



SURAT KLARIFIKASI

Bersamaan dengan ini, pengusul bermaksud untuk memberikan penjelasan terkait dengan jurnal ilmiah internasional bereputasi dengan judul *Drought Stress : Responses and Mechanism in Plants* yang ditulis oleh SST Pamungkas dan 3 olah lainnya, yang dimana saudara Saktiyono Sigit Tri Pamungkas menjadi penulis ke-1 dari 4 sekaligus korespondensi. jurnal tersebut benar adanya digunakan oleh saudara Saktiyono Sigit Tri Pamungkas guna memenuhi syarat pengajuan Lektor Kepala.

Dalam hasil penilaian Reviewer disebutkan bahwa ada kekurangan di bagian bukti korespondensi jurnal tersebut. maka dari itu bersamaan dengan surat klarifikasi ini kami lampirkan bukti korespondensi Jurnal tersebut.

Demikian surat ini dibuat sebagai penjelasan tambahan terkait dengan pengajuan Kembali dan perbaikan dokumen untuk pengajuan jabatan lektor kepala.

Yogyakarta, 15 Desember 2023

Direktur,

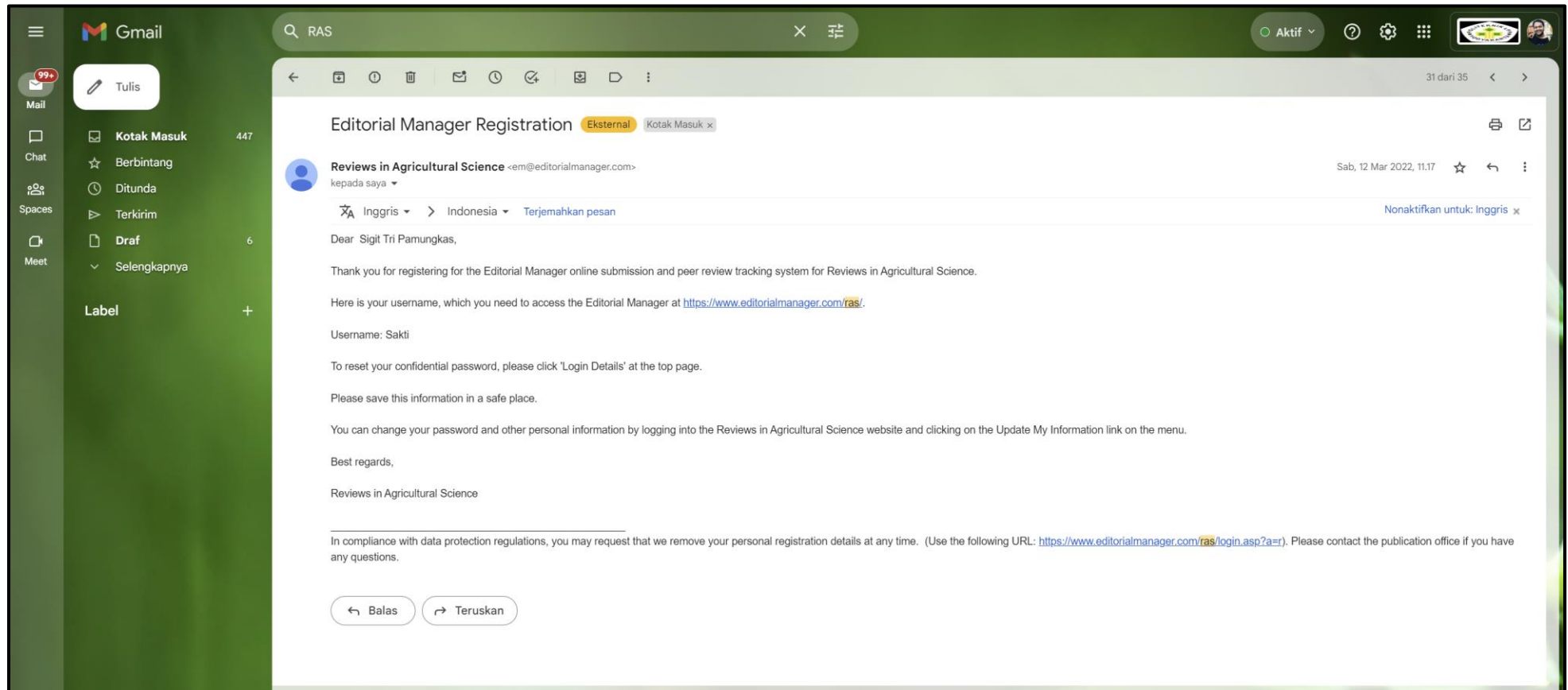


Ir. M. Musjangan, S. G., M. Eng. IPM

BUKTI KORESPONDENSI JURNAL

Nama : Saktiyono Sigit Tri Pamungkas
Nama PT : Politeknik LPP
Alamat PT : Jl. LPP Nomor 1 A Balapan, Kota Yogyakarta
Satuan Kerja : Program Studi Budidaya Tanaman Perkebunan
Nama Jurnal : Reviews in Agricultural Science (RAS)
Alamat URL : https://www.jstage.jst.go.jp/article/ras/10/0/10_168/_article
DOI : https://doi.org/10.7831/ras.10.0_168
Edisi Terbit : 2022 volume 10 (168-185)

1. Proses register untuk *editorial manager online submission* (12 Maret 2022)



Berikut merupakan proses register untuk *editorial manager online submission*:

The screenshot shows the 'Registration Page' of the Editorial Manager system. The page header includes 'Reviews in Agricultural Science' and 'Editorial Manager' with navigation links for 'Bioproduction', 'Life Science', and 'Environment'. The user is 'Not logged in.' The main content area is titled 'Registration Page' and contains a 'Login Details' section. This section includes a note: 'The username you choose must be unique within the system. If the one you choose is already in use, you will be asked for another.' Below this note are three input fields: 'Enter preferred user name *' with the value 'Sakti', 'Password *' with masked characters, and 'Re-type Password *' with masked characters. A 'Password Rules' link is also present. A blue arrow points from this page to the next screenshot.

The screenshot shows the 'Personal Information' page of the Editorial Manager system. The page header is identical to the previous screenshot. The main content area is titled 'Personal Information' and contains a form with the following fields: 'Title' (empty), 'Given/First Name *' (Saktiyono), 'Middle Name' (empty), 'Family/Last Name *' (Sigit Tri Pamungkas), 'Degree' (M.P. with a note '(Ph.D., M.D., etc.)'), 'Preferred Name' (Sakti with a note '(nickname)'), 'Primary Phone *' (+6282137855660 with a note '(including country code)'), 'Secondary Phone' (+6281227985311 with a note '(including country code)'), 'Secondary Phone is for' (Mobile selected, with options for Beeper, Home, Work, Admin, Asst.), 'Fax Number' (empty with a note '(including country code)'), 'E-mail Address *' (skt@poltekjpp.ac.id), and 'Preferred Contact Method *' (E-mail selected, with options for Fax, Postal Mail, Telephone). A note at the bottom of the form states: 'If entering more than one e-mail address, use a semi-colon between each address (e.g., joe@thejournal.com;joe@yahoo.com) Entering a second e-mail address from a different e-mail provider decreases the chance that SPAM filters will trap e-mails sent to you from online systems. Read More.'

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Insert Special Character

Institution Related Information

Position:

Institution: Polytechnic LPP Yogyakarta: Politek

Department: Plantations Department (Vocational)

Street Address: Jl. LPP (Urip Sumoharjo) No. 1 A

City: Balapari

State or Province: Special District of Yogyakarta

Zip or Postal Code: 55222

Country or Region: INDONESIA

Address is for: Work Home Other

Start typing to display potentially matching institutions.



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Areas of Interest or Expertise

Select Personal Classifications:
 Please indicate your areas of expertise by selecting from the pre-defined list using the 'Select Personal Classifications' button.

Edit Personal Keywords:
 Please indicate your areas of expertise by adding your own Personal Keywords individually using the 'Edit Personal Keywords' button.

Personal Classifications: Breeding science, Crop science/Weed science, Horticulture/Landscape architecture

Select Personal Classifications

Select 1-3 Classifications

Personal Keywords: (None Defined)

Edit Personal Keywords

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Confirm Registration

Please confirm the following very important information:

Given/First Name: Saktiyono

Family/Last Name: Sigit Tri Pamungkas

Username: Sakti

E-mail Address: skt@poltekipp.ac.id

Country or Region: INDONESIA

Please click on the privacy policy links below and then check the box.

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Registration Complete

Check your email for a message to confirm your registration. Note that Editorial Manager may have assigned a different Username if the one you selected is already in use.

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User Verification – Request Removal

This page is to request the removal of your personal registration information. Click the links below to view the privacy policies.

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Please Enter the Following

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Username: Sakti
Password:

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Role: Author Username: Sakti

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Request Removal

Thank you for confirming your identity. You may proceed with your request to remove your personal registration details by clicking the 'Please Remove My Details' button.

Saktiyono Sigit Tri Pamungkas, M.P.
skt@poltekipp.ac.id

Polytechnic LPP Yogyakarta: Politeknik LPP Yogyakarta
Plantations Department (Vocational Education)
Jl. LPP (Urip Sumoharjo) No. 1 A
Balapan
Klitren
Gondokusuman
Yogyakarta, Special District of Yogyakarta 55222
INDONESIA

Please enter any additional comments you wish to make to the publication staff:

Dear Editor in Chief Reviews in Agricultural Science Journal

I'm Saktiyono Sigit Tri pamungkas, lecturer from Plantation Department of Polytechnic LPP Yogyakarta, here I created an account Reviews in Agricultural Science International Journal and intends to submit a manuscript. I really hope to be published in the journal that you manage.

Cancel Please Remove My Details

2. Proses submission (14 Maret 2022)

Gmail interface showing an email from Reviews in Agricultural Science. The email subject is "[RAS] Your PDF Drought Stress: Responses and Mechanism in Plants has been built and requires approval". The sender is "Reviews in Agricultural Science" (em@editorialmanager.com). The email content includes instructions for approving the submission, a username (Sakti), and a password (https://www.editorialmanager.com/ras/login.asp?i=6388&l=K2HBB5L3). The email is dated "Sen, 14 Mar 2022, 05.43".

[RAS] Your PDF Drought Stress: Responses and Mechanism in Plants has been built and requires approval Eksternal Kotak Masuk x

Reviews in Agricultural Science <em@editorialmanager.com>
kepada saya ▾

Inggris ▾ > Indonesia ▾ Terjemahkan pesan Nonaktifkan untuk: Inggris x

Dear Pamungkas,

The PDF for your submission, "Drought Stress: Responses and Mechanism in Plants" is ready for viewing.

This is an automatic email sent when your PDF is built. You may have already viewed and approved your PDF while on-line, in which case you do not need to return to view and approve the submission

Please go to <https://www.editorialmanager.com/ras/> to approve your submission.

Username: Sakti
Password: <https://www.editorialmanager.com/ras/login.asp?i=6388&l=K2HBB5L3>

Your submission must be approved in order to complete the submission process and send the manuscript to the Reviews in Agricultural Science editorial office.

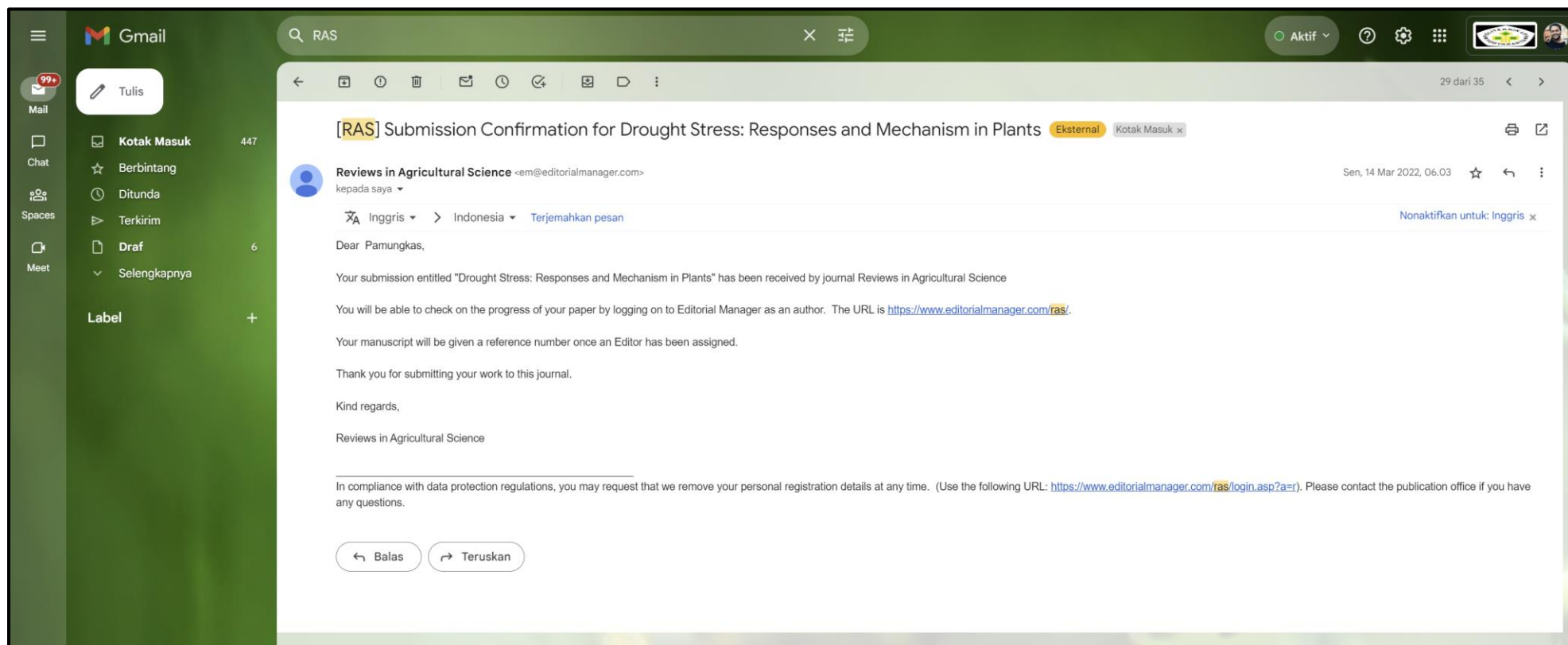
Please view the submission before approving it to be certain that your submission remains free of any errors.

Thank you for your time and patience.

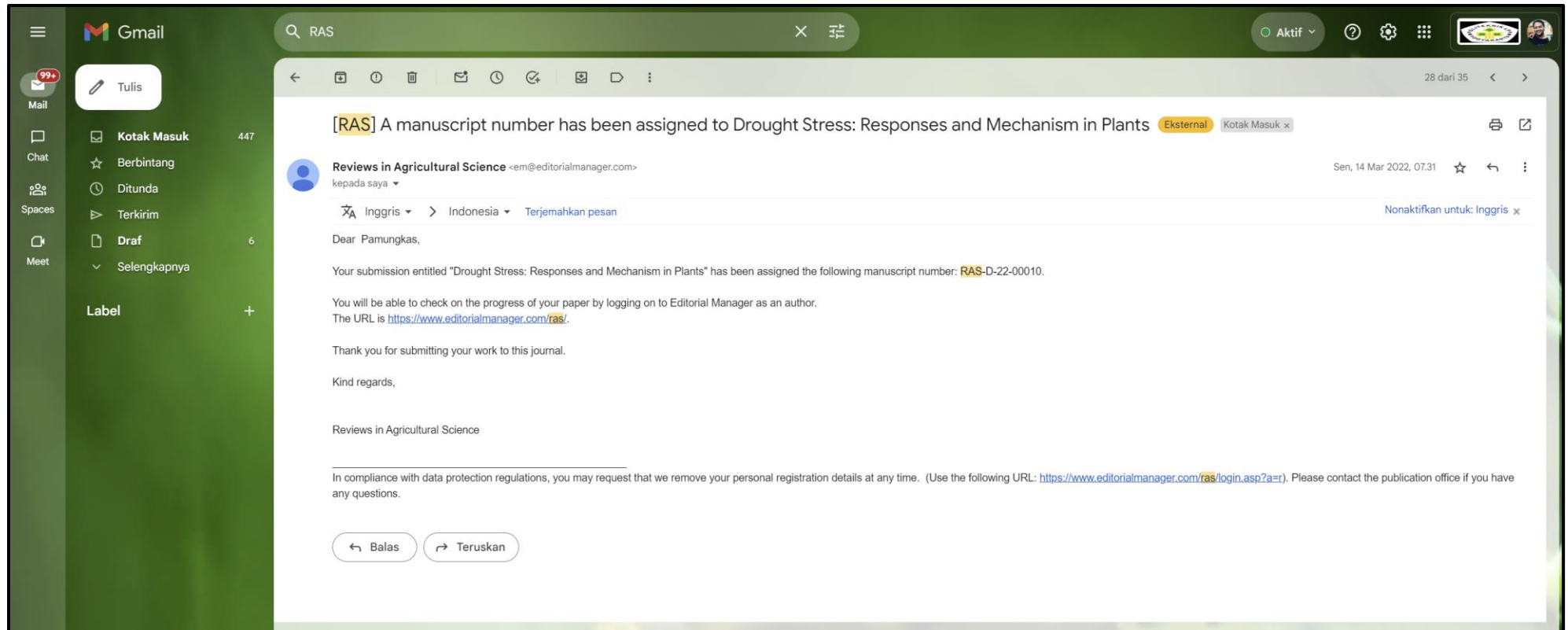
Editorial Office Staff
Reviews in Agricultural Science
<https://www.editorialmanager.com/ras/>

In compliance with data protection regulations, you may request that we remove your personal registration details at any time. (Use the following URL: <https://www.editorialmanager.com/ras/login.asp?a=r>). Please contact the publication office if you have any questions.

3. Proses konfirmasi *submission* (14 Maret 2023)



4. Proses assigned a manuscript (14 Maret 2022)



Berikut merupakan proses *submission a manuscript* :

The screenshot shows the 'Author Main Menu' in the Editorial Manager system. The page is titled 'Reviews in Agricultural Science' and includes navigation links for 'Bioproduction', 'Life Science', and 'Environment'. The user's role is 'Author' and their username is 'Sakti'. The menu is organized into three main sections: 'New Submissions', 'Revisions', and 'Completed'. Each section lists various submission statuses with their respective counts in parentheses.

