract harms seed germination and seedlings' growth, except for onion extract. Application of shallot extract could cause the highest grain dry weight clump^{-1}. The study findings show that the shallot and garlic extract harms the seed germination and seedlings' growth, except for onion extract. However, the shallot extract is a type of Allium that can stimulate rice growth. Therefore, we recommend that the shallot extract application is better for stimulating growth in rice cultivation.

Acknowledgments. We thank the Institute for Research and Community Service, Universitas PGRI Yogyakarta, which has given permission and support for research funds. We would also like to thank the Faculty of Agriculture,

Universitas PGRI Yogyakarta, which has provided loans for facilities in the form of laboratories and equipment for research.

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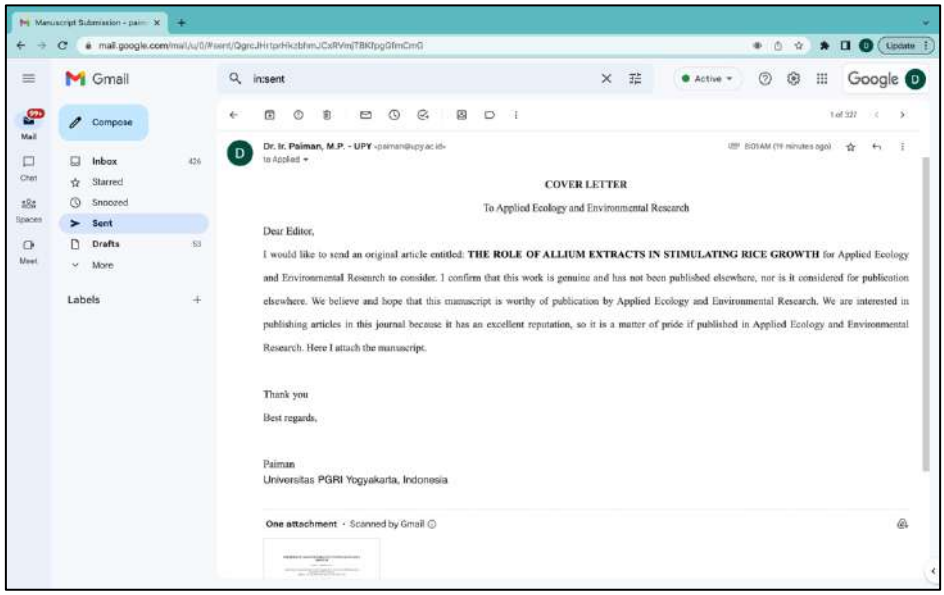
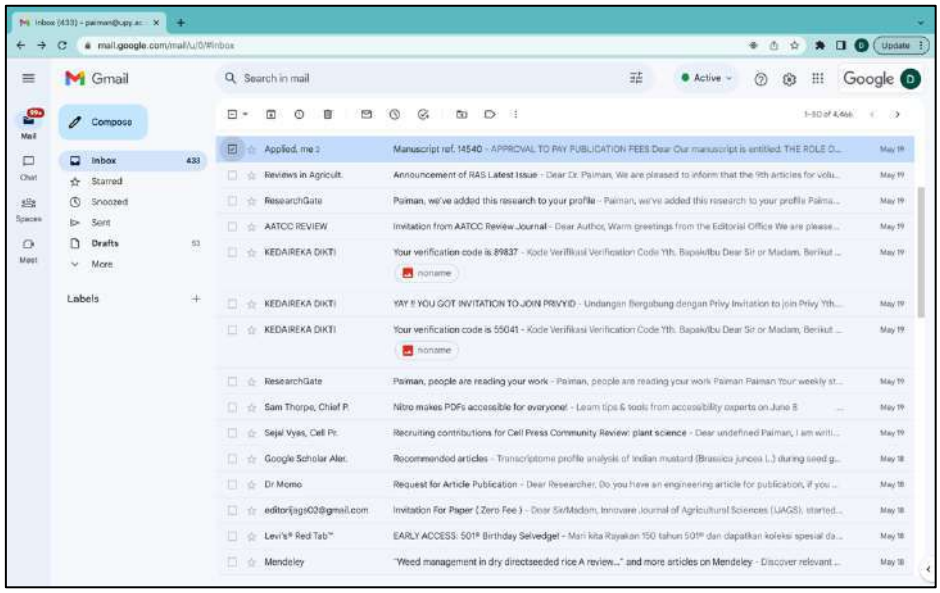
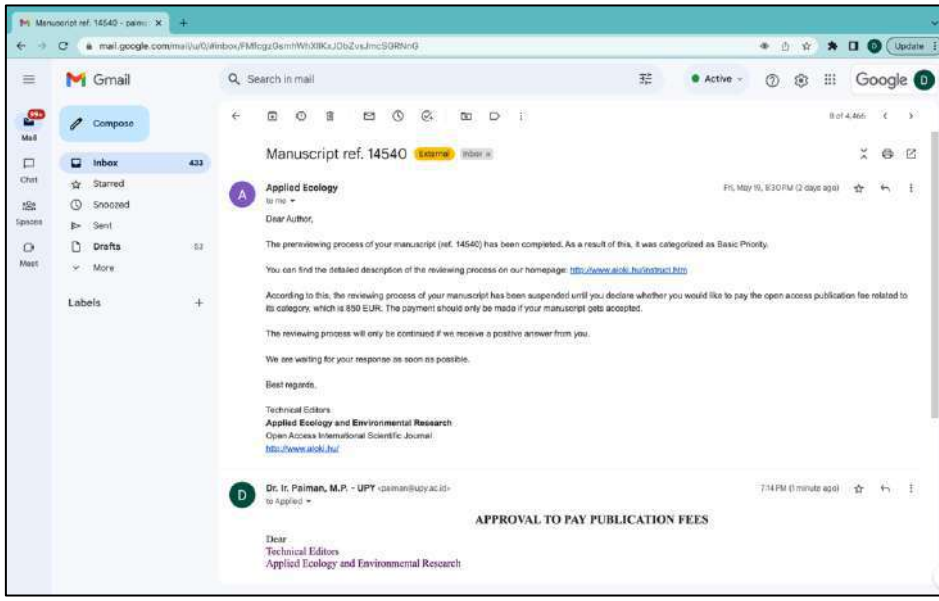
9.2.3. Proof of Manuscript Submission

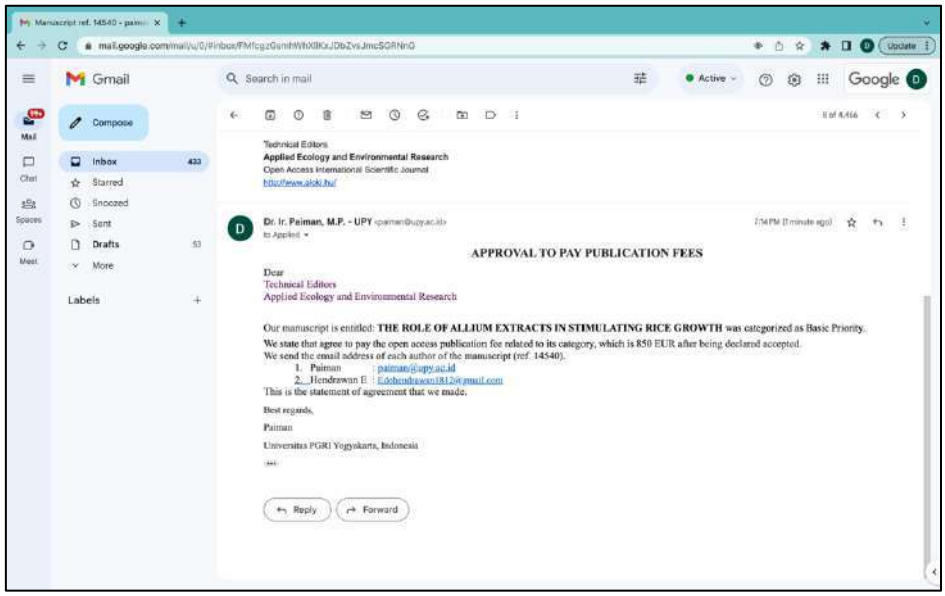


9.2.4. Reply from Journal AEER about publication fees (19 Mei 2023)





9.2.5. Reply Approval of publication fees to the journal



Technical Editors
Applied Ecology and Environmental Research
Open Access International Scientific Journal
http://www.aloki.hu/

Dr. Ir. Paiman, M.P. - UPY <paiman@upy.ac.id>
to Applied

APPROVAL TO PAY PUBLICATION FEES

Dear
Technical Editors
Applied Ecology and Environmental Research

Our manuscript is entitled: **THE ROLE OF ALLIUM EXTRACTS IN STIMULATING RICE GROWTH** was categorized as Basic Priority.
We state that agree to pay the open access publication fee related to its category, which is 850 EUR after being declared accepted.
We send the email address of each author of the manuscript (ref. 14540).

1. Paiman : paiman@upy.ac.id
2. Hendrawan E : Edohendrawan1812@gmail.com

This is the statement of agreement that we made.