Section	Item	Count
New Submissions	Submit New Manuscript	
	Submissions Sent Back to Author	(0)
	Incomplete Submissions	(0)
	Submissions Waiting for Author's Approval	(0)
	Submissions Being Processed	(0)
Revisions	Submissions Needing Revision	(0)
	Revisions Sent Back to Author	(0)
	Incomplete Submissions Being Revised	(0)
	Revisions Waiting for Author's Approval	(0)
	Revisions Being Processed	(0)
	Declined Revisions	(0)
	Completed	Submissions with a Decision



The screenshot shows the 'Article Type Selection' step in the submission process. The page is titled 'Reviews in Agricultural Science' and includes navigation links for 'Bioproduction', 'Life Science', and 'Environment'. The user's role is 'Author' and their username is 'Sakti'. The process is shown as a sequence of steps: 'Article Type Selection', 'Attach Files', and 'Manuscript Data'. The 'Article Type Selection' step is currently active, and the user is prompted to 'Choose the Article Type of your submission from the drop-down menu.' A dropdown menu is open, showing 'Review' as the selected option. A 'Proceed' button is visible at the bottom right.

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Article Type Selection | Attach Files | General Information | Review Preferences | Additional Information | Comments | Manuscript Data

✓ Cover Letter
 ✓ Manuscript
 Please provide any additional items.

Select Item Type: Others
 Description: Others
 Insert Special Character

Browse... OR Drag & Drop File Here

The order in which the attached items appear is the order established by this publication. You may re-order any items of the same type manually if necessary.

Change Item Type of all [Choose] | Files to [Choose] | Change New | Check All | Clear All

Order	Item	Description	File Name	Size	Last Modified	Actions	Select
1	Cover Letter	Cover Letter	Cover Letter_Saktiyono Sigt.docx	20.2 KB	2022-03-11 23:49:56	Download	<input type="checkbox"/>
2	Manuscript	Manuscript	Manuscript_Saktiyono Sigt.docx	363.2 KB	2022-03-11 23:49:59	Download	<input type="checkbox"/>
3	Others	Others	Proofread Certifikasi_Saktiyono Sigt.pdf	648.0 KB	2022-03-11 23:50:24	Download	<input type="checkbox"/>

Update File Order | Remove | Check All | Clear All

← Back | Proceed →

Your Time: 11:04, 12 March • Site Time: 23:50, 11 March



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Please provide the requested information.

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Classifications

Please identify your submission's areas of interest and specialization by selecting one or more classifications.

Required - Select 1 to 2 Classifications
 Breeding science
 Crop science/Weed science
 Add Classifications

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Your Time: 11:56, 12 March • Site Time: 23:52, 11 March

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Article Type Selection | Attach Files | General Information | Review Preferences | Additional Information | Comments | Manuscript Data

Please provide the requested information.

Suggest Reviewers

Please suggest potential reviewers for this submission and provide specific reasons for your suggestion in the comments box for each person. Please note that the editorial office may not use your suggestions, but your help is appreciated and may speed up the selection of appropriate reviewers.

Current Suggested Reviewers List | Add Suggested Reviewer

Zuhud Rozaki, University of Muhammadiyah Yogyakarta: Universitas Muhammadiyah Yogyakarta

Add Suggested Reviewer | Next

Oppose Reviewers

← Back | Proceed →

Your Time: 12:09, 12 March • Site Time: 00:05, 12 March



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Article Type Selection | Attach Files | General Information | Review Preferences | Additional Information | Comments | Manuscript Data

Please respond to the presented questions/statements.

Insert Special Character

Questionnaire

1. Are you a graduate of the United Graduate School of Agricultural Science(s)?

Answer Required:
 please select a response
 Yes
 No
 I am a PhD student of the United Graduate School of Agricultural Science(s).

2. If you selected "Yes" in the question 1 above, select the university you had enrolled.

Please select a response
 Obihiro University of Agriculture and Veterinary Medicine
 Hiroaki University
 Iwate University
 Yamagata University
 Utsunomiya University

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Your Time: 12:12, 12 March • Site Time: 00:07, 12 March

Reviews in Agricultural Science

Bioreproduction Life Science Environment

Editorial Manager Role: Author Username: Sakti

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Article Type Selection ✓ Attach Files ✓ General Information ✓ Review Preferences ✓ Additional Information ✓ Comments ↓ Manuscript Data ○

Please provide the requested information.

Enter Comments

Please enter any additional comments you would like to send to the publication office. These comments will not appear directly in your submission.

Dear Editor in Chief Reviews in Agricultural Science Journal
 I'm Salsiyono Sigit Tri pamungkas, lecturer from Plantation Department of Polytechnic LSP Yogyakarta, here I send the manuscript of my scientific article entitled (review) "Drought Stress: Responses and Mechanism in Plants". I really hope to be published in the journal that you manage!

← Back Proceed →

Your Time: 12:14, 12 March • Site Time: 00:10, 12 March



Reviews in Agricultural Science

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Editorial Manager Role: Author Username: Sakti

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Article Type Selection ✓ Attach Files ✓ General Information ✓ Review Preferences ✓ Additional Information ✓ Comments ✓ Manuscript Data ↓

When possible these fields will be populated with information collected from your uploaded submission file. Steps requiring review will be marked with a warning icon. Please review these fields to be sure we found the correct information and fill in any missing details.

Title

Full Title (required) ✓

Drought Stress: Responses and Mechanism in Plants

body p strong em

Next

Drought Stress: Responses and Mechanism in Plants

body p strong em

Next

Abstract

Abstract (required) ✓

Normal

Abstract

The function of water for plants is crucial, including playing the roles in metabolic reactions. The purpose of this article is to give information on the effects of drought stress on plant morphology, physiology, and biochemistry, as well as mitigation methods in dryland management for plant production. Plants manage drought stress by using three mechanisms. Drought escape is the ability of plants to accelerate flowering or life cycle, drought avoidance is the

body p

Next

5. Proses *correction/reviewers comments* (31 Maret 2022)

The screenshot shows a Gmail interface with a search bar at the top containing 'RAS'. The left sidebar shows navigation options like Mail, Chat, Spaces, and Meet. The main content area displays an email from 'Reviews in Agricultural Science' dated 31 Mar 2022, 11:13. The email subject is '[RAS] Your Submission' and it is marked as 'Eksternal' and 'Kotak Masuk x'. The sender's email is '<em@editorialmanager.com>'. The email content is in Indonesian and discusses reviewer comments on a manuscript titled 'Drought Stress: Responses and Mechanism in Plants' (Ref.: Ms. No. RAS-D-22-00010). The reviewer comments are as follows:

Dear Pamungkas,

Reviewers have now commented on your paper. You will see that they are advising that you revise your manuscript. If you are prepared to undertake the work required, I would be pleased to reconsider my decision.

For your guidance, reviewers' comments are appended below.

Reviewers' comments:

Reviewer #1: Abstract

1. Too long, see author guideline, and try to focus on the main issue and finding.
2. "Plants manage drought stress by using three mechanisms": this statement is not good because no detail explanation in abstract.
3. ...the conclusion...: I think it is better to not mention "conclusion", but directly state the main finding and implication (briefly)

Introduction:

1. Too many "water" for the first word in sentences, you must learn how to diversify it.
2. No aims is stated in introduction
3. I'm not sure whether this paper focus on Indonesian case, but author stated that this paper about Indonesian case.
4. 275-276: "one way"? I don't understand this

Results:

1. Figure 1 and other are not clear enough to be read, you must use good colour combination in order to all illustration can be understood.
2. Maybe it is better to add chapter about the drought stress management.

Conclusion:

1. I think the purpose of this paper need to be clearer, about drought stress or dryland plantation? Focus on theoretical framework of drought stress or optimizing dryland plantation?

Reviewer #2

The topics of your article is very important for crop production in arid area and climate. But the purpose of your paper is not clear as review article. You had better describe your original strategy, opinion and propose for crop production especially in the chapter of "conclusion". I will estimate your revised manuscript, and then make the final decision.

Berikut merupakan proses *correction for reviewers comments batch 1*:

Rev 1_List of Change_Saktiyono x Rev 1_Cover Letter_Saktiyono Sig x | +

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Draw Read aloud Ask Copilot 1 of 4

Dear
Editor in Chief Reviews in Agricultural Science,

I am Saktiyono Sigit Tri Pamungkas, representing on behalf of the manuscript (Suwanto, Suprayogi and Noor Farid). I wish to submit a revision of my paper according to the reviewers comment.

LIST OF CHANGE

Title: Drought Stress: Responses and Mechanism in Plants
Author: Saktiyono S.T. Pamungkas^{1)*}, Suwanto²⁾, Suprayogi²⁾, Noor Farid²⁾

Reviewer 1

No	Reviewer Comment	Response
1.	on abstract: Too long, see author guideline.	Thank you very much for your comment. I have revised it: I have corrected the abstract no more than 300 words according to the guidelines. In the abstract there are 273 word. You can find in line 26 to 46.
2.	on abstract: Try to focus on the main issue and finding.	Thank you very much for your comment. I have revised it: - I have corrected in the abstract. I have written the purpose of writing this review. You can find in line 28. - I have corrected in the abstract. I have focused on the topic of plant responses and mechanisms to drought stress. You can find in line 30 to 43.
3.	on abstract: "Plants manage drought stress by using three mechanisms": this statement is not good because no detail explanation in abstract.	Thank you very much for your comment. I have revised it: I have corrected the statement in the abstract. You can find in line 30.

Rev 1_List of Change_Saktiyono x Rev 1_Cover Letter_Saktiyono Sig x | +

File | D:/POLITEKNIK%20LPP/JURNAL%20SAKTI/RAS%20JEPANG/Bukti%20Dokumen%20Korespondensi/Cores_Rev%201/Rev%201_%2

Draw | Read aloud | Ask Copilot | 2 of 4

4.	on abstract: ...the conclusion...: I think it is better to not mention "conclusion", but directly state the main finding and implication (briefly).	Thank you very much for your comment. I have revised it: I have corrected the statement in the abstract. You can find in line 43 to 46.
5.	on introduction: Too many "water" for the first word in sentences, you must learn how to diversify it.	Thank you very much for your comment. I have revised it: in the introduction I have tried to improve by reducing the word 'water' in the sentence. You can find in line 57 to 96.
6.	on introduction: no aims is stated in introduction.	Thank you very much for your comment. I have revised it: I have added aims in introduction. You can find in line 54.
7.	on introduction: I'm not sure whether this paper focus on Indonesian case, but author stated that this paper about Indonesian case.	Thank you very much for your comment. I have revised it: I apologize for my mistake in writing the drought stress case in Indonesia. I intend to write about the impact of drought and its response to plants, but I hope this paper can be used as basic information about the impact of drought stress and its management efforts, especially on plant cultivation in Indonesia. I have corrected my cover letter.
8.	on Physiological Effects and Mechanisms: 275-276: "one way"? I don't understand this	Thank you very much for your comment. I have revised it: I have corrected the statement. You can find in line 276 to 278.
9.	on result: Figure 1 and other are not clear enough to be read, you must use good colour combination in order to all illustration can be understood.	Thank you very much for your comment. I have revised it: I have corrected figure size and colour combination. I hope these can be understood. You can find in line 889 to 890; 892 to 893; 895 to 896 and 898 to 899.

Rev 1_List of Change_Saktiyono x Rev 1_Cover Letter_Saktiyono Sig x | +

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Draw | Read aloud | Ask Copilot | 3 of 4

10.	on result: Maybe it is better to add chapter about the drought stress management.	Thank you very much for your comment. I have revised it: I have added chapter about the drought stress management. You can find in line 354 to 378.
11.	on conclusion: I think the purpose of this paper need to be clearer, about drought stress or dryland plantation? Focus on theoretical framework of drought stress or optimizing dryland plantation?	Thank you very much for your comment. I have revised it: I have corrected and focus on theoretical framework of drought stress impact and response to plants, but I added some management to reduce the impact of the drought stress. You can find in line 379 to 387.

Reviewer 2

No	Reviewer Comment	Response
Overall Comments		
1.	The topics of your article is very important for crop production in arid area and climate. But the purpose of your paper is not clear as review article.	Thank you very much for your comment. I have revised it: I have written purpose in the abstract and introduction. You can find in line 28 and 54. I have corrected and focus on theoretical framework of drought stress impact and response to plants, but I added some management to reduce the impact of the drought stress. You can find in line 379 to 387.
2.	You had better describe your original strategy, opinion and propose for crop production especially in the chapter of "conclusion".	Thank you very much for your comment. I have revised it: <ul style="list-style-type: none"> - I have added chapter about the drought stress management. Line 354 to 378. - The conclusion chapter briefly describes the impact of drought and some mitigation efforts that can be done. mitigation that is written is a conclusion from drought stress management. You can find in line 354 to 378 (chapter drought stress management) and 379 to 387 (chapter conclusion).

Rev 1_List of Change_Saktiyono × Rev 1_Cover Letter_Saktiyono Sig ×

File | D:/POLITEKNIK%20LPP/JURNAL%20SAKTI/RAS%20JEPANG/Bukti%20Dokumen%20Korespondensi/Cores_Rev%201/Rev%201_Cover%20..

Draw | Read aloud | Ask Copilot | 1 of 1

Dear
Editor in Chief Reviews in Agricultural Science,

I am Saktiyono Sigit Tri Pamungkas, representing on behalf of the manuscript (Suwarto, Suprayogi and Noor Farid). I wish to submit a review article entitled “Drought Stress: Responses and Mechanism in Plants” for consideration Reviews in Agricultural Science.

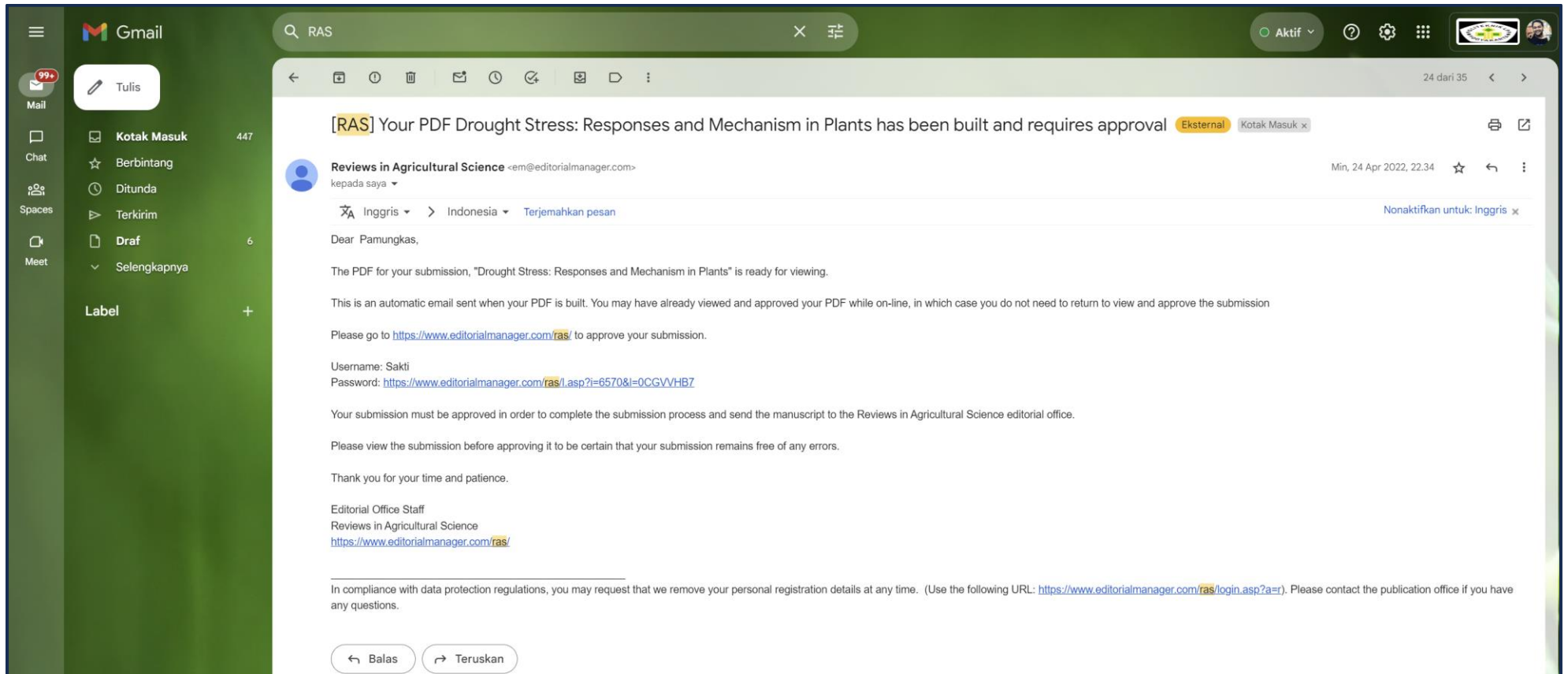
We confirm that this paper is original and has not been published elsewhere, nor is it currently under consideration for publication elsewhere.

In this paper, I explain how the impact of drought stress on plants that will affect growth and development in morphology, physiology and biochemistry, so that it affects crop yields and how to minimize drought stress for agricultural crop cultivation. I hope this paper can be used as a basic knowledge about the impact of drought stress so that early mitigation can be carried out in agricultural crop cultivation. I believe that this manuscript is appropriate for publication by Reviews in Agricultural Science because it matches with journal’s Aims & Scope.

I have no conflicts of interest to disclose.
Please address all correspondence concerning this manuscript to me at skt@polteklpp.ac.id
Thank you for your consideration of this manuscript.

Best regards,
Saktiyono Sigit Tri Pamungkas
Department of Plantation, Vocational Education, Polytechnic of LPP Yogyakarta
Jl. LPP No: 1 A, Balapan, Klitren, Gondokusuman, Yogyakarta, Special District of Yogyakarta,
55222, Indonesia

6. Proses *submission corrected manuscript* (24 April 2022)



The screenshot shows a Gmail interface with a search bar at the top containing "RAS". The left sidebar includes navigation options like Mail, Chat, Spaces, and Meet, along with a list of folders: Kotak Masuk (447), Berbintang, Ditunda, Terkirim, and Draft (6). The main content area displays an email from "Reviews in Agricultural Science" with the subject "[RAS] Your PDF Drought Stress: Responses and Mechanism in Plants has been built and requires approval". The email body contains the following text:

Dear Pamungkas,

The PDF for your submission, "Drought Stress: Responses and Mechanism in Plants" is ready for viewing.

This is an automatic email sent when your PDF is built. You may have already viewed and approved your PDF while on-line, in which case you do not need to return to view and approve the submission

Please go to <https://www.editorialmanager.com/ras/> to approve your submission.

Username: Sakti
Password: <https://www.editorialmanager.com/ras/l.asp?i=6570&i=0CGVVHB7>

Your submission must be approved in order to complete the submission process and send the manuscript to the Reviews in Agricultural Science editorial office.

Please view the submission before approving it to be certain that your submission remains free of any errors.

Thank you for your time and patience.

Editorial Office Staff
Reviews in Agricultural Science
<https://www.editorialmanager.com/ras/>

In compliance with data protection regulations, you may request that we remove your personal registration details at any time. (Use the following URL: <https://www.editorialmanager.com/ras/login.asp?a=r>). Please contact the publication office if you have any questions.

At the bottom of the email, there are two buttons: "Balas" (Reply) and "Teruskan" (Forward).

Gmail interface showing an email from "Reviews in Agricultural Science" with subject "[RAS] Submission Confirmation for RAS-D-22-00010R1". The email content includes a reference number, a title "Drought Stress: Responses and Mechanism in Plants", and a message stating that the journal has received the revised submission. It also provides a link to the Editorial Manager system for checking the manuscript status.

[RAS] Submission Confirmation for RAS-D-22-00010R1 Eksternal Kotak Masuk x

Reviews in Agricultural Science <em@editorialmanager.com> kepada saya ▾ Min, 24 Apr 2022, 22.37 ☆ ↶ ⋮

Inggris ▾ > Indonesia ▾ Terjemahkan pesan Nonaktifkan untuk: Inggris x

Ref.: Ms. No. RAS-D-22-00010R1
Drought Stress: Responses and Mechanism in Plants

Dear Pamungkas,

Reviews in Agricultural Science has received your revised submission.

You may check the status of your manuscript by logging onto Editorial Manager at (<https://www.editorialmanager.com/ras/>).

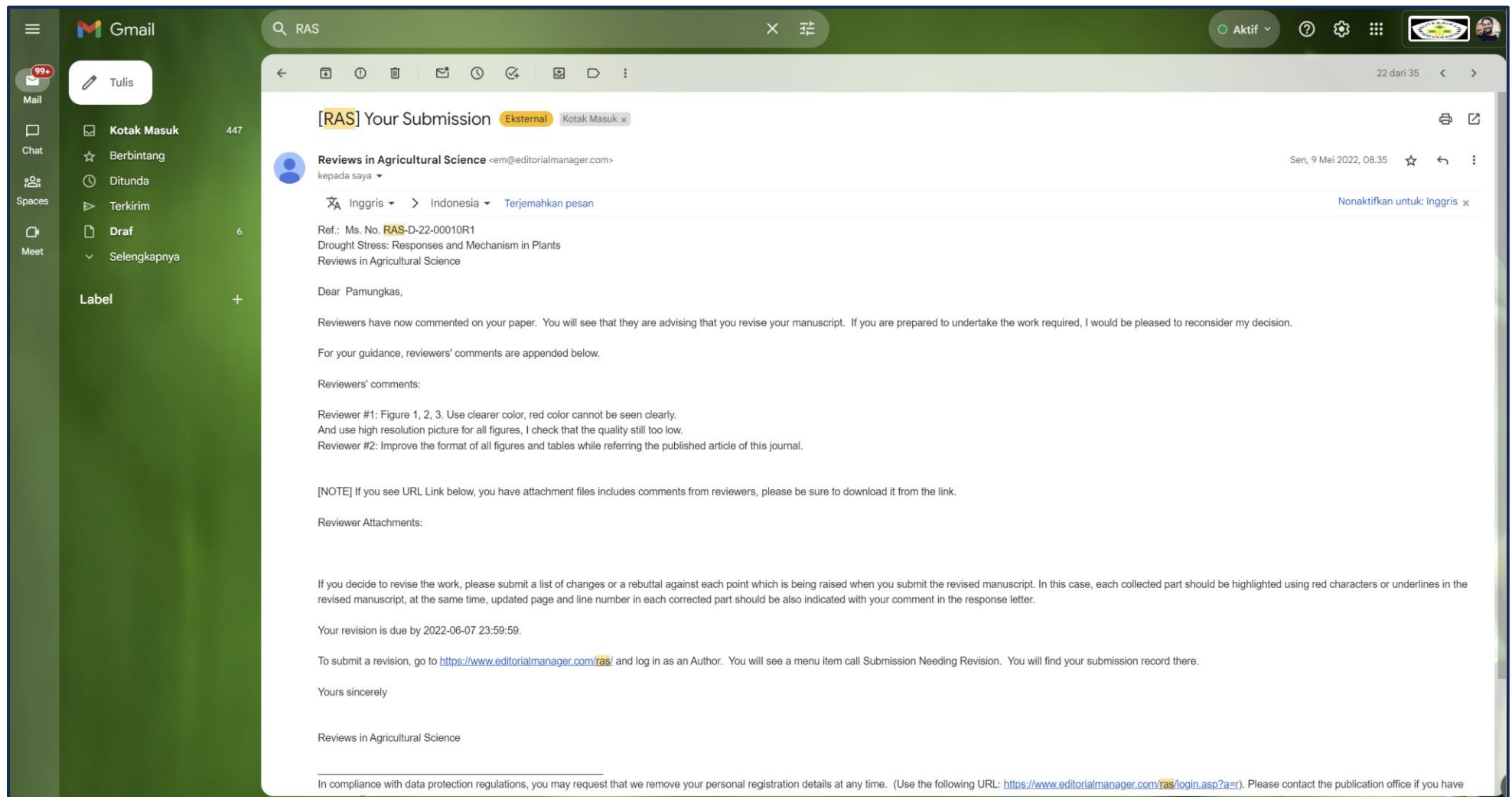
Kind regards,

Reviews in Agricultural Science

In compliance with data protection regulations, you may request that we remove your personal registration details at any time. (Use the following URL: <https://www.editorialmanager.com/ras/login.asp?a=r>). Please contact the publication office if you have any questions.

↶ Balas ↷ Teruskan

7. Proses *correction/reviewers comments* (9 Mei 2022)



The screenshot shows a Gmail interface with a search bar at the top containing 'RAS'. The left sidebar shows the 'Mail' section with 'Kotak Masuk' (447), 'Berbintang', 'Ditunda', 'Terkirim', 'Draf' (6), and 'Selengkapnya'. The main content area displays an email from 'Reviews in Agricultural Science' with the subject '[RAS] Your Submission'. The email body contains the following text:

Ref.: Ms. No. RAS-D-22-00010R1
Drought Stress: Responses and Mechanism in Plants
Reviews in Agricultural Science

Dear Pamungkas,

Reviewers have now commented on your paper. You will see that they are advising that you revise your manuscript. If you are prepared to undertake the work required, I would be pleased to reconsider my decision.

For your guidance, reviewers' comments are appended below.

Reviewers' comments:

Reviewer #1: Figure 1, 2, 3. Use clearer color, red color cannot be seen clearly. And use high resolution picture for all figures, I check that the quality still too low.
Reviewer #2: Improve the format of all figures and tables while referring the published article of this journal.

[NOTE] If you see URL Link below, you have attachment files includes comments from reviewers, please be sure to download it from the link.

Reviewer Attachments:

If you decide to revise the work, please submit a list of changes or a rebuttal against each point which is being raised when you submit the revised manuscript. In this case, each collected part should be highlighted using red characters or underlines in the revised manuscript, at the same time, updated page and line number in each corrected part should be also indicated with your comment in the response letter.

Your revision is due by 2022-06-07 23:59:59.

To submit a revision, go to <https://www.editorialmanager.com/ras/> and log in as an Author. You will see a menu item call Submission Needing Revision. You will find your submission record there.

Yours sincerely

Reviews in Agricultural Science

In compliance with data protection regulations, you may request that we remove your personal registration details at any time. (Use the following URL: <https://www.editorialmanager.com/ras/login.asp?a=r>). Please contact the publication office if you have

Berikut merupakan proses *correction for reviewers comments batch 2*:

Rev 1_ List of Change_Saktiyono × Rev 2_ List of Change_Saktiyono ×

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Dear,

Editor in Chief Reviews in Agricultural Science,

I am Saktiyono Sigit Tri Pamungkas, representing on behalf of the manuscript (Suwanto, Suprayogi and Noor Farid). I wish to submit a second revision of my paper according to the reviewers comment.

LIST OF CHANGE

Title: Drought Stress: Responses and Mechanism in Plants
 Author: Saktiyono S.T. Pamungkas¹⁾, Suwanto²⁾, Suprayogi²⁾, Noor Farid²⁾

Reviewer 1 and 2

No.	Reviewer Comment	Response
Overall Comments		
1.	Reviewer 1 Figure 1, 2, 3. Use clearer color, red color cannot be seen clearly. And use high resolution picture for all figures, I check that the quality still too low.	Thank you very much for your comment. I have revised it: - I have changed all the red color of the figures (1,2 and 3), I hope this is clearer. You can find in line 889, 892 and 895. - I have corrected and have changed all the resolutions of the figures (1,2,3 and 4) to use the dimensions of 10240 x 5760 pixels and a resolutions of 768 dpi. You can find in line 889, 892, 895 and 898.
2.	Reviewer 2 Improve the format of all figures and tables while referring the published article of this journal.	Thank you very much for your comment. I have revised it: - I have have changed all the resolutions of the figures (1,2,3 and 4) to use the dimensions of 10240 x 5760 pixels and a resolutions of 768 dpi. You can find in line 889, 892, 895 and 898. - I have improve the all of tables (1,2 and 3) by increasing the font size, I hope all the tables can be read clearly. You can find in line 879, 882 and 885.

Rev 1_List of Change_Saktiyono × Rev 2_List of Change_Saktiyono × Rev 2_Manuscript_Saktiyono Sigi × +

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Draw | Read aloud | Ask Copilot | 29 of 31

879 **Table 1. Water status relationship between water potential and soil water volume**

Water Status	Water Potential Status		Soil Water Status			Availability to Plant
	pF	Mpa	Sand	Clay	Loam	
Saturation	0	0	39%	50%	54%	Unavailable
Field Capacity	(-) 1-2,5	(-) 0,33	8-10%	20-35%	36-49%	Available
Wilting Point	(-) 4,2	(-) 1,5	4%	9%	29%	Unavailable

880 Source: [23,32] - modified

881

882 **Table 2. Plants responses to drought stress**

Drought Stress	Response		
	Morphology	Physiology	Biochemical
Strengthens the roots system (roots elongated)	Reduce leaf surface area	Stomatal closure	ABA synthesis
Rolling the leaves	Rolling the leaves	Decreasing photosynthesis	Decreased activity of rubisco
Dropping leaves	Dropping leaves	Increased ROS compounds	Accumulation of solute compounds (proline, glycine-betaïne, sugar)
Early flowering	Early flowering		Increased antioxidant compounds
			Drought tolerant gene expression

883 Source: [52] - modified

884

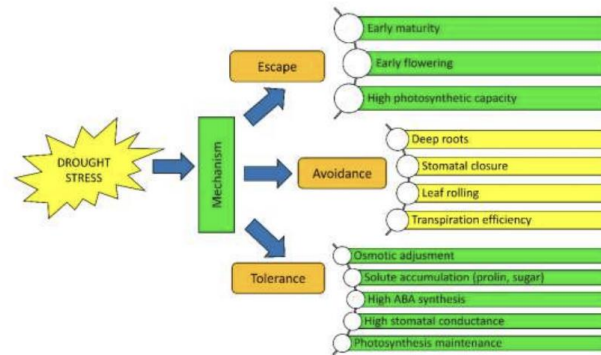
885 **Table 3. Relationship between drought stress and the sensitivity of plant metabolic processes**

Affected process	Sensitivity															
	Very susceptible					Susceptible					Unsusceptible					
(-) decreased	Pressure (Bar) (-)															
(+) increased	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Cell growth (-)																
Cell wall synthesis (-)*																
Protein synthesis (-)*																
Proto-chlorophyll formation (-)**																
Nitrate reductase (-)																
ABA Synthesis (+)																
Stomatal conductivity (-)																
Fixation of CO ₂ (-)																
Respiration																
Xylem conductivity (-)***																
Proline synthesis (+)																
Sugar synthesis (+)																

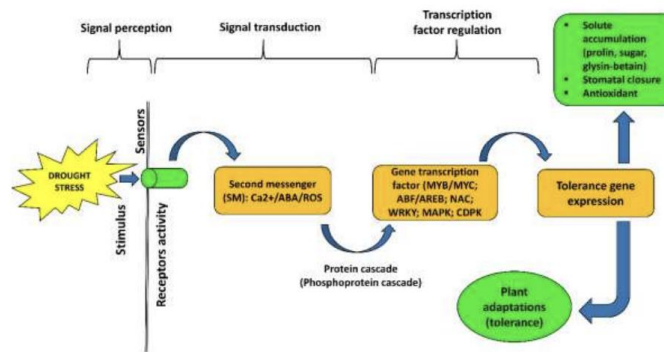
886 Note: *= fast growing tissue; **= etiolated leaves; ***= xylem dimension factor

887 Source: [36] - modified

888



889
890 **Figure 1. Crops mechanism in drought stress [65] - modified**
891



892
893 **Figure 2. Signaling plant networks against drought stress [11,72] - modified**
894

Rev 1_List of Change_Saktiyono x Rev 2_List of Change_Saktiyono x Rev 2_Manuscript_Saktiyono Sigi x

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Draw | Read aloud | Ask Copilot | 31 of 31

```

    graph LR
      A[DROUGHT STRESS] --> B[The effect]
      B --> C[Decreased in yields]
      B --- D[Decreased in water and nutrient uptake]
      B --- E[Decreased in seed weight and seed composition]
      B --- F[Decreased in germination rate]
      B --- G[Reduction in cell division, elongation and differentiation]
      B --- H[Reduction in root growth and development]
      B --- I[Reduction in number of leaves]
      B --- J[Reduction in flowering]
      B --- K[Reduction in chlorophyll contents]
      B --- L[Reduction in photosynthesis]
  
```

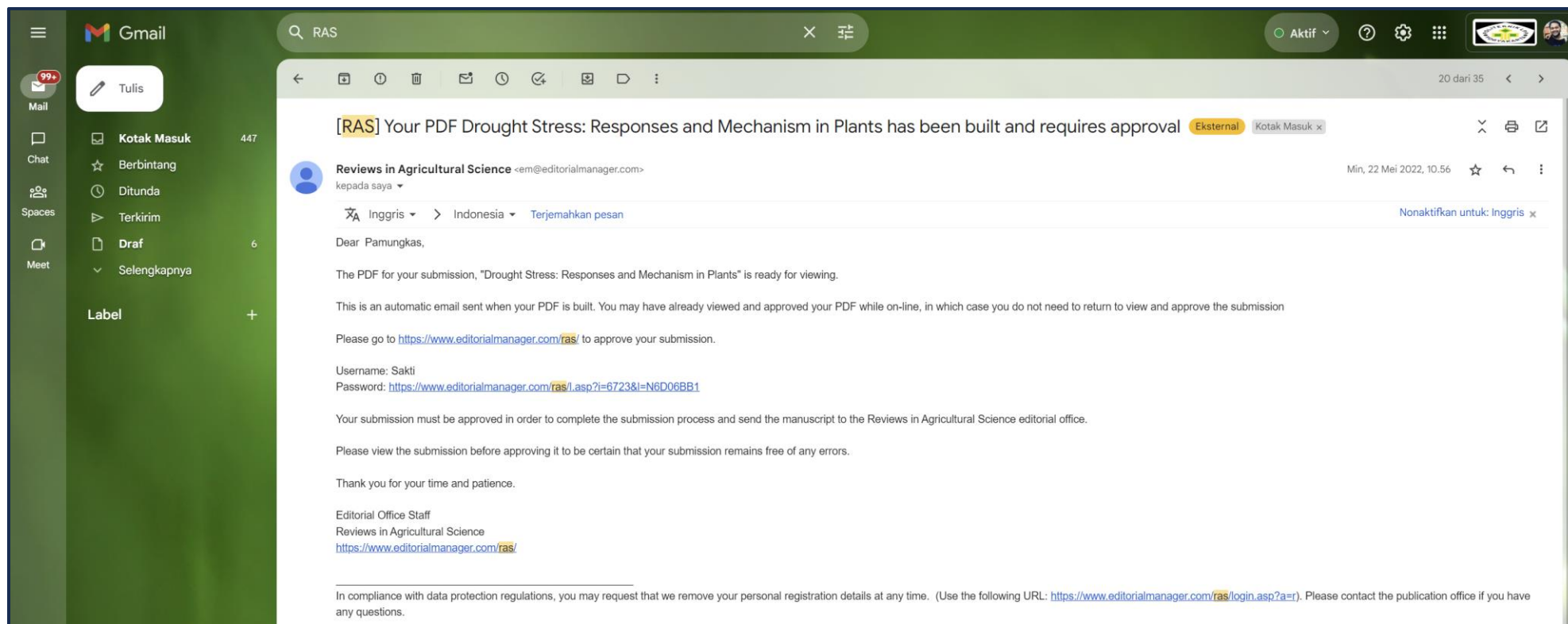
895
896 **Figure 3. The impact of drought stress on crops [137] - modified**
897

```

    graph LR
      A[Mitigation in drought stress] --> B[Increased in yields]
      A --- C[Use drought stress tolerance varieties]
      A --- D[Mechanical soil conservation]
      A --- E[Good irrigation system]
      A --- F[Biology conservation]
      A --- G[In vitro selection of drought tolerant]
      A --- H[Osmo-protectant application]
  
```

898
899 **Figure 4. Mitigation in drought stress**
900
901

8. Proses approved the submission and submission confirmation for RAS (22 Mei 2022)



The screenshot shows a Gmail interface with a dark green sidebar on the left. The main content area displays an email from 'Reviews in Agricultural Science' with the subject '[RAS] Submission Confirmation for RAS-D-22-00010R2'. The email body contains the following text:

Ref.: Ms. No. RAS-D-22-00010R2
Drought Stress: Responses and Mechanism in Plants

Dear Pamungkas,

Reviews in Agricultural Science has received your revised submission.

You may check the status of your manuscript by logging onto Editorial Manager at (<https://www.editorialmanager.com/ras/>).