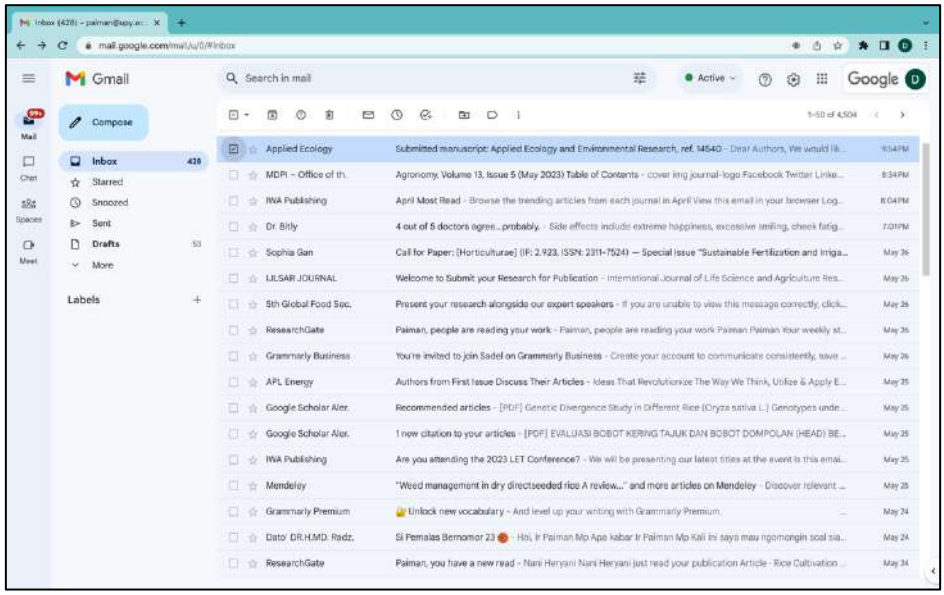
Best regards,

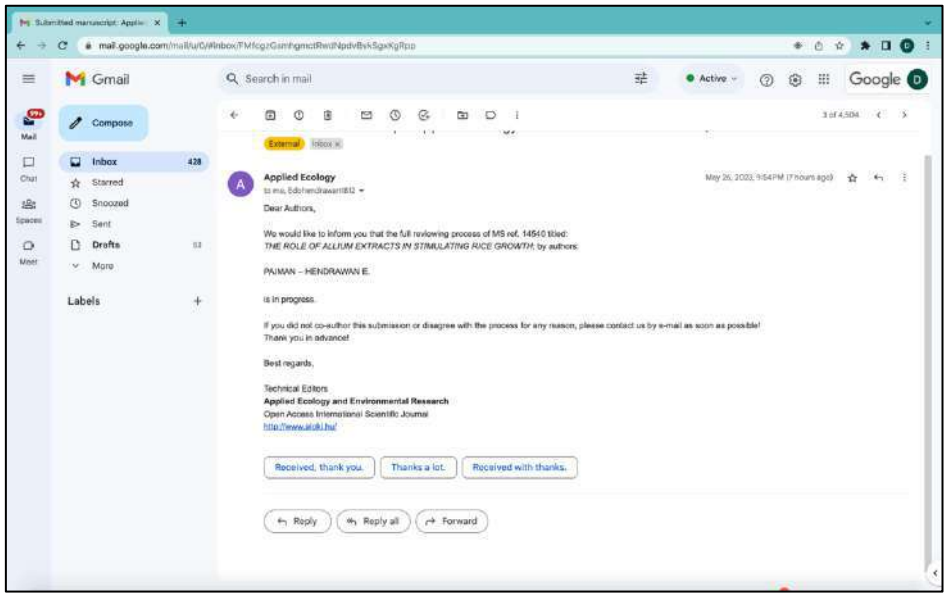
Paiman

Universitas PGRI Yogyakarta, Indonesia

Reply Forward

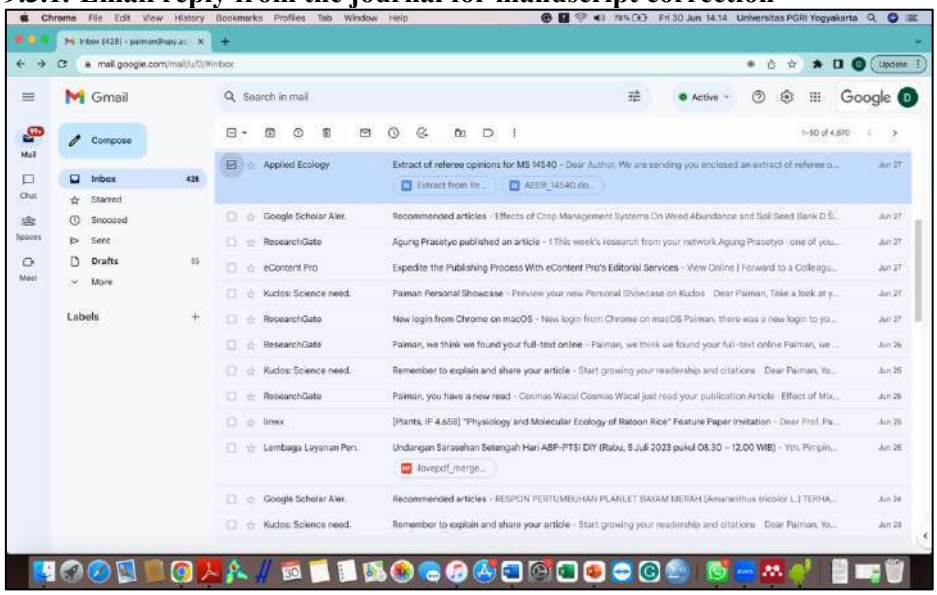
9.2.6. Reply from Journal that manuscript is in progress (27 Mei 2023)

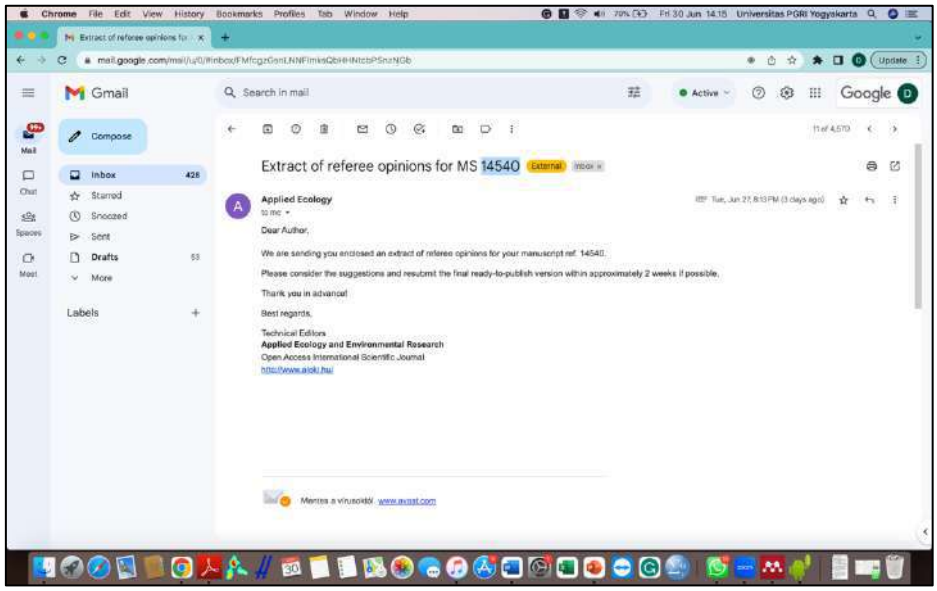


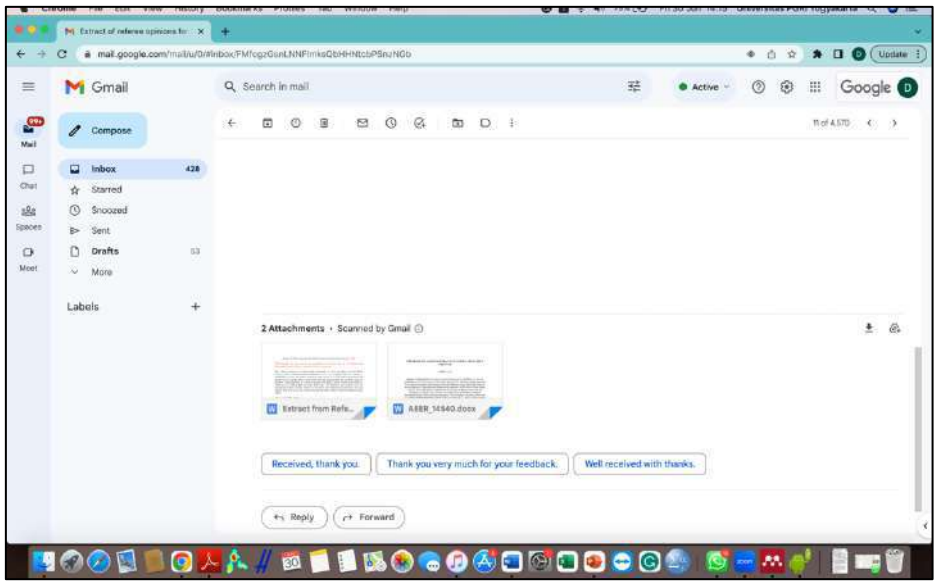


9.3. Manuscript Revision (June 27, 2023)

9.3.1. Email reply from the journal for manuscript correction







9.3.2. Comments to the Authors

Extract of referee opinions and editorial suggestions for manuscript ref. 14540
Unfortunately, this manuscript is not acceptable in its present form. A very detailed and documented major revision is suggested before resubmission.
The authors conducted two quite simple experiments in which the effects of some allium extracts on the germination and development of rice were evaluated. The base concept is problematic because the authors proposed using extract of a field

crop for promoting the growth of rice and the extracts were made from the main products but not from some by-products. Technologically it is hard to imagine that allium species would be harvested in fields just for making PGR for other field crops. The Materials and methods were not introduced in detail, and the numbers of biological and technological replications were not known. The discussion is not comparative and the authors refer to irrelevant literature many times.

Comments to the Authors from the referee:

1. Please take into consideration that national food self-sufficiency is a local problem but not a global one. The introduction presumed that the study could have local practical relevance.
2. The authors mentioned that synthetic PGRs and hormones are expensive, but efficiency would be the key factor in terms of applicability. The authors should involve some synthetic PGRs in the experiments and the effectiveness of the plant extracts should be evaluated in terms of the other products. It must be taken into consideration that onion cultivation is expensive and the extraction has some costs, therefore, it could be that the overall effectiveness of the synthetic hormones would be much better.
2. Please take care of writing the "gibberellic acid" correctly (line 30).
3. Adding a reference would be needed to confirm the following statement: "Using Allium extract at certain concentrations can increase rice production".
4. The units presented in the Introduction should be harmonized for better comparability.
5. The authors confirmed in the Introduction that there is high variability in the active ingredient content of the varieties. The applied shallot, garlic, and onion genotypes need to be mentioned.
6. The authors did not quantify the active ingredient content of the extracts, but without this information, the study is not repeatable. The concentration of the PGRs in the extracts must be known for appropriate interpretation of the results.
7. The authors tested only one dose of extract and one time the extract was added to the plants in the second experiment. Testing the extract along a concentration gradient would be favourable and treating the plants also during the vegetation would be interesting.
8. The fertilizer dose should be indicated for one-kilogram soil.
9. The plant growth conditions were not described as well as the climate during the germination experiments.
10. The number of plants in each box needs to be presented as well as the number of biological and technical repetitions within the treatments.
11. The extract has no positive impact on germination.

12. It is not evident what the difference was between the germination rate and germination power. The germination rate data are extraordinarily low.
13. The information content of Fig. 1 and Table 1 as well and Fig. 2 and Table 2 are overlapping.
14. The results presented between lines 210 and 214 were previously introduced.
15. In the Abstract and M&M chapter please also mention the country of study.
16. The English throughout needs revision and careful proofreading.
17. There should be a photo included of the experimental culture or equipment in the M&M chapter if possible.

Editorial suggestions for manuscript corrections:

The manuscript will need a very thorough revision. The style or grammar or both are incorrect in many cases. The mistakes involve the wrong usage of word order, verb form, style, and other minor misuses in various combinations.

Issues involved:

1. Line 8: “to find the one of best types” ‘one of the best types’ is the correct word order
2. Line 14: “did not significantly stimulate seed germination and seedlings' growth, except for seedlings' height.” it is a contradiction that it did not affect growth but affected height
3. Line 15: “inhibited the seedlings' dry weight” ‘decreased’ is more appropriate in this case than ‘inhibited’
4. Line 16: “The Allium extract types can stimulate to increase in the shoot dry weight clump^{-1}.”’to increase in the’ is not needed
5. Line 18: “except for onion extract” ‘but the onion extract does not’ is suggested to be used instead
6. Line 20: “We recommend that the shallot extract type is better for stimulating” ‘We recommend the shallot extract type for stimulating’
7. Line 24: “The rice plant produces rice as a staple food in the Indonesian population.” ‘which is a staple food for the Indonesian population”
8. Line 26: “Therefore, one attempt to stimulate plant growth regulators (PGR) through growth hormones.” a verb is missing from this sentence ‘an attempt has been made’ is suggested to be used
9. Line 26-27: “PGR in the form of natural can modify or control through physiological action, growth, and maturation of plants.” ‘PGR in its natural form can modify or control physiological actions, growth, and maturation of plants.’

10. Line 30: “alternatively, use natural PGR of the Allium extract.” ‘alternatively, natural PGR from Allium extracts is used.’
11. Line 34-35: “At the end of 10 years, the area dan production of rice has been declining as much as 1.8% and 1.6%, respectively “ this sentence should be clarified

9.4. Re-submission of Manuscript after Revised (June 30, 2023)

9.4.1. Cover Letter of Manuscript Revision

COVER LETTER OF MANUSCRIPT REVISION

To Applied Ecology and Environmental Research (AEER)

Dear Editors,

Thanks for the correction of the manuscript entitled “**THE ROLE OF ALLIUM EXTRACTS IN STIMULATING RICE GROWTH**”. We have improved the quality of English through the help of colleagues who work as proofread and the article has been carefully checked, including the usage of word order, verb form, and grammar or style. There are several changes and additional sentences in the manuscript according to the referee and editor’s suggestions. Herewith I attach the required files. A revised paper with the highlights addressed all issues and required corrections/changes.

Best Regards
Paiman
Universitas PGRI Yogyakarta, Indonesia

9.4.2. Respond to all issue

AN ITEMIZED RESPONSE SHEET

1. Respond to all issue/referee opinions/editor suggestions
2. All amendments made are highlighted in yellow on the revision paper.

Comments to the Authors from referee:	Addressed (Y/N)	Reply/Action taken
20. Please take into consideration that national food self-sufficiency is a local problem but not a global one. The introduction presumed that the study could have local practical relevance.	Y	Thanks for the suggestion. We have added the word 'in Indonesia' in the introduction so that it shows the local problem.