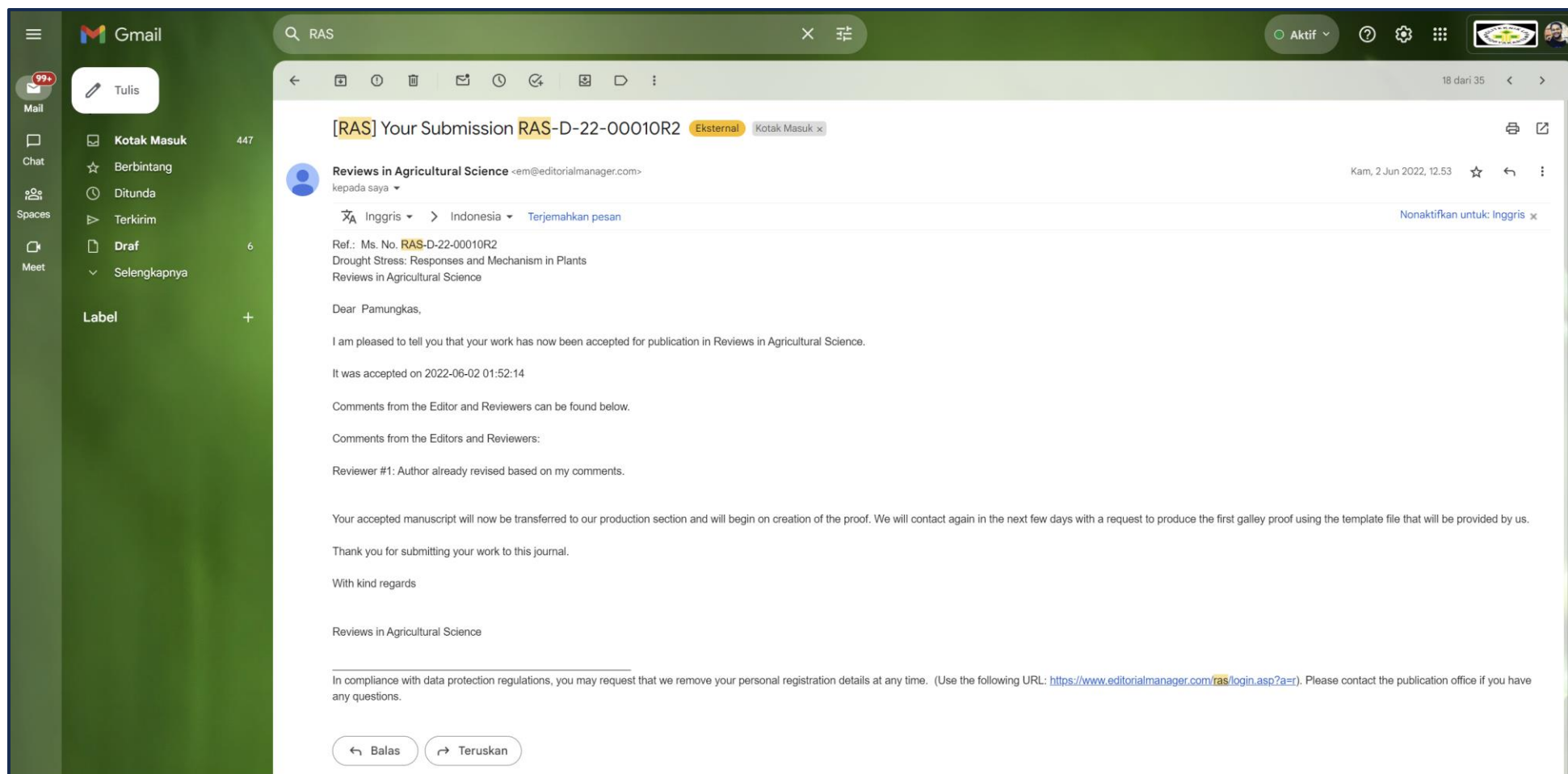
Kind regards,

Reviews in Agricultural Science

In compliance with data protection regulations, you may request that we remove your personal registration details at any time. (Use the following URL: <https://www.editorialmanager.com/ras/login.asp?a=r>). Please contact the publication office if you have any questions.

At the bottom of the email, there are two buttons: 'Balas' (Reply) and 'Teruskan' (Forward).

9. Proses *the manuscript was accepted to publish* (2 Juni 2022)



Gmail interface showing an email from Masateru Senge (senge@gifu-u.ac.jp) regarding the publication of a paper in "Reviews in Agricultural Science".

[RAS] Ready to publish (RAS-D-22-00010) Eksternal Kotak Masuk x

千家 正照 <senge@gifu-u.ac.jp> kepada saya

Ingggris > Indonesia Terjemahkan pesan Nonaktifkan untuk: Inggris x

Dear Author,

I am Masateru SENGE, the chief editor of "Reviews in Agricultural Science".

We would like to appreciate your submission to our journal. And congratulation for accepting your paper; title is Drought Stress: Responses and Mechanism in Plants" by our journal. Now, please remake your manuscript by using the file "RAS_Template20220207.docx" while referring to "instruction of template.pdf".

References_list_format_RAS 20220220.docx and "Sample.pdf" which are attached with this e-mail.

If you make it completely, kindly send the "Word" and "pdf" files of your new manuscript to me by e-mail (senge@gifu-u.ac.jp) for uploading it on the site of J-stage as follows. <https://www.jstage.jst.go.jp/browse/ras-char/ja/>

And please send me the pdf file of "Copyright Transfer Agreement Form" with your signature that will be filled in.

If you have questions, don't hesitate to ask me by e-mail. The temporary deadline is 15th June, 2022. If you will receive this e-mail, please send me by return e-mail at once.

My Best Regards,
Masateru Senge PhD,
Gifu University, Japan
...

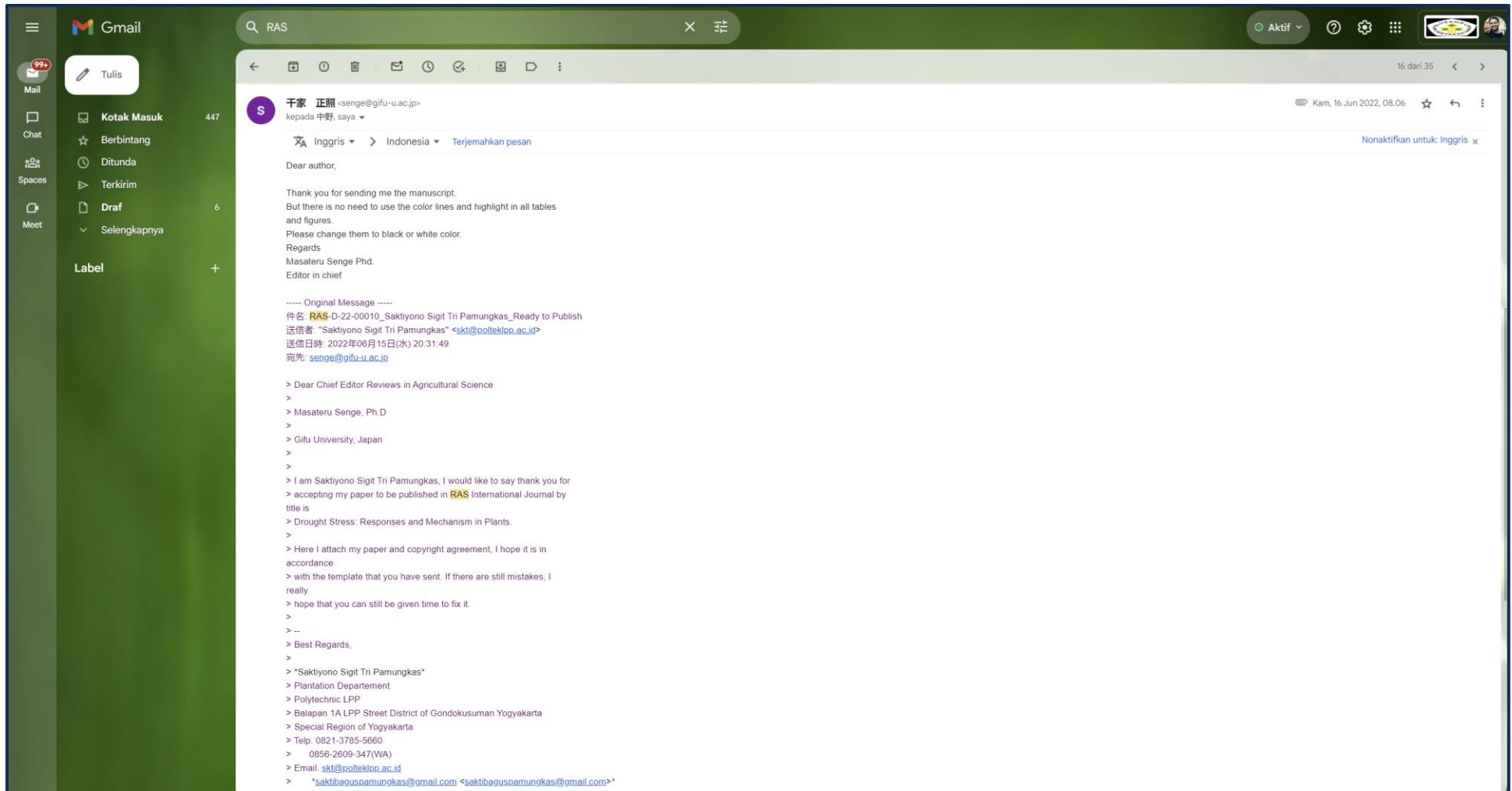
[Pesan dipotong] [Lihat seluruh email](#)

5 Lampiran • Dipindai dengan Gmail

- CopyrightAgree...
- RAS_Template 20...
- Instruction of te...
- Sample.pdf
- References_list_f...

Thank you for your mail. Ok, I will do it. Received, thank you.

10. Proses finalisasi publikasi (2 – 26 Juni 2022)



Gmail interface showing an email from Saktiyono Sigit Tri Pamungkas to Masateru Senge, Ph.D. at Gifu University, Japan. The email subject is "RAS-D-22-00010_Saktiyono Sigit Tri Pamungkas_Ready to Publish". The email content includes a thank you message, a request to change table and figure colors, and contact information for correspondence.

Subject: RAS-D-22-00010_Saktiyono Sigit Tri Pamungkas_Ready to Publish

From: Saktiyono Sigit Tri Pamungkas <skt@poltekipp.ac.id> kepada senge

To: Masateru Senge, Ph.D. Gifu University, Japan

Dear Chief Editor Reviews in Agricultural Science

I am Saktiyono Sigit Tri Pamungkas, I would like to say thank you for accepting my paper to be published in **RAS** International Journal by title is Drought Stress: Responses and Mechanism in Plants*. Here I attach my paper and copyright agreement, I hope it is in accordance with the template that you have sent (change all tables and figures to black or white color). If there are still mistakes, I really hope that you can still be given time to fix it.

Please address all correspondence concerning this manuscript to me at skt@poltekipp.ac.id

My Best Regards,
Saktiyono Sigit Tri Pamungkas
Polytechnic of LPP, Yogyakarta, Indonesia

Best Regards,
Saktiyono Sigit Tri Pamungkas
Plantation Departement
Polytechnic LPP
Balapan 1A LPP Street District of Gondokusuman Yogyakarta
Special Region of Yogyakarta
Telp. 0821-3785-5660
0856-2609-347(WA)
Email. skt@poltekipp.ac.id
saktibagusnamungkas@gmail.com

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- Saktiyono_RAS_R...

Buttons: Balas, Teruskan

Gmail interface showing an email from Masateru Senge Ph.D. (千家 正昭) regarding a manuscript correction. The email is in Indonesian and includes contact information for the sender, who is the Editor in Chief at Gifu University. Two PDF attachments are visible: "RAS10-14 final 1.p..." and "RAS10-14 final 2....".

Please check (RAS) Eksternal Kotak Masuk x

千家 正昭 <senge@gifu-u.ac.jp>
kepada saya

Jum, 24 Jun 2022, 22:26

Inggris Indonesia Terjemahkan pesan

Dear author,

Please check your submitted manuscript corrected by me soon.
If there are some problems in my revision, please write your comments on the attached file "RAS10-14 final1".

Regards
Masateru Senge Ph.D.
Editor in chief

=====
千家正昭 (特任教授)
岐阜大学 応用生物科学部
ユニオン・インフラメンテナス共同研究講座

〒501-1193 岐阜市柳戸1-1
電話 & FAX 058-293-2877
電子メール senge@gifu-u.ac.jp
U R L <http://www.abios.gifu-u.ac.jp/tdunion/>

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...

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2 Lampiran • Dipindai dengan Gmail

RAS10-14 final 1.p... RAS10-14 final 2....

Gmail interface showing an email thread. The left sidebar contains navigation options: Mail (99+), Tulis, Kotak Masuk (447), Chat, Berbintang, Ditunda, Terkirim, Spaces, Draf (6), Selengkapnya, and Label (+).

The main email content shows a conversation between 千家 正照 (senge@gifu-u.ac.jp) and Saktiyono Sigit Tri Pamungkas (skt@poitekipp.ac.id).

From: 千家 正照 (senge@gifu-u.ac.jp)
 kepada saya
 14 dari 35
 Min, 26 Jun 2022, 14.00
 Nonaktifkan untuk: Inggris x

Inggris > Indonesia Terjemahkan pesan

I cannot revise the following parts.

1. P.175 L.7, [45, 45?]==>????
2. P.175 L.26: "Plant growth due to low CO2 absorption [134]"==> This is not sentence !!!!

Please improve these parts.

 > *Saktiyono Sigit Tri Pamungkas*
 > Plantation Departement
 > Polytechnic LPP
 > Balapan 1A LPP Street District of Gondokusuman Yogyakarta
 > Special Region of Yogyakarta
 > Telp. 0821-3785-5660
 > 0856-2609-347(WA)
 > Email skt@poitekipp.ac.id
 > *saktibaguspamungkas@gmail.com <saktibaguspamungkas@gmail.com>*

From: Saktiyono Sigit Tri Pamungkas (skt@poitekipp.ac.id)
 kepada senge
 Min, 26 Jun 2022, 22.33

Dear Chief Editor Reviews in Agricultural Science
 Masateru Senge, Ph.D
 Gifu University, Japan

Thank you very much for your comment and reminding me of my inaccuracy.

1. P.175 L.7; [45, 45?]==>????
 The reference used is [119, 45] not [45, 45]
2. P.175 L.26: "Plant growth due to low CO2 absorption [134]."==> This is not sentence !!!!
 The sentence I should have written is 'Stomata closure is a response that occurs when plants have a lack of water wich will ultimately reduce plant growth rates due to low CO2 absorption [134]'
3. P.169 L.12
 abbreviation 'sea surface temperature' is 'SST' not 'SML'

Please address all correspondence concerning this manuscript to me at skt@poitekipp.ac.id

Gmail interface showing an email titled "Announcement of RAS Latest Issue". The email content includes:

Dear Pamungkas,

We are pleased to inform that the 1st reviews for volume 10 (2022) are available now. It was posted online on July 15 in our platform J-STAGE.

"Seismic Deformation of Earth Dams: A State-of-the-art Review" authored by Phuong Hong Le, Shin-ichi Nishimura, Tatsuhiro Nishiyama, Chen Fang and Thai Canh Nguyen https://www.jstage.jst.go.jp/article/ras.10/0/10_138/_article


"Comparative Characteristics of Venison Produced in Russia, Spain and New Zealand" authored by Vasily Vladimirovich Verkhoturov, Elena Viktorovna Ulrikh, Evgeny Alekseevich Zell and Natalya Yuryevna Romanenko https://www.jstage.jst.go.jp/article/ras.10/0/10_155/_article-char/ja

"Drought Stress: Responses and Mechanism in Plants" authored by Saktiyono Sigit Tri Pamungkas, Suwanto, Suprayogi and Noor Farid https://www.jstage.jst.go.jp/article/ras.10/0/10_169/_article-char/ja

"Soil Contamination by Silver and Assessment of Its Ecotoxicity" authored by Natalia Tsepina, Sergey Kolesnikov, Tatiana Minnikova, Alena Timoshenko and Kamil' Kazeev https://www.jstage.jst.go.jp/article/ras.10/0/10_186/_article-char/ja

Thanks for your continued support to *Reviews in Agricultural Science* e-journal.

Best regards,
Masateru SENGE, Ph.D.
Editorial Office



Reviews in Agricultural Science

A red arrow points to the article link for "Drought Stress: Responses and Mechanism in Plants".

Reviews in Agricultural Science

Online ISSN : 2187-090X

資料トップ 巻号一覧 この資料について

J-STAGEトップ / Reviews in Agricultural Scienc ... / 10 巻 (2022) / 書誌

Drought Stress: Responses and Mechanism in Plants

Saktiyono Sigit Tri Pamungkas, Suwanto, Suprayogi, Noor Farid

✚ 著者情報

キーワード: drought stress, dryland management, osmotic adjustment

ジャーナル フリー HTML

2022 年 10 巻 p. 168-185

DOI https://doi.org/10.7831/ras.10.0_168

✚ 詳細

記事の概要

- > 抄録
- > 引用文献 (164)
- > 図 (4)
- > 著者関連情報

共有する



抄録

The function of water for plants is crucial, including playing the roles in metabolic reactions. The aims of this article are to give information on the effects of drought stress on plant morphology, physiology, and biochemistry, as well as mitigation methods in drought stress management for plant production. Plants manage drought stress using a mechanism, namely drought escape, drought avoidance and drought tolerance. Drought escape is the ability of plants to accelerate flowering or life cycle, drought avoidance is the ability of plants to reduce water loss and increase water absorption through morphological changes in the root system, drought tolerance is the plant adaptation to drought by changes in plant physiological and biochemical processes. Physiological changes that occur include closing the stomata and decreased photosynthesis. The biochemical responses include the synthesis of solute compounds as a form of osmotic

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Drought Stress: Responses and Mechanism in Plants

Saktiyono Sigit Tri Pamungkas, Suwanto, Suprayogi, Noor Farid

⊕ Author information

Keywords: drought stress, dryland management, osmotic adjustment

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2022 Volume 10 Pages 168-185

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Abstract

The function of water for plants is crucial, including playing the roles in metabolic reactions. The aims of this article are to give information on the effects of drought stress on plant morphology, physiology, and biochemistry, as well as mitigation methods in drought stress management for plant production. Plants manage drought stress using a mechanism, namely drought escape, drought avoidance and drought tolerance. Drought escape is the ability of plants to accelerate flowering or life cycle, drought avoidance is the ability of plants to reduce water loss and increase water absorption through morphological changes in the root system, drought tolerance is the plant adaptation to drought by changes in plant physiological and biochemical processes. Physiological changes that occur include closing the stomata and decreased photosynthesis. The biochemical responses include the synthesis of solute compounds as a form of osmotic

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Pamungkas *et al.* *Reviews in Agricultural Science*, 10:168–185, 2022
https://doi.org/10.7831/ras.10.0_168

REVIEWS **OPEN ACCESS**

Drought Stress: Responses and Mechanism in Plants

Saktiyono Sigit Tri Pamungkas^{1*}, Suwanto², Suprayogi² and Noor Farid²

¹ Department of Plantation, Polytechnic of LPP, Yogyakarta, Jl. LPP No: 1 A, Balapan, Gondokusuman, Yogyakarta, 55222, Indonesia
² Department of Plant Breeding, Agriculture Faculty, University of Jenderal Soedirman, Purwokerto, Jl. DR. Soeparno No: 63, Karangwangkal, Purwokerto Utara, Banyumas, 53122, Indonesia

ABSTRACT

The function of water for plants is crucial, including playing the roles in metabolic reactions. The aims of this article are to give information on the effects of drought stress on plant morphology, physiology, and biochemistry, as well as mitigation methods in drought stress management for plant production. Plants manage drought stress using a mechanism, namely drought escape, drought avoidance and drought tolerance. Drought escape is the ability of plants to accelerate flowering or life cycle, drought avoidance is the ability of plants to reduce water loss and increase water absorption through morphological changes in the root system, drought tolerance is the plant adaptation to drought by changes in plant physiological and biochemical processes. Physiological changes that occur include closing the stomata and decreased photosynthesis. The biochemical responses include the synthesis of solute compounds as a form of osmotic adjustment in the cell called osmotic adjustment to reduce water loss from the cell. The biochemical indicators are the increased concentrations of abscisic acid (ABA), proline, and sugar (trehalose). ABA acts as a signal to stimulate stomatal closure to reduce the transpiration rate. Proline is an indicator of plants adapting to drought stress, playing a role in the osmotic adjustment of cells to retain in the cell. Trehalose is a compatible sugar acting as an osmoprotectant, it can maintain the integrity of cell membranes (water replacement) and form hydrogen bonds (water entrapment). Plants under drought stress conditions can adapt by making morphological, physiological, and biochemical responses by osmotic adjustment. These conditions need to be managed so that appropriate strategies and technologies are needed as mitigation measures.

Keywords

drought stress, dryland management, osmotic adjustment

1. Introduction

The aims of this article are to give information on the effects of drought stress on plant morphology, physiology, and biochemistry, as well as mitigation methods in drought stress management for plant production. Water is a vital requirement for the survival of plants. Plant tissues are composed mostly of these, which are about 80% to 95%, predominantly found in the cytoplasm and vacuoles [1]. However, some tissues have a content of about 10–15%, one of which is dormant seeds [2]. Water is a major factor in plant growth since it is needed by plants to carry out physiological processes [3]. In plants, these are the main molecule that makes up protoplasm (cytoplasm, nucleus, and organelles) [4]. Besides that, these is a solvent for dissolved substances in cells. If water is used as a solvent for acidic or alkaline components, it will be positively charged (K^+ , Ca^{++} , NH_4^+) or negatively charged (NO_3^- , SO_3^- , HPO_4^-), respectively. The functions of these as a medium for metabolic and physiological reactions in plants, in

11. Bukti dokumen koreksi (batch 1 dan 2 terlampir)

Lampiran:

1. Correction list (reviewer 1 and 2) batch 1
2. Correction manuscript batch 1
3. Correction list (reviewer 1 and 2) batch 2
4. Correction manuscript batch 2
5. Cover letter submission

Dear

Editor in Chief Reviews in Agricultural Science,

I am Saktiyono Sigit Tri Pamungkas, representing on behalf of the manuscript (Suwanto, Suprayogi and Noor Farid). I wish to submit a revision of my paper according to the reviewers comment.

LIST OF CHANGE

Title: Drought Stress: Responses and Mechanism in Plants

Author: Saktiyono S.T. Pamungkas^{1)*}, Suwanto²⁾, Suprayogi²⁾, Noor Farid²⁾

Reviewer 1

No	Reviewer Comment	Response
1.	on abstract: Too long, see author guideline.	Thank you very much for your comment. I have revised it: I have corrected the abstract no more than 300 words according to the guidelines. In the abstract there are 273 word. You can find in line 26 to 46.
2.	on abstract: Try to focus on the main issue and finding.	Thank you very much for your comment. I have revised it: - I have corrected in the abstract. I have written the purpose of writing this review. You can find in line 28. - I have corrected in the abstract. I have focused on the topic of plant responses and mechanisms to drought stress. You can find in line 30 to 43.
3.	on abstract: "Plants manage drought stress by using three mechanisms": this statement is not good because no detail explanation in abstract.	Thank you very much for your comment. I have revised it: I have corrected the statement in the abstract. You can find in line 30.

4.	<p>on abstract:</p> <p>...the conclusion...: I think it is better to not mention "conclusion", but directly state the main finding and implication (briefly).</p>	<p>Thank you very much for your comment.</p> <p>I have revised it: I have corrected the statement in the abstract. You can find in line 43 to 46.</p>
5.	<p>on introduction:</p> <p>Too many "water" for the first word in sentences, you must learn how to diversify it.</p>	<p>Thank you very much for your comment.</p> <p>I have revised it: in the introduction I have tried to improve by reducing the word 'water' in the sentence. You can find in line 57 to 96.</p>
6.	<p>on introduction:</p> <p>no aims is stated in introduction.</p>	<p>Thank you very much for your comment.</p> <p>I have revised it: I have added aims in introduction. You can find in line 54.</p>
7.	<p>on introduction:</p> <p>I'm not sure whether this paper focus on Indonesian case, but author stated that this paper about Indonesian case.</p>	<p>Thank you very much for your comment.</p> <p>I have revised it: I apologize for my mistake in writing the drought stress case in Indonesia. I intend to write about the impact of drought and its response to plants, but I hope this paper can be used as basic information about the impact of drought stress and its management efforts, especially on plant cultivation in Indonesia. I have corrected my cover letter.</p>
8.	<p>on Physiological Effects and Mechanisms:</p> <p>275-276: "one way"? I don't understand this</p>	<p>Thank you very much for your comment.</p> <p>I have revised it: I have corrected the statement. You can find in line 276 to 278.</p>
9.	<p>on result:</p> <p>Figure 1 and other are not clear enough to be read, you must use good colour combination in order to all illustration can be understood.</p>	<p>Thank you very much for your comment.</p> <p>I have revised it: I have corrected figure size and colour combination. I hope these can be understood. You can find in line 889 to 890; 892 to 893; 895 to 896 and 898 to 899.</p>

10.	<p>on result:</p> <p>Maybe it is better to add chapter about the drought stress management.</p>	<p>Thank you very much for your comment.</p> <p>I have revised it: I have added chapter about the drought stress management. You can find in line 354 to 378.</p>
11.	<p>on conclusion:</p> <p>I think the purpose of this paper need to be clearer, about drought stress or dryland plantation? Focus on theoretical framework of drought stress or optimizing dryland plantation?</p>	<p>Thank you very much for your comment.</p> <p>I have revised it: I have corrected and focus on theoretical framework of drought stress impact and response to plants, but I added some management to reduce the impact of the drought stress. You can find in line 379 to 387.</p>

Reviewer 2

No	Reviewer Comment	Response
Overall Comments		
1.	<p>The topics of your article is very important for crop production in arid area and climate. But the purpose of your paper is not clear as review article.</p>	<p>Thank you very much for your comment.</p> <p>I have revised it: I have written purpose in the abstract and introduction. You can find in line 28 and 54.</p> <p>I have corrected and focus on theoretical framework of drought stress impact and response to plants, but I added some management to reduce the impact of the drought stress. You can find in line 379 to 387.</p>
2.	<p>You had better describe your original strategy, opinion and propose for crop production especially in the chapter of "conclusion".</p>	<p>Thank you very much for your comment.</p> <p>I have revised it:</p> <ul style="list-style-type: none"> - I have added chapter about the drought stress management. Line 354 to 378. - The conclusion chapter briefly describes the impact of drought and some mitigation efforts that can be done. mitigation that is written is a conclusion from drought stress management. You can find in line 354 to 378 (chapter drought stress management) and 379 to 387 (chapter conclusion).

Best regards,

Saktiyono Sigit Tri Pamungkas

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1 Title: Drought Stress: Responses and Mechanism in Plants

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3 Total number of words: 9,898 words

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26 **Abstract:**

27 The function of water for plants is crucial, including playing the roles in metabolic reactions.
28 The aims of this article is to give information on the effects of drought stress on plant
29 morphology, physiology, and biochemistry, as well as mitigation methods in drought stress
30 management for plant production. Plants manage drought stress using a mechanisms, namely
31 drought escape, drought avoidance and drought tolerance. Drought escape is the ability of
32 plants to accelerate flowering or life cycle, drought avoidance is the ability of plants to reduce
33 water loss and increase water absorption through morphological changes in the root system,
34 drought tolerance is the plant adaptation to drought by changes in plant physiological and
35 biochemical processes. Physiological changes that occur include closing the stomata and
36 decreased photosynthesis. The biochemical responses include the synthesis of solute
37 compounds as a form of osmotic adjustment in the cell called osmotic adjustment to reduce
38 water loss from the cell. The biochemical indicators are the increased concentrations of abscisic
39 acid (ABA), proline, and sugar (trehalose). ABA acts as a signal to stimulate stomatal closure
40 to reduce the transpiration rate. Proline is an indicator of plants adapting to drought stress,
41 playing a role in the osmotic adjustment of cells to retain in the cell. Trehalose is a compatible
42 sugar acting as an osmoprotectant, it can maintain the integrity of cell membranes (water
43 replacement) and form hydrogen bonds (water entrapment). Plants under drought stress
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45 osmotic adjustment. These conditions need to be managed so that appropriate strategies and
46 technologies are needed as mitigation measures.

47

48 **Keywords:** Drought Stress, Dryland Management, Osmotic Adjustment

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53 Introduction

54 The aims of this article is to give information on the effects of drought stress on plant
55 morphology, physiology, and biochemistry, as well as mitigation methods in drought stress
56 management for plant production. Water is a vital requirement for the survival of plants. Plant
57 tissues are composed mostly of these, which is about 80% to 95%, predominantly found in the
58 cytoplasm and vacuoles [1] . However, some tissues have a content is about 10-15%, one of
59 which is dormant seeds [2] . Water is a major factor in plant growth since it is needed by plants
60 to carry out physiological processes [3]. In plants, these is the main molecule that makes up
61 protoplasm (cytoplasm, nucleus, and organelles) [4]. Besides that these is a solvent for
62 dissolved substances in cells. If water is used as a solvent for acidic or alkaline components, it
63 will be positively charged (K^+ , Ca^{++} , NH_4^+) or negatively charged (NO_3^- , SO_3^- , HPO_4^-),
64 respectively. The functions of these as a medium for metabolic and physiological reactions in
65 plants, in which metabolic and physiological activities can decrease when there is a lack of
66 water and also plays a role as a medium for transporting essential nutrients and minerals from
67 the soil so that a lack of water can reduce the rate of nutrient uptake from the soil by roots [5].
68 These is also one of the main factors determining plant production related to biomass production
69 and transpiration rate [6]. Water will affect cell turgidity, thereby affecting the process of
70 opening and closing stomata. The conversion of sunlight will be reduced if the stomata are
71 closed, which will affect the photosynthesis results [7]. These is also affects transpiration in
72 plants, in which more water will increase the transpiration rate and vice versa [8].
73 Plants will always be exposed to various stress conditions, including biotic stresses such as
74 pests, pathogens, viruses, nematodes [9], and abiotic stresses, namely drought, water saturation,
75 temperature, and salinity . One of the stresses influencing the growth and yield of cultivated
76 plants is drought [10]. According to the agronomic point of view, drought is defined as the
77 relationship between moisture and water availability in the soil. These absorption and dissolved
78 mineral nutrients decrease when there is a lack in the soil [12]. Disruption in the absorption
79 process disrupts metabolic processes, impacting plant physiological and morphological
80 functions, which can affect yields [11]. Drought occurs due to climate change and soil type. All
81 regions in the world with a share of seawater will experience El Nino, a condition in which the
82 sea surface temperature (SML) warms up, resulting in a long drought that decreases the water
83 availability, which is predicted to affect the rate of evapotranspiration [13]. In Indonesia, in the
84 range of 2019, El Nino had an impact on the expansion of dryland areas almost three times
85 compared to that in 2017 [14]. The characteristics of soil types are very diverse [15], so the

86 ability of the soil to hold water in field capacity varies according to the soil texture [16,17].
87 Sandy soil type can hold water about 2.1 in/ft, clay can hold **these** around 3.8 in/ft, while clay
88 soils can hold **these** around 4.4 in/ft [18].
89 **In the soil these is** divided into four types, including chemical, hygroscopic, capillary, and
90 groundwater [19]. Chemical water **located in** the soil surface that still contains chemicals (**from**
91 **rain**) and is a type of soil that is not available to plants. **Hygroscopic is strongly** bound by the
92 soil (permeates). **Capillary fills** the capillary pores (infiltration) in the soil with a greater
93 cohesive force than the adhesion force on soil particles, making it available to plants. **Whereas**
94 **groundwater can continue** to fall to the bottom layer due to the influence of gravity
95 (percolation). **Available of these is defined as the condition or difference between the amount**
96 **of the field capacity and the amount of the wilting point** [20]. Field capacity is the amount of
97 capillary in the soil, while the wilting point is the amount of hygroscopic water in the soil that
98 makes water unavailable [21].

99 **Water Deficit**

100 The ideal soil composition consists of 45% mineral content, 25% water, 25% air, and 5%
101 organic matter [22,23] . This condition will stabilize the water tension at field capacity (pF) on
102 the soil, stabilizing the force of attraction between water molecules (cohesion) and between
103 water molecules and soil particles (adhesion) becomes. If cohesion is stronger than adhesion,
104 the water can't be bound by soil pores [24,25] . In addition to being influenced by the adhesive
105 power, the soil's ability to bind water also depends on the type of soil. The higher the clay
106 content of the soil, the lower the adhesion force, causing a low pF value, resulting in water
107 saturation so that water is not available. On the other hand, low cohesion will result in a high
108 pF value, which in turn causes a water deficit [26,27]. Besides being influenced by pF, it is also
109 influenced by water potential [28,29]. At a pressure of 0 Mpa, the soil is saturated with water,
110 while -0.33 Mpa at field capacity conditions and -1.5 to -3 Mpa is the permanent wilting point
111 [30,31]. In addition to the influence of pressure, according to Easton [23] and Datta *et al.* [32],
112 the volume of water in the soil also depends on the type of soil to bind water so that it will
113 determine water saturation (sand: 39%, clay: 50%, clay: 54 %), field capacity (sand: 8-10%,
114 clay: 20-35%, clay: 36-49%) and permanent wilting point (sand: 4%, clay: 9%, clay: 29%). A
115 high pF value will lead to high percolation, resulting in water loss and a low groundwater
116 potential. Otherwise, a low pF value causes low water holding capacity with the soil pores
117 (adhesion), resulting in low groundwater potential.

118 In drought conditions, plants will lack water in the rhizosphere (around plant roots), decreasing
119 groundwater potential (Ψ_w) and increasing osmotic potential in plant cells (Ψ_s), which decrease
120 plant cell turgor pressure (Ψ_p) (-) [33,34] . Such conditions must be balanced by maintaining
121 cell turgor pressure to remain in a positive condition. Turgor pressure (Ψ_p) that has a positive
122 value depends on the ability of plant cells to balance the value of Ψ_w and the value of Ψ_s with
123 a certain scheme. This condition is called osmotic adjustment in plant cells (osmotic
124 adjustment), shown in an equation of $\Psi_w = \Psi_s + \Psi_p$ [35,36] .

125 Turgor pressure affects the shape, reaction, and cell changes in plants. Water deficit in grains
126 (barley and corn) was reported to decrease cell turgor pressure [37,38]. Under decreased
127 turgidity, water molecules leave the cell. If water continues to leave the cell, the cell loses
128 flexibility, resulting in wilting [39]. To prevent water from leaving the cell, the cell applies an
129 osmoregulation mechanism to maintain the turgor pressure remains positive (+). If transpiration
130 continues to occur, while the water absorption process continues to decrease, the cell is no
131 longer able to maintain turgidity, other than wilting, if the plant is unable to recover, the plant
132 may die [40]. Water deficit in plants can affect morphology and physiology. At the
133 morphological level, water deficit will cause the leaves to wither, the leaves to shrink, curling
134 leaves, the small number of leaves, the elongated roots [41,42], and early flowering [43]. At the
135 physiological level, it can disrupt metabolism, thereby affecting crop yields. The metabolic
136 process is characterized by the formation of compounds in response to drought conditions, such
137 as sugar [44,45], glycine-betaine [46,47], proline [48,49], and ABA [50,51].

138 **Drought Responses**

139 Drought causes plants to experience an increase in osmotic pressure, resulting in a decrease in
140 cell turgor pressure. If the drought continues beyond the limit of permanent wilting, the plant
141 may suffer damage and death [40,53]. As a form of anticipation, plants carry out certain
142 mechanisms to keep physiological and metabolic processes running. Drought causes water
143 deficit in plants, affecting their morphology [54]. There are three levels of water deficit,
144 consisting of mild drought stress (lower water deficit), moderate drought stress (middle water
145 deficit) when the water potential decreases, and severe drought stress (higher water deficit).
146 Mild, moderate, and severe drought stress occurs when the water potential decreases to 0.1
147 MPa, up to 1.2 MPa to 1.5 MPa, and more than 1.5 MPa, respectively. This condition can
148 decrease the relative water content (RWC) in plants, for example, leaves. Moderate to severe
149 drought stress can decrease relative water content RWC in teak [55]. The decrease in RWC in

150 soybean plants can reduce the water potential in the leaves [56]. In tomatoes, a decrease in
151 RWC can affect fruit weight and the amount of chlorophyll in leaves [57]. Mild, moderate, and
152 severe drought stress will reduce RWC by about 8-10%, 10-20%, and more than 20%,
153 consecutively. The continuous severe drought stress will disrupt the physiological processes of
154 the plant. Disruption of plant physiological processes ultimately results in decreased yields of
155 several crops (tomato, corn, potato, rice, and wheat) [58-68].

156 **Adaptation Strategy**

157 According to Rini *et al.* [11], plants respond to drought stress by three mechanisms (escape,
158 avoidance, and tolerance). Drought escape is a form of plant adaptation to drought stress by
159 accelerating the generative phase. In this condition, the plant stops the vegetative phase and
160 tries to produce seeds before drought stops its life cycle [69]. Wheat plants accelerate the
161 generative phase and terminate vegetative growth to minimize water loss [70]. This strategy is
162 common for plants to complete their life cycle as long as the environment is still possible before
163 facing drought. In Arabidopsis plants, this strategy is carried out by using water efficiently for
164 growth [71]. These mechanisms include early flowering and harvest age, as well as plant
165 plasticity [72]. Drought avoidance is an adaptation of plants to maintain water availability under
166 stress conditions, keeping the water potential in cells remains high. One of the common
167 morphological indications is its effect on root elongation [11,73]. In potato plants, this strategy
168 is indicated by the elongation of roots and differences in the number of shoots [74]. Differences
169 in root morphology in Arabidopsis are used to increase water uptake so that the water content
170 in the tissue remains balanced [75]. The physiological effects that occur may be a decrease in
171 the rate of transpiration and a decrease in the area of transpiration, such as small leaf and a small
172 number of leaves [76]. Drought tolerance is a condition for plants to survive despite
173 experiencing drought stress (water deficit) [11].

174 **Stress Signal Mechanisms**

175 Plants respond to drought stress in the form of a sign, called signal perception (SP), due to the
176 introduction of a stimulus to stress conditions. This signal begins with a disturbance in the
177 balance of the cell wall so that signal activation will occur in the form of protein molecules [11]
178 [72]. The difficulty of roots in absorbing water can provide a signal by modifying the cell
179 membrane so as not to lose cell turgidity [77]. SP is assisted by components in the form of
180 smaller molecules, such as diacylglycerol (DAG) and phosphatidic acids (PA), which are

181 referred to as second messengers (SM) that will transmit SP as a form of stress signal in plants
182 before signal transduction (ST) occurs [11]. Drought will cause changes in osmotic pressure in
183 cells so that SP will stimulate the hydraulic signal (HS) in plant cells by trying to increase
184 dissolved materials so that water does not leave the cell. HS in Arabidopsis plants is initiated
185 by the AHK1 kinase (protein) compound, which functions as an osmo-sensor in the plant cell
186 membrane layer [78]. Osmo-sensors in Arabidopsis plants are associated with calcium channels
187 called hyperosmolality gated calcium-permeable channels (OSCA) that allow Ca^{2+} influx
188 processes in cell membranes [79]. In addition to another OSCA, there is another osmo-sensor
189 called MSL (mechanism sensitive like ion channels). MSL is an osmo-sensor found in plant
190 cell membranes affecting the process of K^+ influx [80]. Another osmo-sensor found in plant
191 cell membranes is receptor-like protein kinase (RLKs) which play an important role in inducing
192 abscisic acid (ABA) as a signal form against drought stress [81].