21. The authors mentioned that synthetic PGRs and hormones are expensive, but efficiency would be the key factor in terms of applicability. The authors should involve some synthetic PGRs in the experiments and the effectiveness of the plant extracts should be evaluated in terms of the other products. It must be taken into consideration that onion cultivation is expensive and the extraction has some costs, therefore, it could be that the overall effectiveness of the synthetic hormones would be much better.	Y	Thank you. The idea of using these natural PGRs came about when we saw that many shallot and garlic crops were abundant and unsalable. We want to utilize PGRs as natural substitutes synthetically. The referee's advice is very good. We will conduct further experiments using synthetic PGRs comparator.
22. Please take care of writing the "gibberellic acid" correctly (line 30).	Y	Thanks for the correction. The word gibberellin acid has been edited to "gibberellic acid"
23. Adding a reference would be needed to confirm the following statement: "Using Allium extract at certain concentrations can increase rice production"	Y	We've been trying to add information about specific concentrations that can increase rice production, but haven't found any. Using a concentration of 20%, we found in the seed germination of melon, the flower cuttings and buds of apples, legumes, *Ixora coccinea,* and *Arenga pinnata.*
24. The units presented in the Introduction should be harmonised for better comparability.	Y	Thank you, the units in the introduction have been harmonised.
25. The authors confirmed in the Introduction that there is high variability in the active ingredient content of the	Y	The content of the active ingredients of the Allium genotype is quite varied and

	varieties. The applied shallot, garlic and onion genotypes need to be mentioned.		has already been mentioned in the introduction.
26.	The authors did not quantify the active ingredient content of the extracts, but without this information, the study is not repeatable. The concentration of the PGRs in the extracts must be known for appropriate interpretation of the results.	Y	The authors only refer to the active ingredient content of Allium extract from the results of previous studies. For future research, researchers will measure the active ingredients of the extract themselves.
27.	The authors tested only one dose of extract and one time the extract was added to the plants in the second experiment. Testing the extract along a concentration gradient would be favourable and treating the plants also during the vegetation would be interesting.	Y	Thank you. The authors only used one concentration of Allium extract, which is 20% (the result of previous studies) at a dose of 2 mL per clump. The use of doses per hectare and the frequency of application of extracts during plant growth need to be further investigated.
28.	The fertilizer dose should be indicated for one-kilogram soil.	Y	We have added it to the manuscript: The dose of urea fertilizer and NPK Phonska is: 0.08 g for one-kilogram soil, respectively in research procedure section.
29.	The plant growth conditions were not described as well as the climate during the germination experiments.	Y	We add the temperature and humidity conditions of the greenhouse room to the study area: During the study showed the average air temperature and humidity were 33 ºC and 60%, respectively.
30.	The number of plants in each box needs to be presented as well as the number of biological and technical repetitions within the treatments.	Y	We have added suggestions in the experiment design section: In the first experiment, only one sample was used for each repetition so that a total of 12 plastic

		germination baths were needed. While in the second experiment, each repetition consisted of six samples so that in total 72 polybags were needed.
31. The extract has no positive impact on germination	Y	The three types of Allium extract have no effect on the rate and power of germination.
32. It is not evident what the difference was between the germination rate and germination power. The germination rate data are extraordinarily low.	Y	Differences in understanding: Germinated seeds are characterized by the rice buds have emerged to the surface of the soil up to 2 cm high. Germination rate is calculated from germinated seeds from the first observation day to the last day, and describes the vigor of seeds. The smaller the germination rate means the faster it germinates. Germination is calculated from the number of seeds that have germinated normally, and explains about seed viability. The greater the percentage that germinates means that the seeds are more viable.
33. The information content of Fig. 1 and Table 1 as well and Fig. 2 and Table 2 are overlapping.	Y	Thank you. We have corrected it to: *Figure 2a* and *2b* show that application of shallot extract gave higher shoot and grain dry weight of rice.
34. The results presented between lines 210 and 214 were previously introduced.	Y	Thanks for the correction. Explanations of Figures 1a and 1b are changed to: *Figure 1a* shows that application of onion extract was effectively stimulating the seedlings' height of rice. *Figure 1b* shows that applying shallot,

		garlic, and onion extract were not effectively stimulating the seedlings' dry weight of rice
35. In the Abstract and M&M chapter please also mention the country of study.	Y	Country where research has been added to the Abstract and M&M, namely: Indonesia.
36. The English throughout needs revision and careful proofreading.	Y	Thanks for the advice. We have corrected errors from pharaprase, verb tenses, and grammar.
37. There should be a photo included of the experimental culture or equipment in the M&M chapter if possible.		Photo of rice crops with Allium extract application at 105 DAP has been added in the M&M.
Issues involved (Editor suggestions)	**Addressed (Y/N)**	**Reply/Action taken**
12. Line 8: "to find the one of best types" 'one of the best types' is the correct word order.	Y	Thank you. In this study, we wanted to find one of the best types of Allium.
13. Line 14: "did not significantly stimulate seed germination and seedlings' growth, except for seedlings' height." it is a contradiction that it did not affect growth but affected height the first time.	Y	We correct the sentence to: 'significantly affected on seedlings' growth, especially for seedlings' height in the fist time'
14. Line 15: "inhibited the seedlings' dry weight" 'decreased' is more appropriate in this case than 'inhibited'.	Y	Thanks for the advice. We replace the word 'inhibited' with 'decreased'
15. Line 16: "The Allium extract types can stimulate to increase in the shoot dry weight clump-1."'to increase in the' is not needed	Y	We have removed the word 'to increase in the'.
16. Line 18: "except for onion extract" 'but the onion	Y	Thank you. We replace with sentences 'but the onion extract does not'

extract does not' is suggested to be used instead.		
17. Line 20: "we recommend that the shallot extract type is better for stimulating" 'we recommend the shallot extract type for stimulating'.	Y	Thank you. We replace with sentences 'we recommend the shallot extract type for stimulating'
18. Line 24: "The rice plant produces rice as a staple food in the Indonesian population." 'which is a staple food for the Indonesian population'	Y	Thank you. The word 'as', we changed to 'which is'
19. Line 26: "Therefore, one attempt to stimulate plant growth regulators (PGR) through growth hormones." a verb is missing from this sentence 'an attempt has been made' is suggested to be used	Y	Thank you. The word 'one attempt', we changed to 'an attempt has been made'
20. Line 26-27: "PGR in the form of natural can modify or control through physiological action, growth, and maturation of plants." 'PGR in its natural form can modify or control physiological actions, growth, and maturation of plants.	Y	Thank you. Word of 'in the form of natural' repalced with 'their natural form'
21. Line 30: "alternatively, use natural PGR of the Allium extract." 'alternatively, natural PGR from Allium extracts is used.'	Y	Thank you. 'alternatively, use natural PGR of the Allium extract, We change it to: alternatively, natural PGR from Allium extracts is used
22. Line 34-35: "At the end of 10 years, the area dan production of rice has been declining as much as 1.8% and 1.6%, respectively "this sentence should be clarified	Y	Thank. In sentence, we change to 'Within the last 10 years (2010-2019)'.

9.4.3. Manuscript after revision

THE ROLE OF ALLIUM EXTRACTS IN STIMULATING RICE GROWTH

AEER_14540

Abstract. **In Indonesia,** the demand for rice always increases from year to year. However, rice production in 2021 decreased by 0.45% more than in 2020. Therefore, production needs to be improved again to meet national food self-sufficiency. One of the innovations to increase growth is utilizing natural plant growth regulators (PGRs) derived from Allium extracts. This study aimed to find one of the best types of Allium extract that can stimulate rice growth. The experimental area was conducted in the greenhouse, Faculty of Agriculture, Universitas PGRI Yogyakarta, Bantul Regency, Yogyakarta Special Region, Indonesia. The research was a single factor arranged in a complete randomized design (CRD) and three replications. The treatments consisted of four types i.e., control (without treatment), shallot (*Allium ascalonicum* L.), garlic (*Allium sativum* L.), and onion (*Allium cepa* L.). Each type of Allium extract used a concentration of 20%. The research results showed that the Allium extract types significantly affected seedlings' growth, especially for seedlings' height for the first time. The shallot and garlic extracts decreased the seedlings' dry weight. The Allium extract types can stimulate shoot dry weight clump^{-1}. Application of shallot extract could cause the highest grain dry weight clump^{-1}. The study findings show that the shallot and garlic extract harms the seed germination and seedlings' growth, but the onion extract does not. However, the shallot extract is a type of Allium that can stimulate rice growth. Therefore, we recommend the shallot extract type for stimulating growth in rice cultivation.

Keywords: Allium extract, rice, shallot, garlic, onion, phytohormone

Introduction

The rice plant produces rice which is a staple food in the Indonesian population. Optimal rice growth can support maximum yields. Therefore, an attempt has been made to stimulate plant growth regulators (PGRs) through growth hormones. PGRs in their natural form can modify or control through physiological action, growth, and maturation of plants. The PGR produced in the plant is called plant hormone or phytohormone.

However, synthetic hormones are very expensive; alternatively, natural PGR from Allium extracts is used. Allium bulbs contain auxins (IAA), gibberellic acid (GA), and cytokinins. IAA and GA hormones can play a role in stimulating rice growth. However, it is not yet known what type of Allium extracts can be used to stimulate rice growth.

In Indonesia, the demand for rice has increased from year to year. However, rice production in 2021 decreased by 0.45% more than in 2020 (BPS, 2021). Within the last 10 years (2010-2019), the area dan production of rice has been declining as much as 1.8% and 1.6%, respectively (Pudjiastuti et al., 2021). Rice production can be increased again to maintain national food security. Therefore, it is necessary to have a solution. Using Allium extract at certain concentrations can increase rice production.

During this time, a rice intensification system has been implemented to obtain higher production, optimal use of labor and capital, input costs, and the need for less water (Toungos, 2018). In addition, rice production in Indonesia has been carried out through five farming programs, i.e., superior seed selection, good tillage, proper fertilization, pest and plant disease control, and good irrigation.

PGRs are a natural and synthetic compound form that can modify or control plants through the action of physiological growth and maturation. Phytohormones are produced as compounds in the plant's body (Ogunyale et al., 2014). It is needed in small amounts but can majorly affect growth and production. For example, IAA, GA, and zeatin (cytokinin) are growth-promoting hormones, while abscisic acid (ABA), ethylene, and phenolic compounds as growth-inhibiting hormones (Agustina et al., 2010). These phytohormones are capable of being produced by plants. One of the family is from the Alliaceae (Wen et al., 2021). The following literature review will be discussed in more detail three types of Allium extract, i.e., shallot, garlic, and onion. The three types are most likely to contain phytohormones.

Shallot bulbs (*Allium ascalonicum* L.) contained PGR, i.e., IAA and cytokinins. However, an excessive concentration of shallot extract will inhibit plant growth. The IAA is a hormone that can affect plant growth: height growth, leaves number, chlorophyll content, root gain, and stem diameter of *Arenga pinnata* (Patma et al., 2013). In addition, shallot contains the hormones of IAA and GA, so shallot extract can help seed germination and growth of roots and shoots of *Ixora coccinea* (Salsabila et al., 2021).

The highest concentration of IAA in shallots was found in bulbs (5.376 mg kg^{-1}), decreased in roots (3.314 mg kg^{-1}), and lowest in leaves (1.006 mg kg^{-1}). The results showed that the IAA content was the highest in shallot var. Bima (6.014 mg kg^{-1}) than var. Maja, Mentes, Pancasona, and Trisula (Sopha and Hartanto, 2021). A concentration of 20% shallot extract most effectively increased the live cuttings percentage, but a concentration of 10% significantly affected the leaves number in *Mucuna bracteata* D.C (Prameswari and Pratomo, 2021). Shallots contain GA_3, IAA, ABA, and zeatin (Dahab et al., 2018), and are effective for increasing germination, fresh weight, and dry weight of melon plants. In addition, shallot extract has the potential to be a source of organic hormones (Yunindanova et al., 2018).

The phytohormone content in garlic (*Allium sativum* L.) was higher than shallot, i.e., GA_3 (2.719 mg 100 g^{-1}), IAA (0.0312 mg 100 g^{-1}), ABA (0.3138 mg 100 g^{-1}), and zeatin (0.0149 mg 100 g^{-1}) (Dahab et al., 2018). Garlic extract

contained enzymes and more than 200 other chemical compounds. The garlic extract contained thiosulfate (307.66 ± 0.043 µM/g), flavonoids (64.33 ± 7.69 µg QE/g), and polyphenols (0.95 ± 0.011 mg GAE/g) as major compounds (Corbu et al., 2021). Garlic contained vitamins, minerals, flavonoids, ascorbic acid, sulfur, iodine, and some amino acids. Sulfur had an important role in the fruiting process of various fruit crops (Al-hadethi et al., 2016).

Garlic contains a high level of phenolic compounds (Griffiths et al., 2002). Flavonoids are the main phenolic in garlic bulbs. It can be classified into various sub-classes: flavones, flavanones, flavonols, isoflavones, flavanonols, flavonols, flavanols, chalcones, and anthocyanins (Perez-Gregorio et al., 2010). The application of garlic extract could result in a marked reduction in nodulation in the roots, plant height, leaf area, and root development of arrears (*Vigna unguiculata*) and peanuts (*Arachis hypogea*) than the control (Adeleke, 2019).