193 After exposure to drought stimulates SP assisted by SM, the next step is ST initiation. ST is a
194 protein kinase molecule that is a series of signals in plants experiencing abiotic stress, including
195 drought, to stimulate certain protein kinases in response to stress [11]. Mitogen-activated
196 protein kinase (MAPK) and Calcium-dependent protein kinase (CDPK) are types of ST in
197 plants connected to target molecules in the MAPK cascade system, functioning as ST in the
198 phosphorylation and dephosphorylation processes [82]. In cotton and Arabidopsis plants, MAPK
199 is found in leaf cell membranes and affects the regulation of stomata and growth (length) of
200 plant roots [83,84]. MAPK interaction with sucrose nonfermenting related protein kinase-1
201 (SnRK1) also affects carbohydrate metabolism to be converted into simpler molecules during
202 drought stress [85]. CDPK is an ST formed due to the influx of Ca^{2++} in plant cell membranes
203 that affect ABA regulation and stomata regulation in potato plant leaves [86]. In strawberries,
204 CDPK is identified on cell membranes in the form of FaCDPK appearing in the fruit ripening
205 phase under drought stress conditions. This FaCDPK causes an increase in ABA in strawberry
206 fruit [87]. In soybean plants, CDPK is identified as GmCDPK3, which can lead to an increase
207 in proline and chlorophyll. This condition increases plant resistance to drought conditions [88].
208 In addition to MAPK and CDPK, drought stress leads to the production of ROS compounds in
209 the form of hydroxyl peroxide (H_2O_2) and singlet oxygen (O_2^-), which decrease the amount of
210 chlorophyll, thereby forcing plants to form antioxidant compounds, one of which is proline
211 [89]. High ROS compounds can cause oxidative stress so that cells can die. Therefore, cells
212 respond by activating antioxidant enzymes to prevent cell damage [90].

213 **Physiological Effects and Mechanisms**

214 Plant growth and development are related to cell division, elongation, and differentiation, which
215 depend on water availability [91-93]. In 15 wheat genotypes, water deficit can reduce yields by
216 20% to 25% [94]. Moderate and severe water drought stress will increase the dry weight of
217 wheat grain per 1000 grains by 1.95% to 2.07% as a result of the starch formation response
218 [95]. There is no significant reduction in the yield of quinoa plants under drought stress.
219 However, there is an increase in the amount of proline, glutamine, Na, K, and ABA and a
220 decrease in the stomatal opening, thereby reducing transpiration [96]. Water deficit in rice
221 plants is a limiting factor that can reduce yields up to 25.4% and affect root length as a strategy
222 to deal with drought stress [97]. In some plants, water deficit inhibits flower formation [98]
223 [99]. The conclusion is that water deficit can inhibit flowering, increase the number of solutes
224 and reduce yields in plants.

225 Water deficit causes plants to carry out physiological responses by reducing transpiration,
226 closing stomata, and reducing the number of leaves [11,72,73]. In tomato plants, a decrease in
227 the rate of photosynthesis is due to a lack of water and a high rate of respiration, resulting in
228 the efficient use of water [100]. The stomatal closure to suppress the transpiration rate is related
229 to the efficiency of photosynthesis. In photosynthesis, the efficiency of light absorption and
230 transformation is determined by chlorophyll fluorescence and electron transport [101]. Low
231 light absorption by chlorophyll can result in low light waves, decreasing the CO₂ and energy
232 absorbed [102,103]. The decrease in CO₂ uptake in canola and wheat plants can reduce the rate
233 of photosynthesis and ultimately reduce biomass in production [104]. Water deficit leads to the
234 production of radical compounds called ROS. If there is no balance between the rate of
235 photosynthesis, the production of antioxidant compounds can be inhibited, as illustrated in the
236 research on canola plants [105]. The decrease in the rate of photosynthesis is also influenced
237 by the ABA response as a signal of drought stress, which results in regulation of stomatal
238 closure [106,107]. ABA is formed in roots and transported to leaves to signal and regulate
239 stomatal closure due to lack of water stimulated by certain genes such as NPF4.6 and DTX5.0
240 [108]. A further impact is the reduction of CO₂ for photosynthesis. The decrease in the CO₂
241 carboxylation process and the closing of stomata due to abiotic stress can reduce the rate of
242 photosynthesis, decreasing the number of functional Ribulose 1.5 biphosphate carboxylae
243 oxygenase (RuBisCo) in photosynthesis [109]. The conclusion is that drought stress causes
244 morphological and physiological responses in plants. Morphological responses occur in root
245 elongation, leaf size, and the number of leaves. Physiologically roots can respond by

246 transporting ABA to regulate stomatal closure to reduce evaporation. Closure of stomata results
247 in low CO₂ absorption, causing the photosynthesis process to be not optimal.

248 The general response of plants to water deficit is to close their stomata, which is beneficial to
249 reduce water loss [110,111]. In addition, water deficit can affect hydraulic conductivity due to
250 hydraulic signals, gas exchange, water potential, and ABA determination in leaves (stomata)
251 [107]. In wheat, stomatal conductivity results in transpiration efficiency, which is influenced
252 by leaf transpiration and assimilation rate [112]. Water loss during the vegetative phase causes
253 soybean plants to balance water potential (osmotic adjustment) by dropping leaves, reducing
254 leaf size, closing stomata, and folding leaves for water usage efficiency through transpiration
255 reduction, however this reduces leaf area index (LAI) and so reduces photosynthetic rate [113].
256 The stomatal closure is a plant response to drought stress, which can decrease transpiration and
257 photosynthesis rate. However, this regulation is a complex mechanism interconnected between
258 external (water availability) and internal (ABA response) factors.

259 The photosynthesis process is influenced by the activity of supporting enzymes, one of which
260 is RuBisCo. RuBisCo plays a role in photosynthesis, namely photosystem II [114]. Under
261 drought stress, the amount of light absorption is small, decreasing the activity of RuBisCo [115]
262 [116]. Drought stress is often accompanied by an increase in temperature, resulting in
263 photoinhibition, which can impair RuBisCo's ability to activate the photosystem II pathway
264 [117]. This decrease occurs because the CO₂ carboxylase process by RuBisCo is not optimal
265 [72]. Drought stress inhibits the RuBisCo enzyme, which can lead to a reduction in carboxylate
266 assimilation. Hence, the regeneration of RuBP will ultimately inhibit the rate of photosystem II
267 [118]. High temperatures and drought stress in rice, wheat, and corn restrict RuBisCo function
268 by inhibiting the RuBisCo activase enzyme, which can reduce photosynthetic optimization
269 [114]. Photosynthetic products are usually transported to parts of the plant. However, in drought
270 conditions, there is a change in carbohydrate translocation in plants so that limited
271 carbohydrates are translocated to places contributing to resisting drought stress [119,45].
272 Carbohydrates are translocated in the form of simple components to maintain osmotic balance,
273 which is in roots are used for morphological growth to increase water uptake and ABA
274 induction [120]. Increasing the amount of carbohydrates in plant parts during the vegetative and
275 generative phases is a method used by plants to survive under drought stress [121].

276 The plants' response to drought stress is to maintain osmotic balance in cells [69,122]. One of
277 the mechanism to maintain this balance is to form soluble compounds to hold water out of the

278 cell (compatible solute) [123,124]. In addition, these soluble compounds are antioxidant
279 compounds that protect cell membranes from damage caused by ROS, one of which is proline
280 [47,125-127]. Proline and glycine-betaine are used as antioxidants and cell membrane
281 protection from radical compounds (ROS) [128]. High proline in the leaves of rice, soybean,
282 and sugarcane plantlets is a physiological indication of plants to resist water deficit
283 [48,129,125]. In wheat cv. Chakwal 50, the proline content increased as a result of drought
284 stress, indicating an osmotic adjustment process in cells in addition to free radical scavengers
285 [130]. The presence of proline in soybean plants can increase water stress resistance and
286 stabilize protein structure [131]. Proline is used as an indicator in drought-tolerant plants so that
287 it is used as the basis for breeding drought-resistant transgenic plants [132]. Proline, in
288 chloroplasts, is a synthesis of glutamate, which is reduced to glutamate semialdehyde (GSA)
289 by the P5CS enzyme (encoded by two genes) and converted spontaneously to P5C (encoded by
290 one gene) [126]. In mitochondria, proline undergoes catabolism with the help of proline oxidase
291 (PDH) to form P5C, which is then converted to glutamate [123].

292 In simple terms, the water balance in plants can be described as the equal amount of water
293 coming out (transpiration) and water coming in (absorption). The imbalance condition will
294 interfere with plant physiology, causing plants to experience stress [133]. In relation to
295 physiological processes, drought stress is related to turgor pressure, stomatal opening,
296 photosynthetic rate, enzyme damage, and root density [72]. plant growth due to low CO₂
297 absorption [134]. The direct inhibiting factor for plant growth is not water potential but osmotic
298 potential and turgor pressure [135,136]. The influence of turgor pressure can result in osmotic
299 adjustments in plants to reduce water loss [137]. Plants regulate water balance by generating
300 phytohormones, such as ABA, through their roots. ABA is a plant mediator in response to
301 drought, which is synthesized mostly in roots [138,108,139]. ABA is said to be the main
302 internal signal allowing plants to resist drought, which is transported to the leaves to affect
303 stomata closure to reduce transpiration [140,141,42]. ABA is a simple sequence of carotenoid
304 compounds. In fungi, ABA is synthesized through the methylerythritol phosphate (MEV) pathway,
305 which begins with the formation of mevalonate. Meanwhile, ABA in plants is synthesized
306 through the MEP pathway, starting with the formation of carotenoids into more specific
307 compounds (zeaxanthin) [139]. Assisted by the zeaxanthin epoxidase (ZEP), zeaxanthin is
308 converted to violaxanthin and turned to neoxanthin. In Arabidopsis, the gene involved in this
309 process is ABA4. Neoxanthin will be converted into xanthine with NCEDs enzymes as
310 activators (found in Arabidopsis, corn, tomatoes, cowpea, and grains). In maize, the gene

311 involved is known to be VIP14. Xanthine is converted to abscisic aldehyde and then to ABA.
312 The genes involved in this process are ABA2 and ABA3 in Arabidopsis plants and TaNAC48
313 in wheat [142].

314 ABA formed in the roots is transported to the leaves and the flowers. NCED2 and NECD3
315 proteins are known to play a more dominant role in the synthesis of ABA in roots, while
316 NCED5, NCED6, and NCED9 are more dominant in the flowering part. Apart from being an
317 early signal of drought that will be transported to the leaves, ABA will also affect the growth
318 of stressed plant roots by increasing water influx by the roots [143]. ABA transport to the leaves
319 occurs with enzymes (such as CLE25) as activators. When ABA reaches the leaves, it becomes
320 a signal for stomata to close [144]. Stomatal closure can be beneficial to reduce transpiration
321 [145,146], but the rate of photosynthesis will decrease, photorespiration will increase, and the
322 accumulation of ROS compounds will increase [147]. The ABA-mediated gene for stomatal
323 closure in wheat is TaNAC48 [142]. When the stomata close, there is a lack of CO₂. The excess
324 O₂ from photosynthesis is bound by RuBisCo molecules, and some of these compounds can
325 form ROS chemicals. RuBisCo should be able to bind CO₂ absorbed from PEP (in C₄ plants).
326 With the decrease in the amount of CO₂, the O₂ bound by RuBisCo can produce CO₂, but more
327 energy (ATP) is required, thereby reducing the efficiency of photosynthesis. When the stomata
328 are closed, there will be a buildup of singlet oxygen (O[•]) and hydroxide compounds (H₂O₂) as
329 a result of photosynthesis, forming toxic ROS compounds. This condition is anticipated by
330 forming direct antioxidant compounds (carotenoids, mannitol) and antioxidant enzymatic
331 reactions, such as SOP, APX, and CAT, which can convert ROS compounds into O₂ and H₂O
332 [90,148,149,76]. However, severe and long-duration stress causes an imbalance between ROS
333 and antioxidants. If the ROS is higher than the antioxidant, it will attack the fatty acids on the
334 membrane (PUFAs) so that the cell membrane will be damaged, and if the plant cannot adapt,
335 the plant will be sensitive and die [150]. The increase in ROS compounds that are not matched
336 by an increase in antioxidant compounds and other solute compounds causes membrane
337 damage to plant cell walls and other responses such as proline formation and an increase in
338 reaction enzymes such as SOP, APX, and CAT [76].

339 Plants such as tomato plants [151], sunflower plants [152], sugarcane [153] respond to drought
340 stress by forming compatible solutes, namely sugars with low molecular weights that are
341 osmoprotectant compounds (stress protecting agents) [154]. Regarding the function of
342 trehalose, there are at least two supporting theories. The first theory is water replacement

343 because it can form hydrogen bonds with surrounding structural molecules that function as a
344 substitute for water, for example, trehalose with lipid molecules will function as membrane
345 integrity guards during drought stress (changes in the membrane from a fluid phase to a gel
346 phase). The second theory is water entrapment since it can play a role in collecting water by
347 forming hydrogen bonds to form a water layer in the cell [155]. Trehalose is a disaccharide
348 group formed from the breakdown of carbohydrates into two glucose molecules [156]. Plants
349 under drought stress will increase ABA synthesis, playing a role in stomatal closure and
350 stimulating signal transduction by forming a protein cascade, namely TPS1 protein. This
351 protein will activate transcriptional genes such as the TreGP gene (TGP), which will play a role
352 in the formation of trehalose as a compatible solute in cells that supports osmotic adjustment in
353 cells [156,157].

354 **Drought Stress Management**

355 Drought stress has an impact on agriculture crop cultivation, thereby decreasing crop
356 production. Therefore, it is necessary in these condition to require management to increase crop
357 production. These condition has management variations so that appropriate strategies and
358 technologies are needed as mitigation measures. Mitigation management can be done by:1) Use
359 early maturing varieties and drought stress tolerance varieties. The use of early maturing to
360 facing drought stress can be used to increase crop index (CI) and it will maintain high yields
361 [158]. Drought tolerance varieties can respond and induces expression of drouht stress related
362 genes so that the plant will survive in these conditions [159]. 2) using mechanical soil
363 conservation such as making terraces and bed planting which are used to suppress surface water
364 flow and hold back puddles. The terraces are supported and can help in binding soil particles
365 and also to bind water longer whereas bed planting can enhances the water infiltration rate and
366 can maintain mouisture conditions [160]. 3) applying a good irrigation system. Drought and
367 water scarcity conditions need irrigation management, this should be seen within supply and
368 demand management for plant [161]. 4) biological conservation using mulch to improve soil
369 structure and to increase the ability of the soil to hold water. Mulching is one of the important
370 management practice for conserving soil moisture in plants cultivation. That evaporates from
371 soil with mulch will be condenses on the lower surfaces and go back to the soil thus conserving
372 moisture [162]. 5) selecting drought-tolerant plants both in vitro and in vivo by using selector
373 agents such as PEG. The in vitro screening using PEG-6000 is an alternative for the early
374 selection of drought tolerance varieties, it is known through gene markers of varieties that are

375 considered optimal growth in drought stress [163]. 6) applying osmo-protectant compounds,
376 such as glycine betaine. Glycine betaine exogenous application can reducing the aggregation
377 of ROS, that can improving SOD and CAT activities which will result in an osmotic adjustment
378 mechanism [164].

379 **Conclusion**

380 Drought stress causes plant to be in a state of water deficit. Water deficit has an impact on cell
381 division, cell elongation, cell differentiation, and a decrease in CO₂ fixation so that it can reduce
382 photosynthetic results and the accumulation of ROS compounds, thereby decreasing crop
383 production. These condition stimulates plants responses through morphological and
384 physiological changes. Mitigation management can be done by several ways such as use
385 tolerance varieties (early maturing), soil conservation, good irrigation system, use mulch as
386 biological conservation, selection in vitro to screening drought stress tolerance varieties and
387 exogenous application osmo-protectant like glycine betaine.