Many organosulfur compounds are found in onions (*Allium cepa* L.). Diallyl sulfide, diallyl monosulfide, disulfide, trisulfide, and tetrasulfide are the main onion compounds. Onions are considered an excellent source of flavonoids from the polyphenol family. Flavonols are a sub-class of flavonoids (Pareek et al., 2017). Red and yellow cultivar onions contain polyphenols in the form of gallic acid, ferulic acid, and quercetin. The research results showed that red-cultivar onions were better antioxidant activity than yellow cultivars. Higher polyphenol and flavonoid content was also associated with higher antioxidant activity (Cheng et al., 2013).

Onions contain vitamins (A, B_1, B_2, C, nicotinic acid, and pantothenic acid). The essential substances are protein, calcium, phosphorus, potassium, Fe, Al, Cu, Zn, Mn, and I. In addition, onions contain phenolic compounds, namely, phenolic acids and flavonoids that can act as natural antioxidants, anti-carcinogens, and anti-microbial agents (Akbudak et al., 2018). The research results showed that yellow cultivars accumulated N, P, K, Mg, Fe, Mn, Zn, Cu, and reducing sugars in much larger quantities than red cultivars. Red cultivars contained much more significant amounts of sugar and vitamin C than yellow cultivars (Jurgiel-Malecka et al., 2015). Therefore, a concentration of 20% onion extract can be recommended to stimulate early flowering with a higher percentage. There was an improvement in the quality of higher yields by regulating the metabolism of amino acids, including proline and indole, and the activity of catalase and hydrogen peroxide in apple flower buds (El-yazal and Rady, 2014).

Based on the literature review previous studies have shown that shallot and garlic extract contained growth-promoting hormones (IAA, GA, and cytokinin) and inhibitors (ABA) of plants, as well as phenolic compounds. The application of shallot and garlic extract at a concentration of 20% positively affected the seed germination of melon, the flower cuttings, and the buds of apples and legumes. However, there was not enough information about the effect of Allium extract on the growth and yield of rice. Study in the application of shallot, garlic, and onion extracts has never been tried on seed germination, growth, and yield of rice. Not yet known type of Allium extract that can increase the growth and yield of rice.

Therefore, it is necessary to research the application of Allium extract in rice cultivation. Therefore, this study aimed to find the one of best types of Allium extract that can stimulate rice growth.

Materials and methods

Study area

The study was conducted from December 2021 to April 2022. The experimental area was conducted in the greenhouse, Faculty of Agriculture, Universitas PGRI Yogyakarta, Bantul Regency, Yogyakarta Special Region, Indonesia. The height of the study site was 118 m above sea level (m ASL) and located at the 8°30'-7°20' South latitude and 109°40'-111°0' East longitude. The study showed the average air temperature and humidity were 33 ºC and 60%, respectively

Materials and Tools

The materials used were wooden box germination of 50 cm (width) × 80 cm (length) × 20 cm (height), latosol soil, cow manure, urea, and NPK Phonska, polybags in size of 40 cm (width) × 35 cm (height), paper, mica plastic labels, bamboo sticks of 50 cm (height), rice seed variety of Padjajaran Agritan, plastic tub germination with a size of 30 cm (length) × 25 cm (width) × 5 cm (height), water, shallot, garlic, and onion. The equipment used were a hoe, sickle, ruler, Philips Blender HR2115/01, filter paper, soil sieve of 2 × 2 cm, pipette volume of 10 mL, plastic bottle volume of 1 L, Erlenmeyer pyrex volume of 500 mL, oven Binder drying oven ED series, ACIS AD-i Series digital analytical balance, manual scales capacity of 30 kg, and grain moisture tester JV-001S.

Experimental design

This study was carried out in two stages of experiments. The first was about seed germination and seedling growth of rice, and the second was about rice growth and yield. The study was a single factor arranged in a complete randomized design (CRD) and three replications. The treatments consisted of four types, i.e., control (without treatment), shallot (*Allium ascalonicum* L.), garlic (*Allium sativum* L.), and onion (*Allium cepa* L.). Each type of Allium extract used a concentration of 20%. In the first experiment, only one sample was used for each repetition so a total of 12 plastic germination baths were needed. While in the second experiment, each test consisted of six samples so in total 72 polybags were needed.

Research procedures

Processing steps of Allium extract at 20% concentration were followed. First, the bulbs' fresh weight of 100 g was put in a blender, and 200 mL of water was

added for extraction. Next, the shallot extract was fed into the Erlenmeyer tube for a centrifuge for 10 minutes at a speed of 500 rpm. The resulting shallot extract was poured into a measuring cup and added the water up to a volume of 500 mL. After that, the extract was filtered with filter paper. The liquid that escaped from the sieve was used as a phytohormone. Next, the liquid of the solution was fermented for seven days in plastic bottles.

Latosol soil as a planting medium was taken from the top-soil layer at a depth of 0-20 cm. The soil was dredged, then crushed with a hoe to a uniform grain, and filtered with a soil sieve. In the first experiment, the seed germination test required 36 plastic tubs. Each germination plastic tub was filled with 1 kg of soil, and the soil surface was flat. For the second experiment, 90 polybags were needed, each filled with 10 kg of soil. Polybags were placed on a table located inside the greenhouse building. The Padjajaran Agritan variety was used in this study.

The first experiment was done by randomizing all germination plastic tubs filled with soil. Randomization was carried out at once against the all of treatments. Next, the treatment label used paper affixed to the outer wall of the germination plastic tub. Randomization was carried out in the second experiment on all polybags with the same method. Next, the treatment label used mica plastic with the help of bamboo sticks. Bamboo sticks were plugged into the center planting medium on the germination plastic tub.

The first experiment was carried out by scattering as many as 20 rice seeds per germination plastic tubs in above the soil surface in water-saturated conditions. In total, 240 rice seeds are needed. However, the preparation of the second experiment was carried out on wooden box germination and filled with a mixture of soil and manure in a ratio of 1:1. As many as 216 rice seeds were stocked over the soil medium in water-saturated conditions. Seedlings ready were planted into polybags at the age of 18 days after sowing (DAS). Rice seedlings as planting material are selected that have uniform growth.

For the first experiment, the application of Allium extract was as much as 2 mL per germination plastic tub evenly above the soil surface suitable for the treatment. Each treatment was given simultaneously when stocking seeds. Likewise, for the second experiment, the treatment of Allium extract, as much as 2 mL polybag^{-1} evenly above the soil surface, was carried out simultaneously at the time of planting. The plant spacing between seedlings in polybags was 25 × 25 cm. A rice seedling was planted in the middle of the soil surface inside the polybag. Seedlings were planted at a depth of 2 cm. Each polybag only was planted one seedling, so the overall need was as many as 72 rice seedlings.

The water availability in the first experiment was kept in field capacity until ten days after planting (DAP). However, in the second experiment, water was always maintained at 2 cm from the soil surface daily at 1-105 DAP. The recommended dose of fertilizer was 225 kg ha-1 (or 0.08 g for one-kg soil) urea and 225 kg ha-1 (or 0.08 g for one-kg soil) NPK Phonska 15-15-15 for rice cultivation. Fertilization was carried out in two stages. The first application was

40% of the recommended dose at 14 DAP. The second application was as much as 60% of the recommended dose at the age of 35 DAP. Weed control was carried out twice during the study. Pest control was carried out twice during flowering using Dursban pesticides. Rice harvesting was carried out at 105 DAP when the grains matured physiologically (95% turned yellow).

The experiment culture of rice crops with Allium extract application at 105 DAP can be seen in *Figure 1*.

***Figure 1**. Photo of rice crops with Allium extract application at 105 DAP*

Measurement and Parameter

For the first experiment, the rate and power of germination were observed from the 1st to the 10th day, while the seedling's height and dry weight were observed at 10 DAS. Germinated seeds are counted and measured if shoots have appeared 2 cm above ground level in a germination plastic tub. The seedlings' height is calculated from the average of all seedlings that have grown, while the seedlings' dry weight is calculated from all seedlings that have grown per germination plastic tub. For the second experiment, plant growth was observed at 80 DAP, including the tillers number and plant height, while shoot and grain dry weight was observed at 105 DAP. Measurement of rice growth and yield is carried out on all samples in each repeat, then the average per clump is calculated. Seedlings and shoot dry weight were dried in an oven for 48 hours at 80°C or until the dry weight was constant. Grain dry weight was measured using the digital analytical balance after drying under sunlight until it reaches a seed moisture content of 14%.

Statistical analysis

Observational data were analyzed by analysis of variance at the 5% significance level. To determine the difference between treatments, Duncan's new multiple distance test (DMRT) was used at 5% significance level (Gomez and Gomez, 1984).

Results

Effect of Allium Extract Types on the Seed Germination and Seedling Growth

The research results in the first experiment showed that Allium extract types did not significantly affect the rate and power of germination. Still, it affected the seedlings' height and dry weight. The results of multiple comparisons with DMRT at a 5% significance level on seed germination and seedlings' growth can be seen in *Table 1*.

Table 1*. Effect of Allium extracts types on the seed germination and seedlings' growth at 10 DAS*

Allium extract type	Germination rate	Germination power (%)	Seedlings' height (cm)	Seedlings' dry weight (g per germination plastic tub)
Control	3.19 a	98.33 a	4.00 b	0.54 a
Shallot	2.96 a	91.67 a	4.00 b	0.44 b
Garlic	2.93 a	90.00 a	4.33 b	0.47 b
Onion	3.32 a	98.33 a	5.00 a	0.56 a

Remarks: The number followed by the same character in a column is not significantly different based on DMRT at 5% significant level.

Table 1 explains that the Allium extract types did not significantly affect the rate and power of germination. However, the onion extract application could increase the seedlings' height and greatly differ from shallot and garlic extracts or control. The treatment of shallot and garlic extracts caused the seedlings' dry weight to be lower than the control and onion. Shallot and garlic extracts application inhibited the seedlings' growth of rice. For more details, the effect of Allium extract types on the height and dry weight of seedlings can be seen in *Figure 1*.

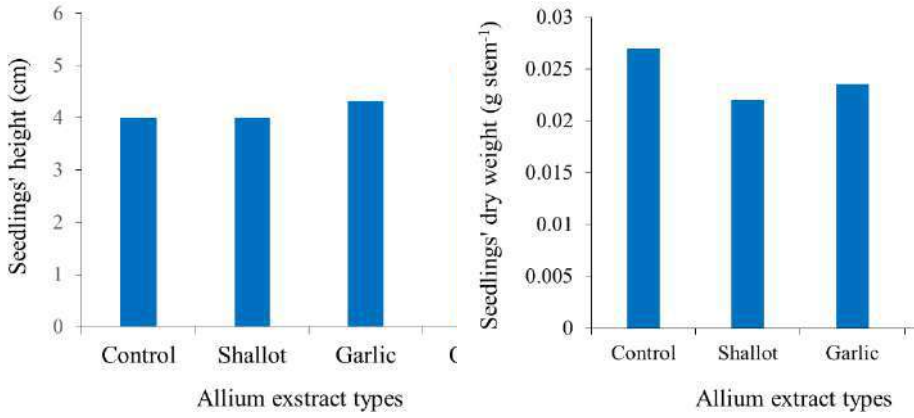


***Figure 2**. Application of Allium extract on the seedlings' height (a) and seedlings' dry weight (b)*

Figure 2a explains that the application of onion extract was effectively stimulating the seedlings' height of rice. *Figure bb* shows that applying shallot, garlic, and onion extract was not effectively stimulating the seedlings' dry weight of rice.

Effect of Allium Extract Types on the Growth and Yield of Rice

The research results in the second experiment showed that the type of Allium extract did not significantly affect the tiller's number and plant height, but it affected the shoot and grain dry weight. The results of multiple comparisons with DMRT at a 5% significance level on the growth and yield of rice can be seen in *Table 2*.

***Table 2**. Effect of Allium extracts types on the growth and yield of rice*

Allium extract type	Tillers number (stem clump^{-1})	Plant height (cm)	Shoot dry weight (g clump^{-1})	Grain dry weight (g clump^{-1})
Control	8.44 a	75.67 a	24.28 b	20.64 b
Shallot	9.78 a	84.22 a	42.89 a	31.10 a
Garlic	10.11 a	75.44 a	27.00 b	22.35 b
Onion	9.11 a	77.67 a	35.61 ab	16.83 b

Remarks: The number followed by the same character in a column is not significantly different based on DMRT at 5% significant level.