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390 **Conflict of interest**

391 The authors declare no conflict of interest.

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879 Table 1. Water status relationship between water potential and soil water volume

Water Status	Water Potential Status		Soil Water Status			Availability to Plant
	pF	Mpa	Sand	Clay	Loam	
Saturation	0	0	39%	50%	54%	Unavailable
Field Capacity	(-) 1-2,5	(-) 0,33	8-10%	20-35%	36-49%	Available
Wilting Point	(-) 4,2	(-) 1,5	4%	9%	29%	Unavailable

880 Source: [23,32] - modified

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882 Table 2. Plants responses to drought stress

Drought Stress	Response		
	Morphology	Physiology	Biochemical
Strengthens the roots system (roots elongated)		Stomatal closure	ABA synthesis
Reduce leaf surface area		Reduce CO ₂ fixation	Decreased activity of rubisco
Rolling the leaves		Decreasing photosynthesis	Accumulation of solute compounds (proline, glycine-betaine, sugar)
Dropping leaves		Increased ROS compounds	Increased antioxidant compounds
Early flowering			Drought tolerant gene expression

883 Source: [52] - modified

884

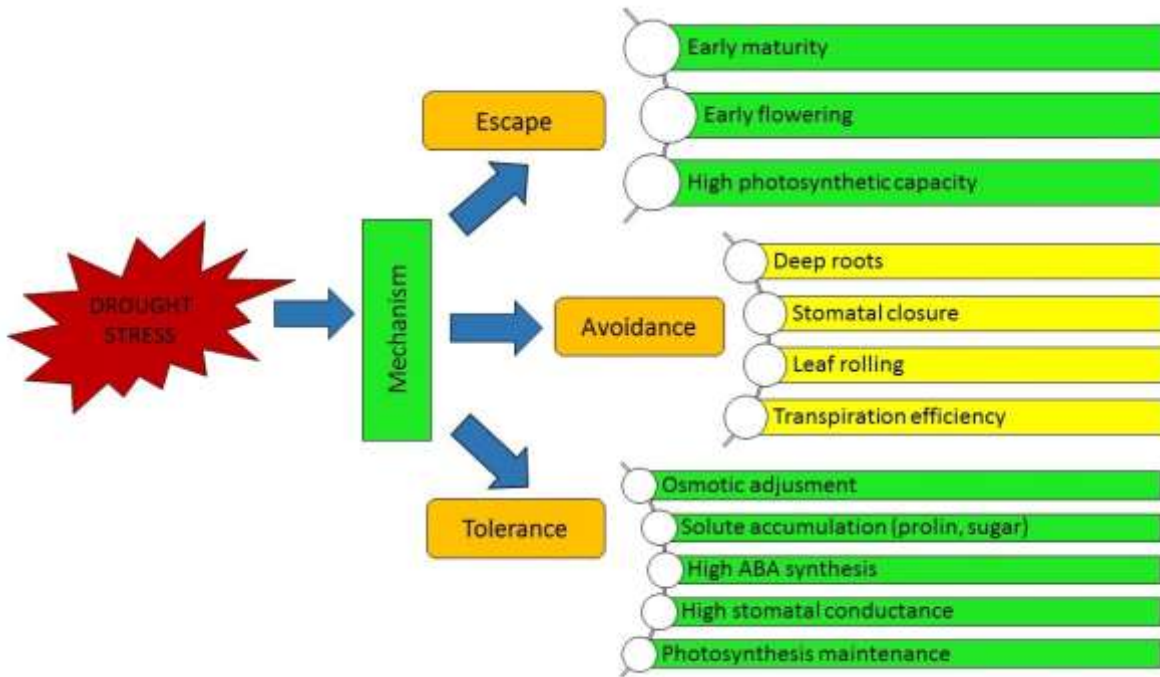
885 Table 3. Relationship between drought stress and the sensitivity of plant metabolic processes

Affected process	Sensitivity																
	Very susceptible					Susceptible					Unsusceptible						
(-) decreased	Pressure (Bar) (-)																
(+) increased	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Cell growth (-)																	
Cell wall synthesis (-)*																	
Protein synthesis (-)*																	
Proto-chlorophyll formation (-)**																	
Nitrate reductase (-)																	
ABA Synthesis (+)																	
Stomatal conductivity (-)																	
Fixation of CO ₂ (-)																	
Respiration																	
Xylem conductivity (-)***																	
Proline synthesis (+)																	
Sugar synthesis (+)																	

886 Note: *= fast growing tissue; **= etiolated leaves; ***= xylem dimension factor

887 Source: [36] - modified

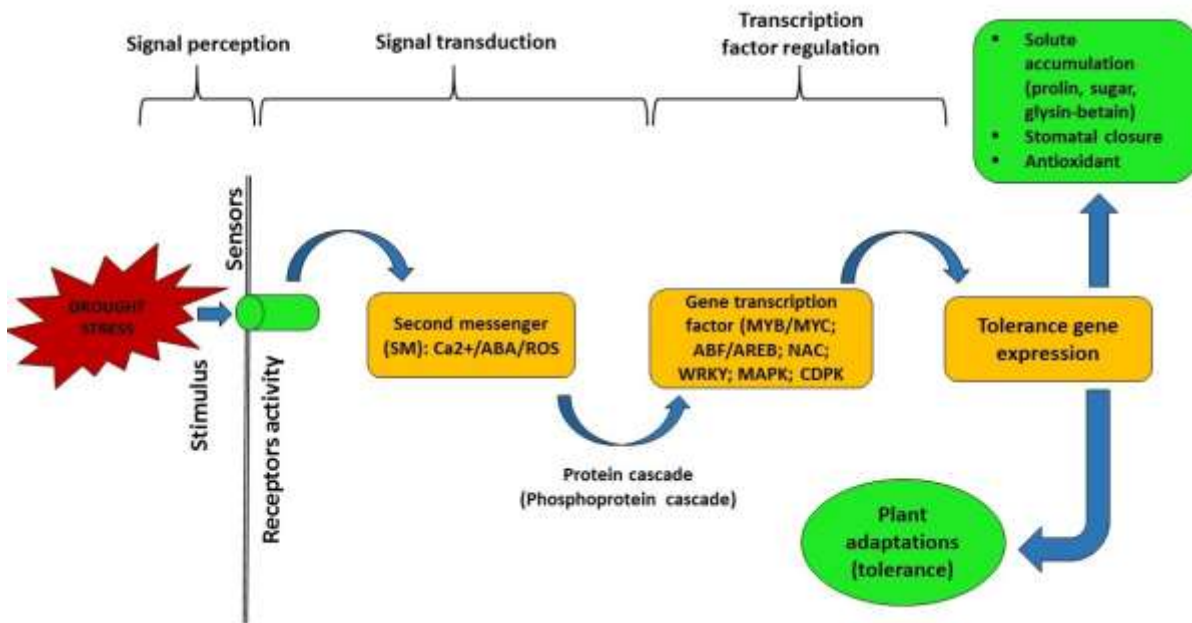
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890 Figure 1. Crops **mechanism** in drought stress [65] - modified

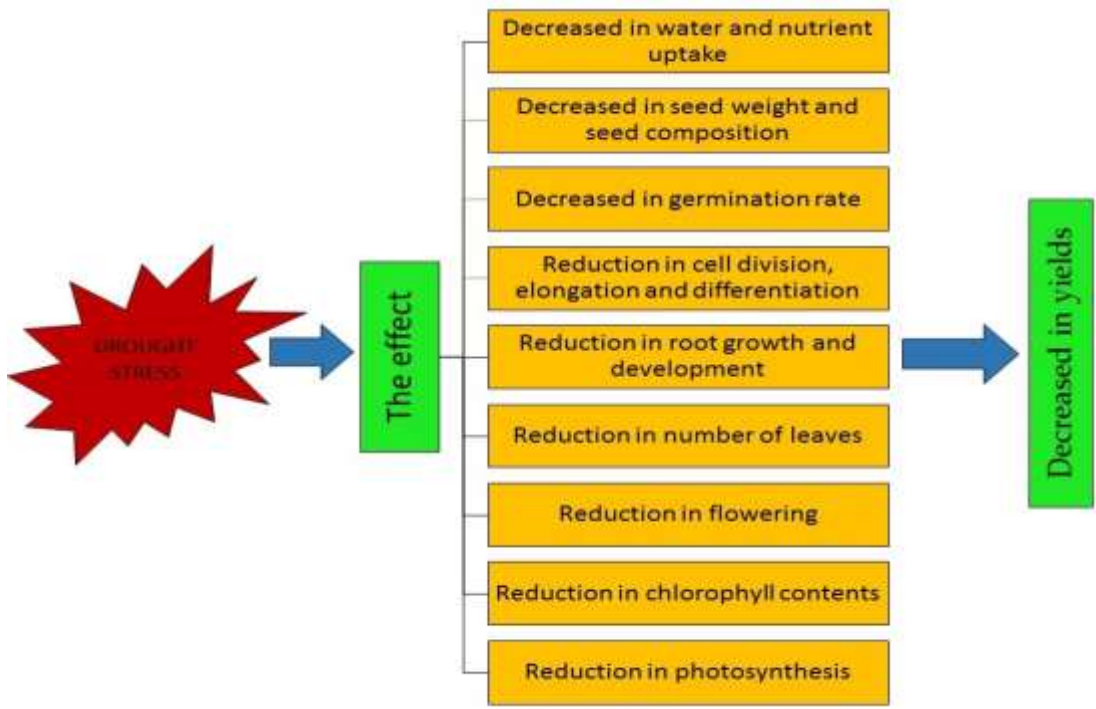
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893 Figure 2. Signaling plant networks against drought stress [11,72] - modified

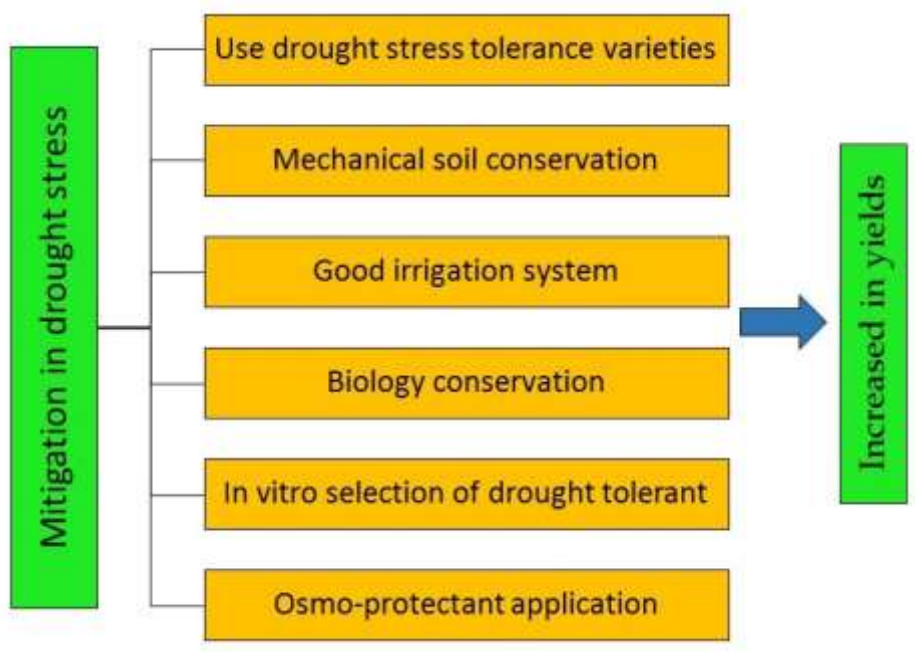
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896 Figure 3. The impact of drought stress on crops [137] - modified

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899 Figure 4. Mitigation in drought stress

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Dear,

Editor in Chief Reviews in Agricultural Science,

I am Saktiyono Sigit Tri Pamungkas, representing on behalf of the manuscript (Suwarto, Suprayogi and Noor Farid). I wish to submit a second revision of my paper according to the reviewers comment.

LIST OF CHANGE

Title: Drought Stress: Responses and Mechanism in Plants

Author: Saktiyono S.T. Pamungkas^{1)*}, Suwarto²⁾, Suprayogi²⁾, Noor Farid²⁾

Reviewer 1 and 2

No.	Reviewer Comment	Response
Overall Comments		
1.	Reviewer 1 Figure 1, 2, 3. Use clearer color, red color cannot be seen clearly. And use high resolution picture for all figures, I check that the quality still too low.	Thank you very much for your comment. I have revised it: - I have changed all the red color of the figures (1,2 and 3), I hope this is clearer. You can find in line 889, 892 and 895. - I have corrected and have changed all the resolutions of the figures (1,2,3 and 4) to use the dimensions of 10240 x 5760 pixels and a resolutions of 768 dpi. You can find in line 889, 892, 895 and 898.
2.	Reviewer 2 Improve the format of all figures and tables while referring the published article of this journal.	Thank you very much for your comment. I have revised it: - I have have changed all the resolutions of the figures (1,2,3 and 4) to use the dimensions of 10240 x 5760 pixels and a resolutions of 768 dpi. You can find in line 889, 892, 895 and 898. - I have improve the all of tables (1,2 and 3) by increasing the font size, I hope all the tables can be read clearly. You can find in line 879, 882 and 885.

Best regards,

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26 **Abstract:**

27 The function of water for plants is crucial, including playing the roles in metabolic reactions.
28 The aims of this article is to give information on the effects of drought stress on plant
29 morphology, physiology, and biochemistry, as well as mitigation methods in drought stress
30 management for plant production. Plants manage drought stress using a mechanisms, namely
31 drought escape, drought avoidance and drought tolerance. Drought escape is the ability of
32 plants to accelerate flowering or life cycle, drought avoidance is the ability of plants to reduce
33 water loss and increase water absorption through morphological changes in the root system,
34 drought tolerance is the plant adaptation to drought by changes in plant physiological and
35 biochemical processes. Physiological changes that occur include closing the stomata and
36 decreased photosynthesis. The biochemical responses include the synthesis of solute
37 compounds as a form of osmotic adjustment in the cell called osmotic adjustment to reduce
38 water loss from the cell. The biochemical indicators are the increased concentrations of abscisic
39 acid (ABA), proline, and sugar (trehalose). ABA acts as a signal to stimulate stomatal closure
40 to reduce the transpiration rate. Proline is an indicator of plants adapting to drought stress,
41 playing a role in the osmotic adjustment of cells to retain in the cell. Trehalose is a compatible
42 sugar acting as an osmoprotectant, it can maintain the integrity of cell membranes (water
43 replacement) and form hydrogen bonds (water entrapment). Plants under drought stress
44 conditions can adapt by making morphological, physiological, and biochemical responses by
45 osmotic adjustment. These conditions need to be managed so that appropriate strategies and
46 technologies are needed as mitigation measures.

47

48 **Keywords:** Drought Stress, Dryland Management, Osmotic Adjustment

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53 **Introduction**

54 The aims of this article is to give information on the effects of drought stress on plant
55 morphology, physiology, and biochemistry, as well as mitigation methods in drought stress
56 management for plant production. Water is a vital requirement for the survival of plants. Plant
57 tissues are composed mostly of these, which is about 80% to 95%, predominantly found in the
58 cytoplasm and vacuoles [1] . However, some tissues have a content is about 10-15%, one of
59 which is dormant seeds [2] . Water is a major factor in plant growth since it is needed by plants
60 to carry out physiological processes [3]. In plants, these is the main molecule that makes up
61 protoplasm (cytoplasm, nucleus, and organelles) [4]. Besides that these is a solvent for
62 dissolved substances in cells. If water is used as a solvent for acidic or alkaline components, it
63 will be positively charged (K^+ , Ca^{++} , NH_4^+) or negatively charged (NO_3^- , SO_3^- , HPO_4^-),
64 respectively. The functions of these as a medium for metabolic and physiological reactions in
65 plants, in which metabolic and physiological activities can decrease when there is a lack of
66 water and also plays a role as a medium for transporting essential nutrients and minerals from
67 the soil so that a lack of water can reduce the rate of nutrient uptake from the soil by roots [5].
68 These is also one of the main factors determining plant production related to biomass production
69 and transpiration rate [6]. Water will affect cell turgidity, thereby affecting the process of
70 opening and closing stomata. The conversion of sunlight will be reduced if the stomata are
71 closed, which will affect the photosynthesis results [7]. These is also affects transpiration in
72 plants, in which more water will increase the transpiration rate and vice versa [8].

73 Plants will always be exposed to various stress conditions, including biotic stresses such as
74 pests, pathogens, viruses, nematodes [9], and abiotic stresses, namely drought, water saturation,
75 temperature, and salinity . One of the stresses influencing the growth and yield of cultivated
76 plants is drought [10]. According to the agronomic point of view, drought is defined as the
77 relationship between moisture and water availability in the soil. These absorption and dissolved
78 mineral nutrients decrease when there is a lack in the soil [12]. Disruption in the absorption
79 process disrupts metabolic processes, impacting plant physiological and morphological
80 functions, which can affect yields [11]. Drought occurs due to climate change and soil type. All
81 regions in the world with a share of seawater will experience El Nino, a condition in which the
82 sea surface temperature (SML) warms up, resulting in a long drought that decreases the water
83 availability, which is predicted to affect the rate of evapotranspiration [13]. In Indonesia, in the
84 range of 2019, El Nino had an impact on the expansion of dryland areas almost three times
85 compared to that in 2017 [14]. The characteristics of soil types are very diverse [15], so the

86 ability of the soil to hold water in field capacity varies according to the soil texture [16,17].
87 Sandy soil type can hold water about 2.1 in/ft, clay can hold these around 3.8 in/ft, while clay
88 soils can hold these around 4.4 in/ft [18].

89 In the soil these is divided into four types, including chemical, hygroscopic, capillary, and
90 groundwater [19]. Chemical water located in the soil surface that still contains chemicals (from
91 rain) and is a type of soil that is not available to plants. Hygroscopic is strongly bound by the
92 soil (permeates). Capillary fills the capillary pores (infiltration) in the soil with a greater
93 cohesive force than the adhesion force on soil particles, making it available to plants. Whereas
94 groundwater can continue to fall to the bottom layer due to the influence of gravity
95 (percolation). Available of these is defined as the condition or difference between the amount
96 of the field capacity and the amount of the wilting point [20]. Field capacity is the amount of
97 capillary in the soil, while the wilting point is the amount of hygroscopic water in the soil that
98 makes water unavailable [21].

99 **Water Deficit**

100 The ideal soil composition consists of 45% mineral content, 25% water, 25% air, and 5%
101 organic matter [22,23] . This condition will stabilize the water tension at field capacity (pF) on
102 the soil, stabilizing the force of attraction between water molecules (cohesion) and between
103 water molecules and soil particles (adhesion) becomes. If cohesion is stronger than adhesion,
104 the water can't be bound by soil pores [24,25] . In addition to being influenced by the adhesive
105 power, the soil's ability to bind water also depends on the type of soil. The higher the clay
106 content of the soil, the lower the adhesion force, causing a low pF value, resulting in water
107 saturation so that water is not available. On the other hand, low cohesion will result in a high
108 pF value, which in turn causes a water deficit [26,27]. Besides being influenced by pF, it is also
109 influenced by water potential [28,29]. At a pressure of 0 Mpa, the soil is saturated with water,
110 while -0.33 Mpa at field capacity conditions and -1.5 to -3 Mpa is the permanent wilting point
111 [30,31]. In addition to the influence of pressure, according to Easton [23] and Datta *et al.* [32],
112 the volume of water in the soil also depends on the type of soil to bind water so that it will
113 determine water saturation (sand: 39%, clay: 50%, clay: 54 %), field capacity (sand: 8-10%,
114 clay: 20-35%, clay: 36-49%) and permanent wilting point (sand: 4%, clay: 9%, clay: 29%). A
115 high pF value will lead to high percolation, resulting in water loss and a low groundwater
116 potential. Otherwise, a low pF value causes low water holding capacity with the soil pores
117 (adhesion), resulting in low groundwater potential.

118 In drought conditions, plants will lack water in the rhizosphere (around plant roots), decreasing
119 groundwater potential (Ψ_w) and increasing osmotic potential in plant cells (Ψ_s), which decrease
120 plant cell turgor pressure (Ψ_p) (-) [33,34] . Such conditions must be balanced by maintaining
121 cell turgor pressure to remain in a positive condition. Turgor pressure (Ψ_p) that has a positive
122 value depends on the ability of plant cells to balance the value of Ψ_w and the value of Ψ_s with
123 a certain scheme. This condition is called osmotic adjustment in plant cells (osmotic
124 adjustment), shown in an equation of $\Psi_w = \Psi_s + \Psi_p$ [35,36] .

125 Turgor pressure affects the shape, reaction, and cell changes in plants. Water deficit in grains
126 (barley and corn) was reported to decrease cell turgor pressure [37,38]. Under decreased
127 turgidity, water molecules leave the cell. If water continues to leave the cell, the cell loses
128 flexibility, resulting in wilting [39]. To prevent water from leaving the cell, the cell applies an
129 osmoregulation mechanism to maintain the turgor pressure remains positive (+). If transpiration
130 continues to occur, while the water absorption process continues to decrease, the cell is no
131 longer able to maintain turgidity, other than wilting, if the plant is unable to recover, the plant
132 may die [40]. Water deficit in plants can affect morphology and physiology. At the
133 morphological level, water deficit will cause the leaves to wither, the leaves to shrink, curling
134 leaves, the small number of leaves, the elongated roots [41,42], and early flowering [43]. At the
135 physiological level, it can disrupt metabolism, thereby affecting crop yields. The metabolic
136 process is characterized by the formation of compounds in response to drought conditions, such
137 as sugar [44,45], glycine-betaine [46,47], proline [48,49], and ABA [50,51].