Table 2 explains that the Allium extract types could increase the shoot dry weight and be significantly different from the garlic extract, but was not significantly different from the onion extract. On the other hand, the shallot

extract application could increase the grain dry weight clump^{-1} and be significantly different from the garlic and onion extract. The effect of Allium extract types on the dry weight of the shoot and grain can be seen in *Figure 3*.

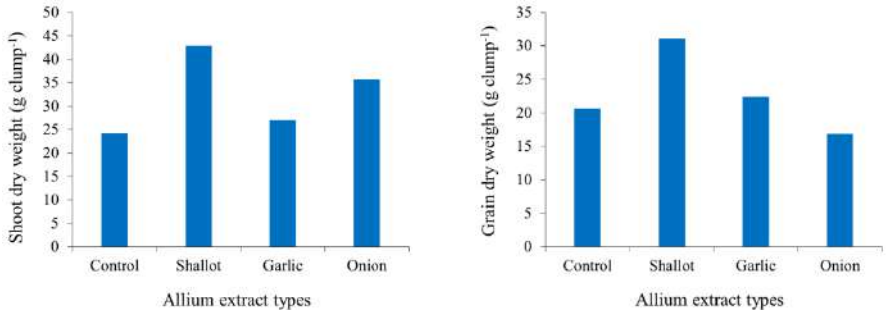


Figure 3. *Application of Allium extract on shoot dry weight (a) and grain dry weight (b)*

Figures 3a and *3b* explain that the application of shallot extract gave higher shoot and grain dry weight of rice.

Discussion

Allium extracts have a bad effect on rice seed germination. The application of shallot and garlic extract inhibits the growth of dry weight of seedlings. Shallot and garlic extract contained high phenolic compounds so can interfere with the initial of seedlings growth. Seed germination was sufficiently stimulated by the PGRs contained in it. Seed germination did not require additional PGRs from organic material.

The rate germination, power germination, and seedlings' height did not require the additional external phytohormones from shallot and garlic extract, but required onion extract. The addition of shallot extract and garlic did not increase the seedlings' height of rice. Conversely, onion extract can increase the vertical growth of rice seedlings. The application of Allium extract will increase the concentration of IAA in the rice seed and will inhibit it because the content becomes excessive. According to Lee et al. (2022), poor seed germination and inhibition of seedling growth due to excessive accumulation of IAA.

Shallot and garlic extract contained phytohormones, especially GA. The GA compounds were considered negative regulators of innate immunity in rice crops (Yang et al., 2013). The GA content in rice seeds was enough to support their seed germination. The GA could diffuse into the aleurone layer and initiate signaling synthesizing amylase and other hydrolytic enzymes. Then, hydrolytic enzymes secreted into the endosperm and hydrolyzed food reserves. Next, the hydrolytic enzymes will hydrolyze starch, lipids, hemicellulose proteins,

polyphosphates, and other stored materials into simpler forms that are available to the embryo (Ali and Elozeiri, 2017).

Not all types of Allium extracts have a significant effect on rice growth and yield. Garlic and onion extracts were not effective for increasing the dry weight of shoot and grain, while shallot was effective. Adding external phytohormones to the soil media effectively optimized the shoot's dry weight. Besides, the shallot extract application could significantly increase the grain dry weight. The content of IAA in shallot could stimulate the growth of rice plants. According to Sopha and Hartanto (2021), shallot bulb tissue contained higher IAA concentrations than leaves and roots.

The IAA is a common auxin form that participates in plant growth and development. The sources of IAA can come from organic material. Shallot bulbs can produce natural hormones, namely IAA. The IAA played a role in stimulating plant growth, such as enlargement, elongation, cell division, affected nucleic acid metabolism, and plant metabolism (Pamungkas and Puspitasari, 2018). Auxin affected some aspects of the plant development (Wang et al., 2018). The use of IAA contained in Allium extract, especially in shallot has a good role in increasing plant growth.

The use of exogenous auxin in the right concentration increased the yield of dry matter in plants (Sosnowski et al., 2023). Therefore, the IAA of shallot can be used to stimulate the growth and yield of rice. However, the shallot extract has been shown to increase rice's shoot and grain dry weight higher than garlic extract.

Based on the discussion above, it can be affirmed that Allium extract is better used to support plant growth of rice than in nurseries. Shallot bulb extract supports rice growth better than garlic and onion.

Conclusion

The research results and discussion above showed that the significantly affected seedlings' growth, especially for seedlings' height the first time. The shallot and garlic extracts decreased the seedlings' dry weight. The shallot extract can stimulate to increase the shoot dry weight of rice. The application of shallot and garlic extract harms seed germination and seedlings' growth, except for onion extract. Application of shallot extract could cause the highest grain dry weight clump^{-1}. The study findings show that the shallot and garlic extract harms the seed germination and seedlings' growth, but the onion extract does not. However, the shallot extract is a type of Allium that can stimulate rice growth. Therefore, we recommend the shallot extract type for stimulating growth in rice cultivation.

Acknowledgments**. We thank the –**

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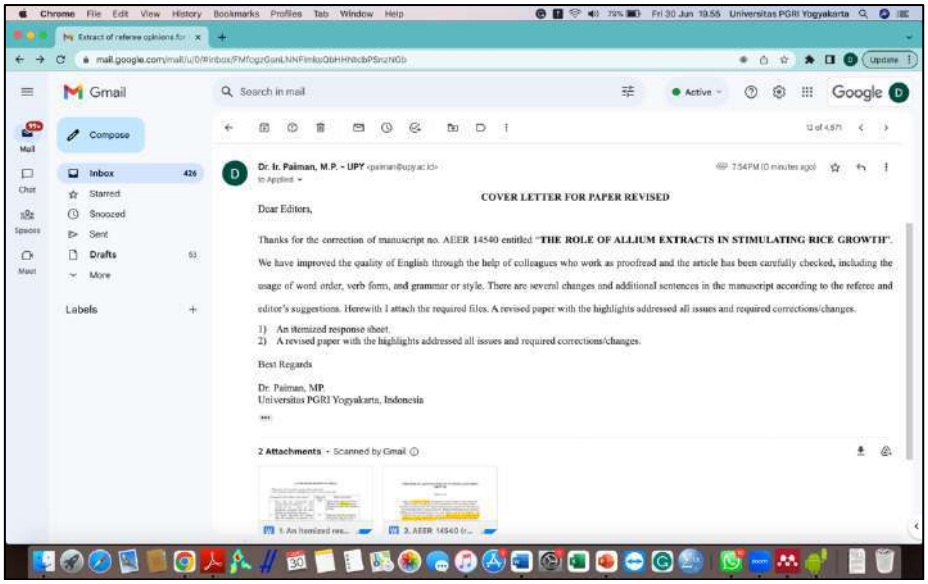

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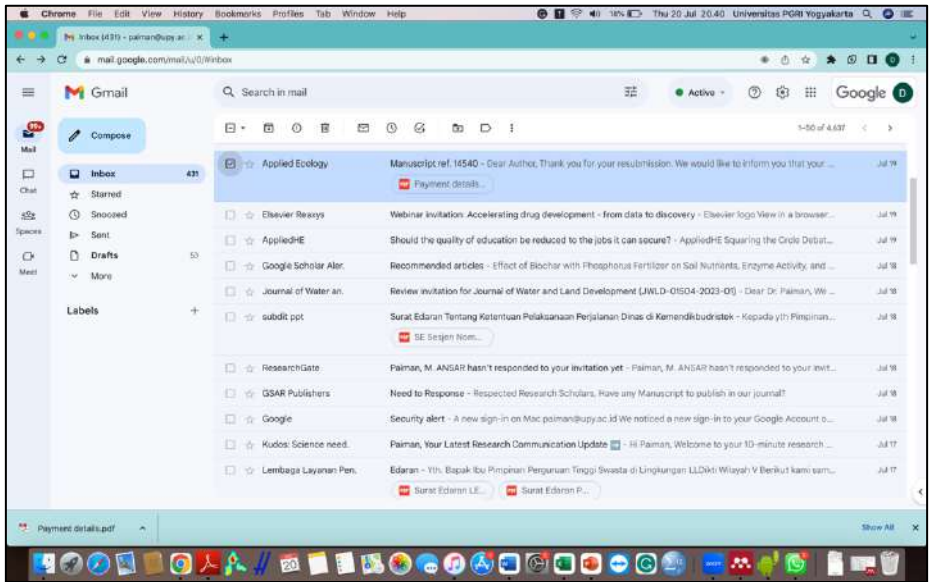
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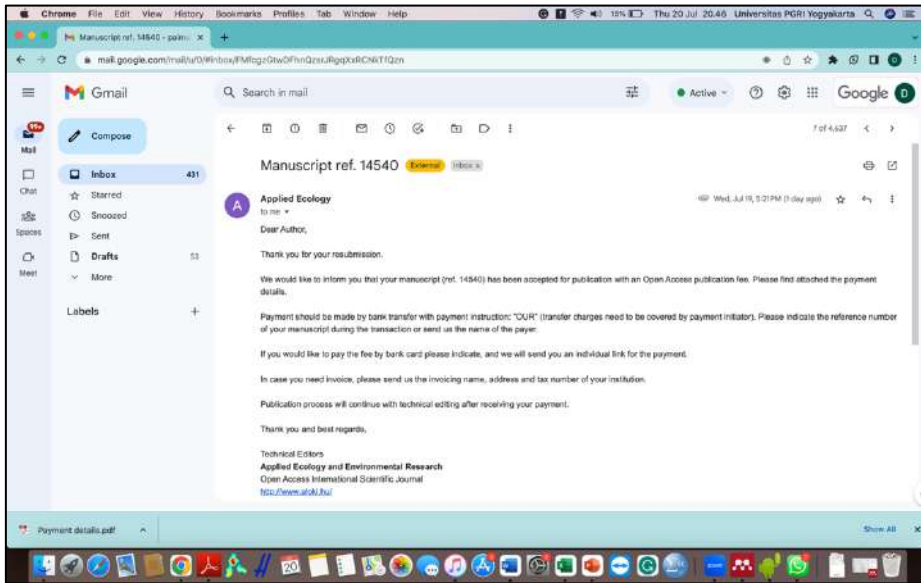
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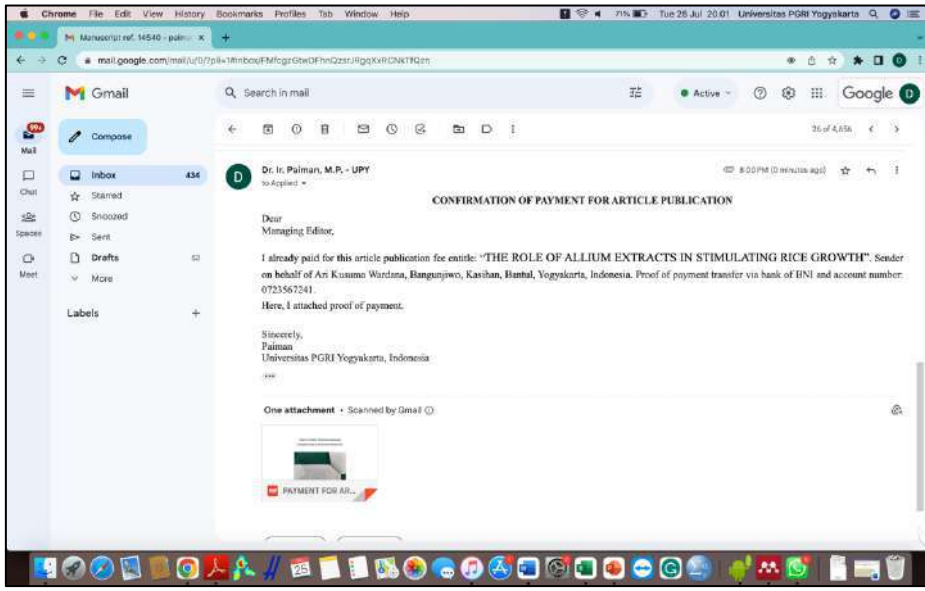

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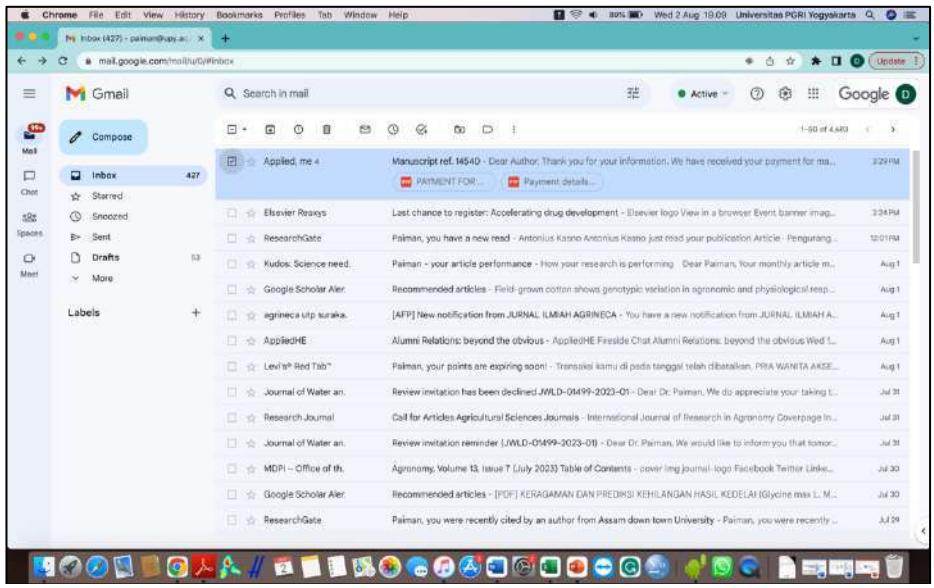

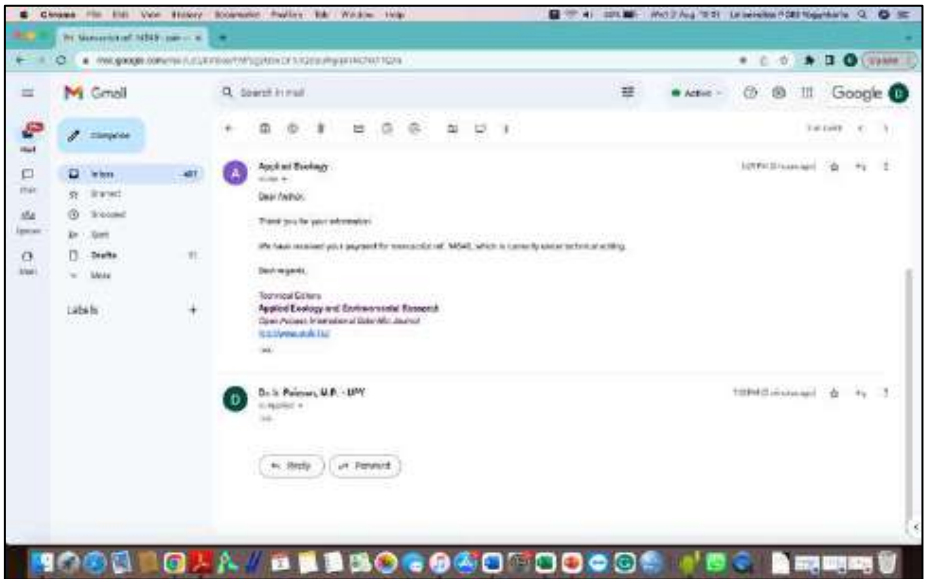

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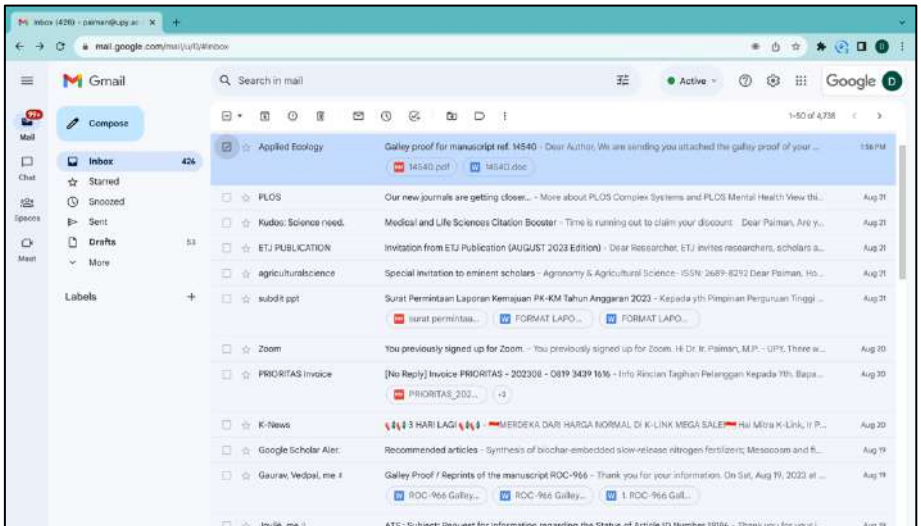

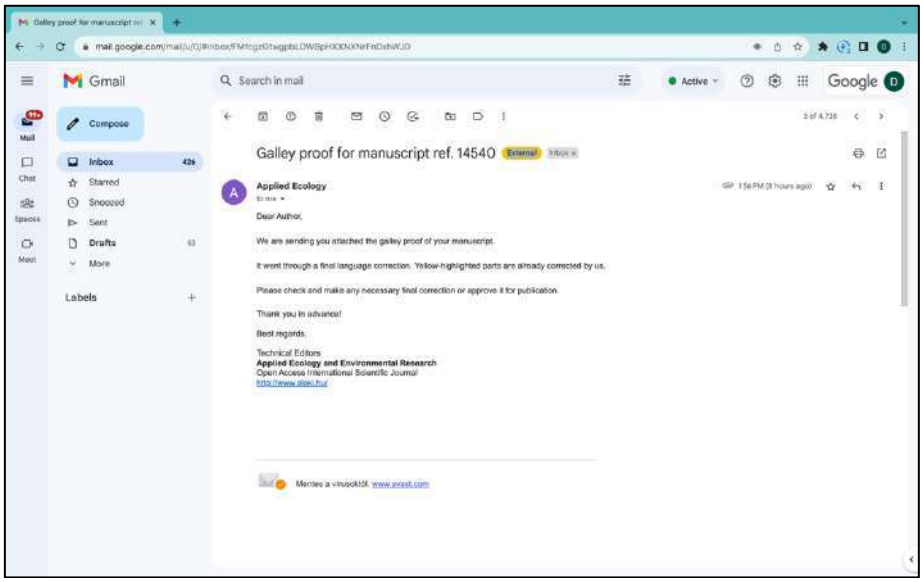

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THE ROLE OF ALLIUM EXTRACTS IN STIMULATING RICE GROWTH

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Abstract. In Indonesia, the demand for rice always increases from year to year. However, the rice production in 2021 decreased by 0.45% more than in 2020. Therefore, production needs to be improved again to meet national food self-sufficiency. One of the innovations to increase growth is utilizing natural plant growth regulators (PGRs) derived from Allium extracts. This study aimed to find one of the best types of Allium extract that can stimulate rice growth. The study area was conducted in the greenhouse, Faculty of Agriculture, Universitas PGRI Yogyakarta, Bantul Regency, Yogyakarta Special Region, Indonesia. The

research was a single factor arranged in a complete randomized design (CRD) and three replications. The treatments involved four allium species i.e., control (without treatment), shallot (*Allium ascalonicum* L.), garlic (*Allium sativum* L.), and onion (*Allium cepa* L.). Each type of Allium extract was used at a concentration of 20%. The research results showed that the Allium extract types significantly affected seedling growth, especially seedling height for the first time. The shallot and garlic extracts decreased seedling dry weight. The Allium extract types can stimulate shoot dry weight clump^{-1}. Application of shallot extract could cause the highest grain dry weight clump^{-1}. The study findings show that shallot and garlic extracts harm seed germination and seedling growth, but the onion extract does not. However, shallot is a type of Allium whose extract can stimulate rice growth. Therefore, we recommend the shallot extract type for stimulating growth in rice cultivation.

Keywords: Allium extract, rice, shallot, garlic, onion, phytohormone

Introduction

Rice is a staple food in the Indonesian population. Optimal rice growth can support maximum yields. Therefore, an attempt has been made to stimulate plant growth regulators (PGRs) through growth hormones. PGRs in their natural form can modify or control through physiological action, growth, and maturation of plants. The PGR produced in the plant is called plant hormone or phytohormone.

However, synthetic hormones are very expensive; alternatively, natural PGR from Allium extracts is used. Allium bulbs contain auxins (IAA), gibberellic acid (GA), and cytokinins. IAA and GA hormones can play a role in stimulating rice growth. However, it is not yet known what type of Allium extracts can be used to stimulate rice growth.

In Indonesia, the demand for rice has increased from year to year. However, rice production in 2021 decreased by 0.45% more than in 2020 (BPS, 2021). Within the last 10 years (2010-2019), the area dan production of rice has been declining as much as 1.8% and 1.6%, respectively (Pudjiastuti et al., 2021). Rice production can be increased again to maintain national food security. Therefore, it is necessary to have a solution. Using Allium extract at certain concentrations can increase rice production.

During this time, a rice intensification system has been implemented to obtain higher production, optimal use of labor and capital, input costs, and the need for less water (Toungos, 2018). In addition, rice production in Indonesia has been carried out through five farming programs, i.e., superior seed selection, good tillage, proper fertilization, pest and disease control, and good irrigation.

PGRs are natural and synthetic compound forms that can modify or control plants through the action of physiological growth and maturation. Phytohormones are produced in the plant (Ogunyale et al., 2014) in small amounts but can majorly affect growth and production. For example, IAA, GA, and zeatin (cytokinin) are growth-promoting hormones, while abscisic acid (ABA), ethylene, and phenolic compounds are growth-inhibiting hormones (Agustina et al., 2010). These phytohormones are capable of being produced by plants. One of these plant families is from the Alliaceae (Wen et al., 2021). The following literature review will discuss three types of Allium extract, i.e., shallot, garlic, and onion. These three types are most likely to contain phytohormones.

Shallot bulbs (*Allium ascalonicum* L.) contain PGR, i.e., IAA and cytokinins. However, an excessive concentration of shallot extract will inhibit plant growth. The IAA is a hormone that can affect plant growth: height growth, leaves number, chlorophyll content, root gain, and stem diameter of *Arenga pinnata* (Patma et al., 2013). In addition, shallot contains IAA and GA hormones, so shallot extract can help seed germination and growth of roots and shoots of *Ixora coccinea* (Salsabila et al., 2021).

The highest concentration of IAA in shallots was found in bulbs (5.376 mg kg^{-1}), decreased in roots (3.314 mg kg^{-1}), and the lowest was in leaves (1.006 mg kg^{-1}). The results showed that the IAA content was the highest in shallot var. Bima (6.014 mg kg^{-1}) compared to var. Maja, Mentes, Pancasona, and Trisula (Sopha and Hartanto, 2021). A concentration of 20% shallot extract most effectively increased the live cuttings percentage, but a concentration of 10% significantly affected the leaves number in *Mucuna bracteata* D.C (Prameswari and Pratomo, 2021). Shallots contain GA_3, IAA, ABA, and zeatin (Dahab et al., 2018), and are effective for increasing germination, fresh weight, and dry weight of melon plants. In addition, shallot extract has the potential to be a source of organic hormones (Yunindanova et al., 2018).

The phytohormone content in garlic (*Allium sativum* L.) was higher than that in shallot, i.e., GA_3 (2.719 mg 100 g^{-1}), IAA (0.0312 mg 100 g^{-1}), ABA (0.3138 mg 100 g^{-1}), and zeatin (0.0149 mg 100 g^{-1}) (Dahab et al., 2018). Garlic extract contained enzymes and more than 200 other chemical compounds. The garlic extract contained thiosulfinate (307.66 ± 0.043 µM/g), flavonoids (64.33 ± 7.69 µg QE/g), and polyphenols (0.95 ± 0.011 mg GAE/g) as major compounds (Corbu et al., 2021). Garlic contained vitamins, minerals, flavonoids, ascorbic acid, sulfur, iodine, and some amino acids. Sulfur had an important role in the fruiting process of various fruit crops (Al-hadethi et al., 2016).

Garlic contains a high level of phenolic compounds (Griffiths et al., 2002), out of which flavonoids are the main in garlic bulbs. Flavonoids can be classified into various sub-classes, i.e. flavones, flavanones, flavonols, isoflavones, flavanonols, flavonols, flavanols, chalcones, and anthocyanins (Perez-Gregorio et al., 2010). The application of garlic extract could result in a marked reduction in nodulation in the roots, plant height, leaf area, and root development of arrears (*Vigna unguiculata*) and peanuts (*Arachis hypogea*) compared to control (Adeleke, 2019).

Many organosulfur compounds are found in onions (*Allium cepa* L.). Diallyl sulfide, diallyl monosulfide, disulfide, trisulfide, and tetrasulfide are the main sulfur compounds in onion. Onions are considered an excellent source of flavonoids of the polyphenol family. Flavonols are a sub-class of flavonoids (Pareek et al., 2017). Red and yellow cultivar onions contain polyphenols in the form of gallic acid, ferulic acid, and quercetin. The research results showed that red-cultivar onions had better antioxidant activity than yellow cultivars. Higher polyphenol and flavonoid content were also associated with higher antioxidant activity (Cheng et al., 2013).

Onions contain vitamins (A, B_1, B_2, C, nicotinic acid, and pantothenic acid) and also essential substances, such as protein, calcium, phosphorus, potassium, Fe, Al, Cu, Zn, Mn, and I. In addition, onions contain phenolic compounds, namely, phenolic acids and flavonoids that can act as natural antioxidants, anti-carcinogens, and anti-microbial agents (Akbudak et al., 2018). The research results showed that yellow cultivars accumulated N, P, K, Mg, Fe, Mn, Zn, Cu, and reducing sugars in much larger quantities than red cultivars. Red cultivars contained sugar and vitamin C in much more significant amounts than yellow cultivars (Jurgiel-Malecka et al., 2015). Therefore, a concentration of 20% onion extract can be recommended to stimulate early flowering in a higher percentage. There was an improvement in the quality of higher yields by regulating the metabolism of amino acids, including proline and indole, and the activity of catalase and hydrogen peroxide in apple flower buds (El-yazal and Rady, 2014).

Based on the literature review previous studies have shown that shallot and garlic extract contained growth-promoting hormones (IAA, GA, and cytokinin) and inhibitors (ABA) of plants, as well as phenolic compounds. The application of shallot and garlic extract at a concentration of 20% positively affected the seed germination of melon, the flower cuttings, and the buds of apples and legumes. However, there was not enough information about the effect of Allium extract on the growth and yield of rice. No study was carried out on the application of shallot, garlic, and

onion extracts to examine seed germination, growth, and yield of rice. No type of Allium extract was known that can increase the growth and yield of rice. Therefore, this study aimed to research the application of Allium extract in rice cultivation and to find one of the best types of Allium extract that can stimulate rice growth.

Materials and methods

Study area

The study was conducted from December 2021 to April 2022. The study area was in the greenhouse of the Faculty of Agriculture, Universitas PGRI Yogyakarta, Bantul Regency, Yogyakarta Special Region, Indonesia. The height of the study area was 118 m above sea level (m ASL) and located at the 8°30'-7°20' South latitude and 109°40'-111°0' East longitude. During the study period the average air temperature and humidity were 33°C and 60%, respectively.

Materials and tools

The materials used were wooden germination boxes of 50 cm (width) × 80 cm (length) × 20 cm (height), latosol soil, cow manure, urea, and NPK Phonska, polybags in size of 40 cm (width) × 35 cm (height), paper, mica plastic labels, bamboo sticks of 50 cm (height), rice seed variety of Padjajaran Agritan, plastic germination tub with a size of 30 cm (length) × 25 cm (width) × 5 cm (height), water, shallot, garlic, and onion. The equipment used were a hoe, sickle, ruler, Philips Blender HR2115/01, filter paper, soil sieve of 2 × 2 cm, pipette volume of 10 mL, plastic bottle volume of 1 L, Erlenmeyer pyrex volume of 500 mL, oven Binder drying oven ED series, ACIS AD-i Series digital analytical balance, manual scales capacity of 30 kg, and grain moisture tester JV-001S.

Experimental design

This study was carried out in two stages of experiments. The first was about seed germination and seedling growth of rice, and the second was about rice growth and yield. The study was a single factor arranged in a complete randomized design (CRD) and three replications. The treatments consisted of four types, i.e., control (without treatment), shallot (*Allium ascalonicum* L.), garlic (*Allium sativum* L.), and onion (*Allium cepa* L.). Each type of Allium extract used a concentration of 20%. In the first experiment, only one sample was used for each repetition so a total of 12

plastic germination baths were needed. While in the second experiment, each test consisted of six samples so in total 72 polybags were needed.

Research procedures

Processing steps of Allium extract at 20% concentration were followed. First, the bulbs with a fresh weight of 100 g was put in a blender, and 200 mL of water was added for extraction. Next, the shallot extract was fed into the Erlenmeyer tube for a centrifuge for 10 min at a speed of 500 rpm. The resulting shallot extract was poured into a measuring cup and added the water up to a volume of 500 mL. After that, the extract was filtered with filter paper. The liquid that escaped from the sieve was used as a phytohormone. Next, the liquid of the solution was fermented for seven days in plastic bottles.

Latosol soil as a planting medium was taken from the top-soil layer at a depth of 0-20 cm. The soil was dredged, then crushed with a hoe to a uniform grain, and filtered with a soil sieve. In the first experiment, the seed germination test required 36 plastic tubs. Each germination plastic tub was filled with 1 kg of soil, and the soil surface was flat. For the second experiment, 90 polybags were needed, each filled with 10 kg of soil. Polybags were placed on a table located inside the greenhouse building. In this study, the Padjajaran Agritan variety was used.

The first experiment was done by randomizing all germination plastic tubs filled with soil. Randomization was carried out at once against all of the treatments. Next, the treatment was labelled by a paper affixed to the outer wall of the germination plastic tub. Randomization was carried out in the second experiment on all polybags with the same method. Next, the treatment was labelled by mica plastic with the help of bamboo sticks. Bamboo sticks were plugged into the center planting medium in the plastic germination tub.

The first experiment was carried out by scattering as many as 20 rice seeds per plastic germination tubs above the soil surface in water-saturated conditions. In total, 240 rice seeds were needed. However, the preparation of the second experiment was carried out in wooden germination boxes filled with a mixture of soil and manure in a ratio of 1:1. As many as 216 rice seeds were stocked over the soil medium in water-saturated conditions. Seedlings ready were planted into polybags at the age of 18 days after sowing (DAS). Rice seedlings that showed uniform growth were selected as planting materials. For the first experiment, the application of Allium extract was as much as 2 mL per plastic germination tub applied evenly above the soil surface suitable for the treatment. Each treatment was given simultaneously when stocking seeds. For the second

experiment, Allium extract treatment was given twice with a dose of 2 mL polybag^{-1}, namely at planting time and 15 days after planting (DAP). The plant spacing between seedlings in polybags was 25 × 25 cm. A rice seedling was planted in the middle of the soil surface inside the polybag. Seedlings were planted at a depth of 2 cm. Only one seedling was planted in each polybag, so the overall need was as many as 72 rice seedlings.

The water availability in the first experiment was kept in field capacity until 10 DAP. However, in the second experiment, water was always maintained at 2 cm from the soil surface daily at 1-105 DAP. The recommended dose of fertilizer was 225 kg ha^{-1} (or 0.08 g for one-kg soil) urea and 225 kg ha^{-1} (or 0.08 g for one-kg soil) NPK Phonska 15-15-15 for rice cultivation. Fertilization was carried out in two stages. The first application was 40% of the recommended dose at 14 DAP. The second application was as much as 60% of the recommended dose at the age of 35 DAP. Weed control was carried out twice during the study. Pest control was carried out twice during flowering using Dursban pesticides. Rice harvesting was carried out at 105 DAP when the grains matured physiologically (95% turned yellow).

The experiment culture of rice crops with Allium extract application at 105 DAP can be seen in *Figure 1*.

Figure 1. Photo of rice crops with Allium extract application at 105 DAP

Measurement and parameter

For the first experiment, the rate and power of germination were observed from the 1st to the 10th day, while the seedling height and dry weight were observed at 10 DAS. Germinated seeds were counted and measured if shoots appeared 2 cm above ground level in a germination plastic tub. The seedling height was calculated from the average of all seedlings that have grown, while the seedlings' dry weight is calculated from all seedlings that have grown per germination plastic tub. For the second experiment, plant growth was observed at 80 DAP, including the tiller number and plant height, while shoot and grain dry weight was observed at 105 DAP. Measurement of rice growth and yield was carried out on all samples in each repeat, then the average per clump was calculated. The seedlings and shoots were dried in an oven for 48 h at 80°C or until the dry weight was constant. The grain dry weight was measured using a digital analytical balance after drying under sunlight until it reached a seed moisture content of 14%.

Statistical analysis

Observational data were analyzed by analysis of variance at 5% significance level. To determine the difference between treatments, Duncan's new multiple range test (DMRT) was used at 5% significance level (Gomez and Gomez, 1984).

Results

Effect of Allium extract types on the seed germination and seedling growth

The research results in the first experiment showed that Allium extract types did not significantly affect the rate and power of germination. Still, the treatments affected the seedling height and dry weight. The results of multiple comparisons with DMRT at 5% significance level on seed germination and seedling growth are presented in *Table 1*.

Table 1 explains that the Allium extract types did not significantly affect the rate and power of germination. However, the onion extract application could increase the seedling height and greatly differ from shallot and garlic extracts or control. The treatment of shallot and garlic extracts caused the seedling dry weight to be lower than the control and onion. Shallot and garlic extracts application inhibited the rice seedlings growth. For more details, the effect of Allium extract types on the height and dry weight of seedlings are presented in *Figure 2*.

Table 1. *Effect of Allium extracts types on the seed germination and seedling growth at 10 DAS*

Allium extract type	Germination rate	Germination power (%)	Seedling height (cm)	Seedling dry weight (g per germination plastic tub)
Control	3.19 a	98.33 a	4.00 b	0.54 a
Shallot	2.96 a	91.67 a	4.00 b	0.44 b
Garlic	2.93 a	90.00 a	4.33 b	0.47 b
Onion	3.32 a	98.33 a	5.00 a	0.56 a

The number followed by the same character in a column is not significantly different based on DMRT at 5% significant level

Figure 2a shows that the application of onion extract was effectively stimulating the rice seedlings height. *Figure 2b* shows that applying shallot, garlic, and onion extract were not effectively stimulating the rice seedlings dry weight.

Effect of Allium extract types on the growth and yield of rice

The research results in the second experiment showed that the type of Allium extract did not significantly affect the tiller number and plant height, but it affected the shoot and grain dry weight. The results of multiple comparisons with DMRT at 5% significance level on the growth and yield of rice are presented in *Table 2*.

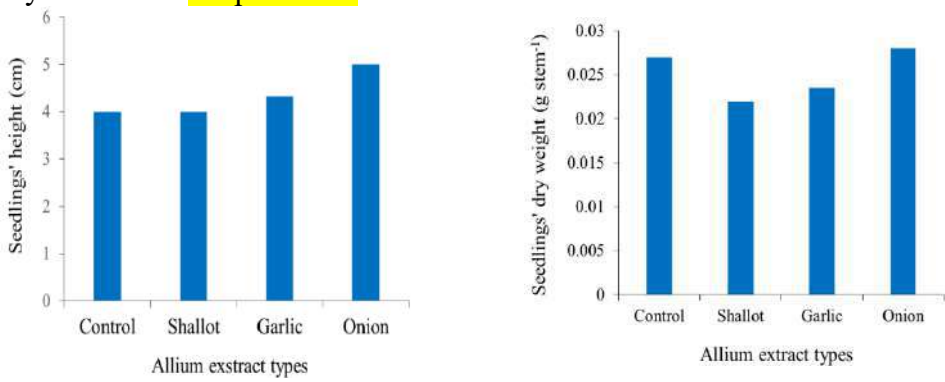


Figure 2. Application of Allium extract on the seedling height (a) and seedling dry weight (b)

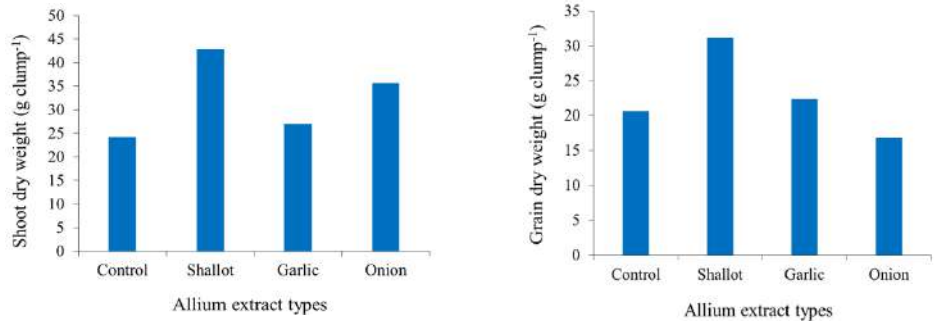
Table 2 explains that the Allium extract types could increase the shoot dry weight and be significantly different from the garlic extract, but was not significantly different from the onion extract. On the other hand, the shallot extract application could increase the grain dry weight clump^{-1} and be significantly different from the garlic and onion extract. The effect of Allium extract types on shoot and grain dry weight can be seen in Figure 3.

Table 2. *Effect of Allium extracts types on the growth and yield of rice*

Allium extract type	Tillers number (stem clump^{-1})	Plant height (cm)	Shoot dry weight (g clump^{-1})	Grain dry weight (g clump^{-1})
Control	8.44 a	75.67 a	24.28 b	20.64 b
Shallot	9.78 a	84.22 a	42.89 a	31.10 a
Garlic	10.11 a	75.44 a	27.00 b	22.35 b
Onion	9.11 a	77.67 a	35.61 ab	16.83 b

The number followed by the same character in a column is not significantly different based on DMRT at 5% significant level

Figure 3a and *b* show that the application of shallot extract gave higher shoot and grain dry weight than other treatments.



(a) (b)

Figure 3. Application of Allium extract on shoot dry weight (a) and grain dry weight (b)

Discussion

Allium extracts have a bad effect on rice seed germination. The application of shallot and garlic extract actually inhibits the rice seedlings dry weight. Shallot and garlic extract contained high phenolic compounds so can interfere with the initiation of seedlings growth. Seed germination was sufficiently stimulated by the PGRs contained in itself. Thus, seed germination did not require additional PGRs from organic material.

The rate germination, power germination, and seedlings height did not require the additional external phytohormones from shallot and garlic extract, but required onion extract. The addition of shallot extract and garlic did not increase the rice seedlings height of rice. Conversely, onion extract

can increase the vertical growth of rice seedlings. The application of Allium extract will increase the concentration of IAA in the rice seed and will inhibit it because the content becomes excessive. According to Lee et al. (2022), poor seed germination and inhibition of seedling growth is due to excessive accumulation of IAA.

Shallot and garlic extract contained phytohormones, especially GA. The GA compounds were considered negative regulators of innate immunity in rice crops (Yang et al., 2013). The GA content in rice seeds was enough to support their seed germination. The GA could diffuse into the aleurone layer and initiate signaling synthesizing amylase and other hydrolytic enzymes. Then, hydrolytic enzymes secreted into the endosperm and hydrolyzed food reserves. Next, the hydrolytic enzymes will hydrolyze starch, lipids, hemicellulose proteins, polyphosphates, and other stored materials into simpler forms that are available to the embryo (Ali and Elozeiri, 2017).

Not all types of Allium extracts have a significant effect on rice growth and yield. Garlic and onion extracts were not effective for increasing the dry weight of shoot and grain, while shallot was effective. Adding external phytohormones to the soil media effectively optimized the shoots dry weight. Besides, the shallot extract application could significantly increase the grain dry weight. The content of IAA in shallot could stimulate the growth of rice plants. According to Sopha and Hartanto (2021), shallot bulb tissue contained higher IAA concentrations than leaves and roots.

The IAA is a common auxin form that participates in plant growth and development. The sources of IAA can come from organic material. Shallot bulbs can produce natural hormones, namely IAA. The IAA played a role in stimulating plant growth, such as enlargement, elongation, cell division, affected nucleic acid metabolism, and plant metabolism (Pamungkas and Puspitasari, 2018). Auxin affected some aspects of the plant development (Wang et al., 2018). The use of IAA contained in Allium extract, especially in shallot has a good role in increasing plant growth.

The use of exogenous auxin in the right concentration increased the yield of dry matter of plants (Sosnowski et al., 2023). Therefore, the IAA of shallot can be used to stimulate the growth and yield of rice. However, the shallot extract has been shown to increase rice shoot and grain dry weight more than garlic extract.

Based on the discussion above, it can be affirmed that Allium extract is better used to support plant growth of rice than in nurseries. Shallot bulb extract supports rice growth better than garlic and onion.

Conclusion

The research results and discussion above showed that seedling growth, especially seedlings height in the first time was significantly affected. The shallot and garlic extracts decreased the seedling dry weight. The shallot extract can increase rice shoots dry weight. The application of shallot and garlic extract harms seed germination and seedlings growth, except for onion extract. Application of shallot extract could cause the highest grain dry weight clump^{-1}. The study findings show that the shallot and garlic extract harms the seed germination and seedlings growth, but the onion extract does not. However, the shallot is a type of Allium that extract can stimulate rice growth. Therefore, we recommend the shallot extract type for stimulating growth in rice cultivation.

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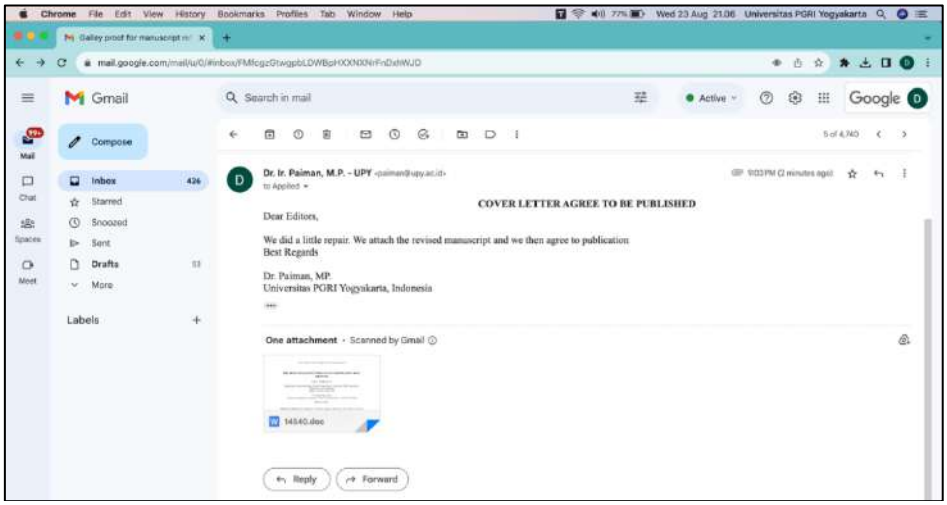

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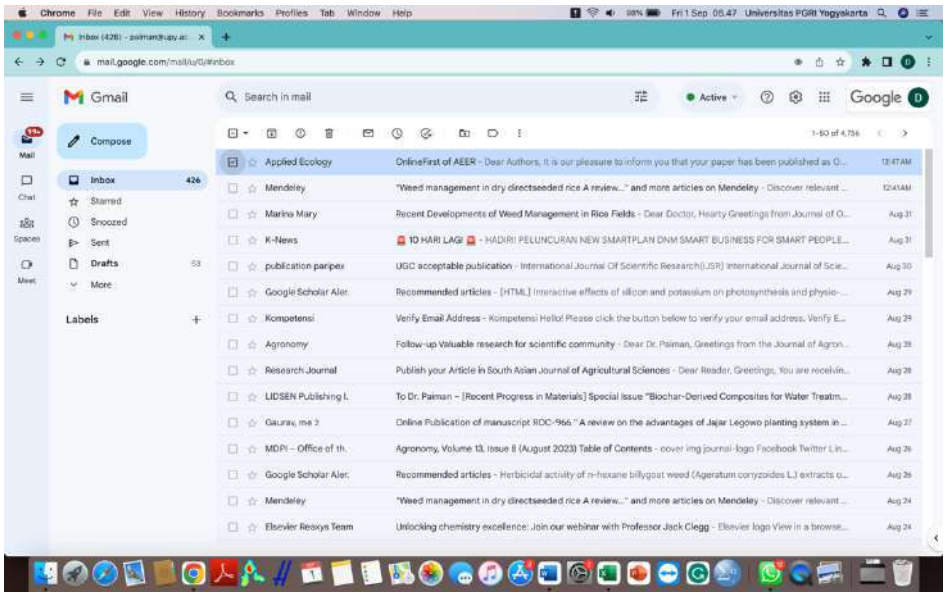

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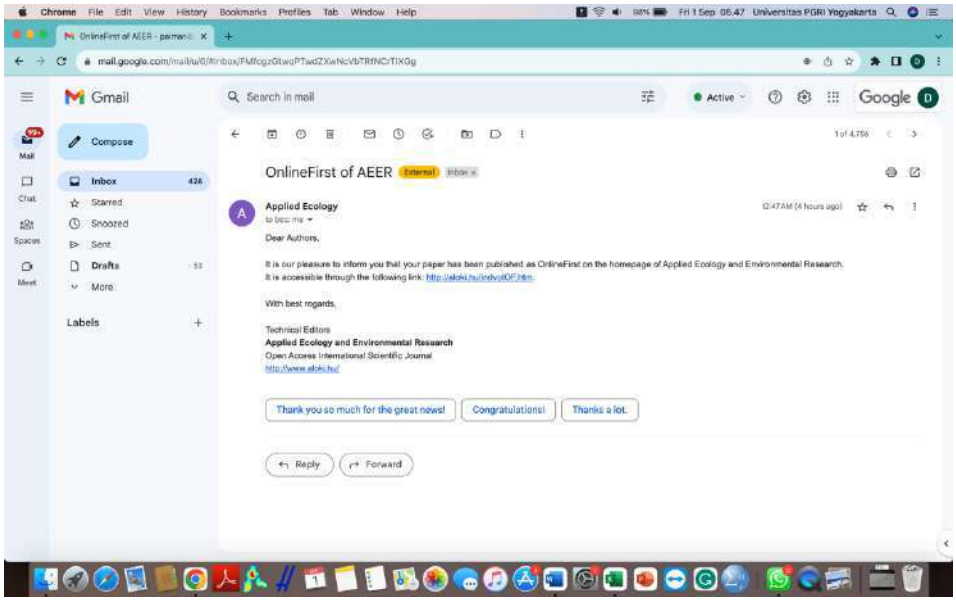

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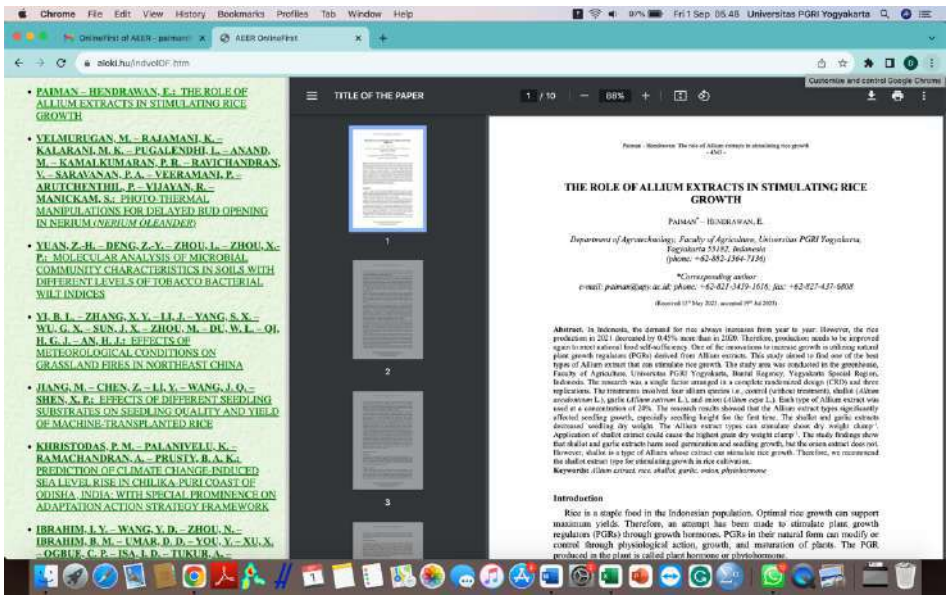

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HOW TO WRITE RESEARCH ARTICLES

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