138 **Drought Responses**

139 Drought causes plants to experience an increase in osmotic pressure, resulting in a decrease in
140 cell turgor pressure. If the drought continues beyond the limit of permanent wilting, the plant
141 may suffer damage and death [40,53]. As a form of anticipation, plants carry out certain
142 mechanisms to keep physiological and metabolic processes running. Drought causes water
143 deficit in plants, affecting their morphology [54]. There are three levels of water deficit,
144 consisting of mild drought stress (lower water deficit), moderate drought stress (middle water
145 deficit) when the water potential decreases, and severe drought stress (higher water deficit).
146 Mild, moderate, and severe drought stress occurs when the water potential decreases to 0.1
147 MPa, up to 1.2 MPa to 1.5 MPa, and more than 1.5 MPa, respectively. This condition can
148 decrease the relative water content (RWC) in plants, for example, leaves. Moderate to severe
149 drought stress can decrease relative water content RWC in teak [55]. The decrease in RWC in

150 soybean plants can reduce the water potential in the leaves [56]. In tomatoes, a decrease in
151 RWC can affect fruit weight and the amount of chlorophyll in leaves [57]. Mild, moderate, and
152 severe drought stress will reduce RWC by about 8-10%, 10-20%, and more than 20%,
153 consecutively. The continuous severe drought stress will disrupt the physiological processes of
154 the plant. Disruption of plant physiological processes ultimately results in decreased yields of
155 several crops (tomato, corn, potato, rice, and wheat) [58-68].

156 **Adaptation Strategy**

157 According to Rini *et al.* [11], plants respond to drought stress by three mechanisms (escape,
158 avoidance, and tolerance). Drought escape is a form of plant adaptation to drought stress by
159 accelerating the generative phase. In this condition, the plant stops the vegetative phase and
160 tries to produce seeds before drought stops its life cycle [69]. Wheat plants accelerate the
161 generative phase and terminate vegetative growth to minimize water loss [70]. This strategy is
162 common for plants to complete their life cycle as long as the environment is still possible before
163 facing drought. In Arabidopsis plants, this strategy is carried out by using water efficiently for
164 growth [71]. These mechanisms include early flowering and harvest age, as well as plant
165 plasticity [72]. Drought avoidance is an adaptation of plants to maintain water availability under
166 stress conditions, keeping the water potential in cells remains high. One of the common
167 morphological indications is its effect on root elongation [11,73]. In potato plants, this strategy
168 is indicated by the elongation of roots and differences in the number of shoots [74]. Differences
169 in root morphology in Arabidopsis are used to increase water uptake so that the water content
170 in the tissue remains balanced [75]. The physiological effects that occur may be a decrease in
171 the rate of transpiration and a decrease in the area of transpiration, such as small leaf and a small
172 number of leaves [76]. Drought tolerance is a condition for plants to survive despite
173 experiencing drought stress (water deficit) [11].

174 **Stress Signal Mechanisms**

175 Plants respond to drought stress in the form of a sign, called signal perception (SP), due to the
176 introduction of a stimulus to stress conditions. This signal begins with a disturbance in the
177 balance of the cell wall so that signal activation will occur in the form of protein molecules [11]
178 [72]. The difficulty of roots in absorbing water can provide a signal by modifying the cell
179 membrane so as not to lose cell turgidity [77]. SP is assisted by components in the form of
180 smaller molecules, such as diacylglycerol (DAG) and phosphatidic acids (PA), which are

181 referred to as second messengers (SM) that will transmit SP as a form of stress signal in plants
182 before signal transduction (ST) occurs [11]. Drought will cause changes in osmotic pressure in
183 cells so that SP will stimulate the hydraulic signal (HS) in plant cells by trying to increase
184 dissolved materials so that water does not leave the cell. HS in Arabidopsis plants is initiated
185 by the AHK1 kinase (protein) compound, which functions as an osmo-sensor in the plant cell
186 membrane layer [78]. Osmo-sensors in Arabidopsis plants are associated with calcium channels
187 called hyperosmolality gated calcium-permeable channels (OSCA) that allow Ca^{2+} influx
188 processes in cell membranes [79]. In addition to another OSCA, there is another osmo-sensor
189 called MSL (mechanism sensitive like ion channels). MSL is an osmo-sensor found in plant
190 cell membranes affecting the process of K^+ influx [80]. Another osmo-sensor found in plant
191 cell membranes is receptor-like protein kinase (RLKs) which play an important role in inducing
192 abscisic acid (ABA) as a signal form against drought stress [81].

193 After exposure to drought stimulates SP assisted by SM, the next step is ST initiation. ST is a
194 protein kinase molecule that is a series of signals in plants experiencing abiotic stress, including
195 drought, to stimulate certain protein kinases in response to stress [11]. Mitogen-activated
196 protein kinase (MAPK) and Calcium-dependent protein kinase (CDPK) are types of ST in
197 plants connected to target molecules in the MAPK cascade system, functioning as ST in the
198 phosphorylation and dephosphorylation processes [82]. In cotton and Arabidopsis plants, MAPK
199 is found in leaf cell membranes and affects the regulation of stomata and growth (length) of
200 plant roots [83,84]. MAPK interaction with sucrose nonfermenting related protein kinase-1
201 (SnRK1) also affects carbohydrate metabolism to be converted into simpler molecules during
202 drought stress [85]. CDPK is an ST formed due to the influx of Ca^{2++} in plant cell membranes
203 that affect ABA regulation and stomata regulation in potato plant leaves [86]. In strawberries,
204 CDPK is identified on cell membranes in the form of FaCDPK appearing in the fruit ripening
205 phase under drought stress conditions. This FaCDPK causes an increase in ABA in strawberry
206 fruit [87]. In soybean plants, CDPK is identified as GmCDPK3, which can lead to an increase
207 in proline and chlorophyll. This condition increases plant resistance to drought conditions [88].
208 In addition to MAPK and CDPK, drought stress leads to the production of ROS compounds in
209 the form of hydroxyl peroxide (H_2O_2) and singlet oxygen (O_2^-), which decrease the amount of
210 chlorophyll, thereby forcing plants to form antioxidant compounds, one of which is proline
211 [89]. High ROS compounds can cause oxidative stress so that cells can die. Therefore, cells
212 respond by activating antioxidant enzymes to prevent cell damage [90].

213 **Physiological Effects and Mechanisms**

214 Plant growth and development are related to cell division, elongation, and differentiation, which
215 depend on water availability [91-93]. In 15 wheat genotypes, water deficit can reduce yields by
216 20% to 25% [94]. Moderate and severe water drought stress will increase the dry weight of
217 wheat grain per 1000 grains by 1.95% to 2.07% as a result of the starch formation response
218 [95]. There is no significant reduction in the yield of quinoa plants under drought stress.
219 However, there is an increase in the amount of proline, glutamine, Na, K, and ABA and a
220 decrease in the stomatal opening, thereby reducing transpiration [96]. Water deficit in rice
221 plants is a limiting factor that can reduce yields up to 25.4% and affect root length as a strategy
222 to deal with drought stress [97]. In some plants, water deficit inhibits flower formation [98]
223 [99]. The conclusion is that water deficit can inhibit flowering, increase the number of solutes
224 and reduce yields in plants.

225 Water deficit causes plants to carry out physiological responses by reducing transpiration,
226 closing stomata, and reducing the number of leaves [11,72,73]. In tomato plants, a decrease in
227 the rate of photosynthesis is due to a lack of water and a high rate of respiration, resulting in
228 the efficient use of water [100]. The stomatal closure to suppress the transpiration rate is related
229 to the efficiency of photosynthesis. In photosynthesis, the efficiency of light absorption and
230 transformation is determined by chlorophyll fluorescence and electron transport [101]. Low
231 light absorption by chlorophyll can result in low light waves, decreasing the CO₂ and energy
232 absorbed [102,103]. The decrease in CO₂ uptake in canola and wheat plants can reduce the rate
233 of photosynthesis and ultimately reduce biomass in production [104]. Water deficit leads to the
234 production of radical compounds called ROS. If there is no balance between the rate of
235 photosynthesis, the production of antioxidant compounds can be inhibited, as illustrated in the
236 research on canola plants [105]. The decrease in the rate of photosynthesis is also influenced
237 by the ABA response as a signal of drought stress, which results in regulation of stomatal
238 closure [106,107]. ABA is formed in roots and transported to leaves to signal and regulate
239 stomatal closure due to lack of water stimulated by certain genes such as NPF4.6 and DTX5.0
240 [108]. A further impact is the reduction of CO₂ for photosynthesis. The decrease in the CO₂
241 carboxylation process and the closing of stomata due to abiotic stress can reduce the rate of
242 photosynthesis, decreasing the number of functional Ribulose 1.5 biphosphate carboxylae
243 oxygenase (RuBisCo) in photosynthesis [109]. The conclusion is that drought stress causes
244 morphological and physiological responses in plants. Morphological responses occur in root
245 elongation, leaf size, and the number of leaves. Physiologically roots can respond by

246 transporting ABA to regulate stomatal closure to reduce evaporation. Closure of stomata results
247 in low CO₂ absorption, causing the photosynthesis process to be not optimal.

248 The general response of plants to water deficit is to close their stomata, which is beneficial to
249 reduce water loss [110,111]. In addition, water deficit can affect hydraulic conductivity due to
250 hydraulic signals, gas exchange, water potential, and ABA determination in leaves (stomata)
251 [107]. In wheat, stomatal conductivity results in transpiration efficiency, which is influenced
252 by leaf transpiration and assimilation rate [112]. Water loss during the vegetative phase causes
253 soybean plants to balance water potential (osmotic adjustment) by dropping leaves, reducing
254 leaf size, closing stomata, and folding leaves for water usage efficiency through transpiration
255 reduction, however this reduces leaf area index (LAI) and so reduces photosynthetic rate [113].
256 The stomatal closure is a plant response to drought stress, which can decrease transpiration and
257 photosynthesis rate. However, this regulation is a complex mechanism interconnected between
258 external (water availability) and internal (ABA response) factors.

259 The photosynthesis process is influenced by the activity of supporting enzymes, one of which
260 is RuBisCo. RuBisCo plays a role in photosynthesis, namely photosystem II [114]. Under
261 drought stress, the amount of light absorption is small, decreasing the activity of RuBisCo [115]
262 [116]. Drought stress is often accompanied by an increase in temperature, resulting in
263 photoinhibition, which can impair RuBisCo's ability to activate the photosystem II pathway
264 [117]. This decrease occurs because the CO₂ carboxylase process by RuBisCo is not optimal
265 [72]. Drought stress inhibits the RuBisCo enzyme, which can lead to a reduction in carboxylate
266 assimilation. Hence, the regeneration of RuBP will ultimately inhibit the rate of photosystem II
267 [118]. High temperatures and drought stress in rice, wheat, and corn restrict RuBisCo function
268 by inhibiting the RuBisCo activase enzyme, which can reduce photosynthetic optimization
269 [114]. Photosynthetic products are usually transported to parts of the plant. However, in drought
270 conditions, there is a change in carbohydrate translocation in plants so that limited
271 carbohydrates are translocated to places contributing to resisting drought stress [119,45].
272 Carbohydrates are translocated in the form of simple components to maintain osmotic balance,
273 which is in roots are used for morphological growth to increase water uptake and ABA
274 induction [120]. Increasing the amount of carbohydrates in plant parts during the vegetative and
275 generative phases is a method used by plants to survive under drought stress [121].

276 The plants' response to drought stress is to maintain osmotic balance in cells [69,122]. One of
277 the mechanism to maintain this balance is to form soluble compounds to hold water out of the

278 cell (compatible solute) [123,124]. In addition, these soluble compounds are antioxidant
279 compounds that protect cell membranes from damage caused by ROS, one of which is proline
280 [47,125-127]. Proline and glycine-betaine are used as antioxidants and cell membrane
281 protection from radical compounds (ROS) [128]. High proline in the leaves of rice, soybean,
282 and sugarcane plantlets is a physiological indication of plants to resist water deficit
283 [48,129,125]. In wheat cv. Chakwal 50, the proline content increased as a result of drought
284 stress, indicating an osmotic adjustment process in cells in addition to free radical scavengers
285 [130]. The presence of proline in soybean plants can increase water stress resistance and
286 stabilize protein structure [131]. Proline is used as an indicator in drought-tolerant plants so that
287 it is used as the basis for breeding drought-resistant transgenic plants [132]. Proline, in
288 chloroplasts, is a synthesis of glutamate, which is reduced to glutamate semialdehyde (GSA)
289 by the P5CS enzyme (encoded by two genes) and converted spontaneously to P5C (encoded by
290 one gene) [126]. In mitochondria, proline undergoes catabolism with the help of proline oxidase
291 (PDH) to form P5C, which is then converted to glutamate [123].

292 In simple terms, the water balance in plants can be described as the equal amount of water
293 coming out (transpiration) and water coming in (absorption). The imbalance condition will
294 interfere with plant physiology, causing plants to experience stress [133]. In relation to
295 physiological processes, drought stress is related to turgor pressure, stomatal opening,
296 photosynthetic rate, enzyme damage, and root density [72]. plant growth due to low CO₂
297 absorption [134]. The direct inhibiting factor for plant growth is not water potential but osmotic
298 potential and turgor pressure [135,136]. The influence of turgor pressure can result in osmotic
299 adjustments in plants to reduce water loss [137]. Plants regulate water balance by generating
300 phytohormones, such as ABA, through their roots. ABA is a plant mediator in response to
301 drought, which is synthesized mostly in roots [138,108,139]. ABA is said to be the main
302 internal signal allowing plants to resist drought, which is transported to the leaves to affect
303 stomata closure to reduce transpiration [140,141,42]. ABA is a simple sequence of carotenoid
304 compounds. In fungi, ABA is synthesized through the methylerythritol phosphate (MEV) pathway,
305 which begins with the formation of mevalonate. Meanwhile, ABA in plants is synthesized
306 through the MEP pathway, starting with the formation of carotenoids into more specific
307 compounds (zeaxanthin) [139]. Assisted by the zeaxanthin epoxidase (ZEP), zeaxanthin is
308 converted to violaxanthin and turned to neoxanthin. In Arabidopsis, the gene involved in this
309 process is ABA4. Neoxanthin will be converted into xanthine with NCEDs enzymes as
310 activators (found in Arabidopsis, corn, tomatoes, cowpea, and grains). In maize, the gene

311 involved is known to be VIP14. Xanthine is converted to abscisic aldehyde and then to ABA.
312 The genes involved in this process are ABA2 and ABA3 in Arabidopsis plants and TaNAC48
313 in wheat [142].

314 ABA formed in the roots is transported to the leaves and the flowers. NCED2 and NECD3
315 proteins are known to play a more dominant role in the synthesis of ABA in roots, while
316 NCED5, NCED6, and NCED9 are more dominant in the flowering part. Apart from being an
317 early signal of drought that will be transported to the leaves, ABA will also affect the growth
318 of stressed plant roots by increasing water influx by the roots [143]. ABA transport to the leaves
319 occurs with enzymes (such as CLE25) as activators. When ABA reaches the leaves, it becomes
320 a signal for stomata to close [144]. Stomatal closure can be beneficial to reduce transpiration
321 [145,146], but the rate of photosynthesis will decrease, photorespiration will increase, and the
322 accumulation of ROS compounds will increase [147]. The ABA-mediated gene for stomatal
323 closure in wheat is TaNAC48 [142]. When the stomata close, there is a lack of CO₂. The excess
324 O₂ from photosynthesis is bound by RuBisCo molecules, and some of these compounds can
325 form ROS chemicals. RuBisCo should be able to bind CO₂ absorbed from PEP (in C₄ plants).
326 With the decrease in the amount of CO₂, the O₂ bound by RuBisCo can produce CO₂, but more
327 energy (ATP) is required, thereby reducing the efficiency of photosynthesis. When the stomata
328 are closed, there will be a buildup of singlet oxygen (O[•]) and hydroxide compounds (H₂O₂) as
329 a result of photosynthesis, forming toxic ROS compounds. This condition is anticipated by
330 forming direct antioxidant compounds (carotenoids, mannitol) and antioxidant enzymatic
331 reactions, such as SOP, APX, and CAT, which can convert ROS compounds into O₂ and H₂O
332 [90,148,149,76]. However, severe and long-duration stress causes an imbalance between ROS
333 and antioxidants. If the ROS is higher than the antioxidant, it will attack the fatty acids on the
334 membrane (PUFAs) so that the cell membrane will be damaged, and if the plant cannot adapt,
335 the plant will be sensitive and die [150]. The increase in ROS compounds that are not matched
336 by an increase in antioxidant compounds and other solute compounds causes membrane
337 damage to plant cell walls and other responses such as proline formation and an increase in
338 reaction enzymes such as SOP, APX, and CAT [76].

339 Plants such as tomato plants [151], sunflower plants [152], sugarcane [153] respond to drought
340 stress by forming compatible solutes, namely sugars with low molecular weights that are
341 osmoprotectant compounds (stress protecting agents) [154]. Regarding the function of
342 trehalose, there are at least two supporting theories. The first theory is water replacement

343 because it can form hydrogen bonds with surrounding structural molecules that function as a
344 substitute for water, for example, trehalose with lipid molecules will function as membrane
345 integrity guards during drought stress (changes in the membrane from a fluid phase to a gel
346 phase). The second theory is water entrapment since it can play a role in collecting water by
347 forming hydrogen bonds to form a water layer in the cell [155]. Trehalose is a disaccharide
348 group formed from the breakdown of carbohydrates into two glucose molecules [156]. Plants
349 under drought stress will increase ABA synthesis, playing a role in stomatal closure and
350 stimulating signal transduction by forming a protein cascade, namely TPS1 protein. This
351 protein will activate transcriptional genes such as the TreGP gene (TGP), which will play a role
352 in the formation of trehalose as a compatible solute in cells that supports osmotic adjustment in
353 cells [156,157].

354 **Drought Stress Management**

355 Drought stress has an impact on agriculture crop cultivation, thereby decreasing crop
356 production. Therefore, it is necessary in these condition to require management to increase crop
357 production. These condition has management variations so that appropriate strategies and
358 technologies are needed as mitigation measures. Mitigation management can be done by:1) Use
359 early maturing varieties and drought stress tolerance varieties. The use of early maturing to
360 facing drought stress can be used to increase crop index (CI) and it will maintain high yields
361 [158]. Drought tolerance varieties can respond and induces expression of drouht stress related
362 genes so that the plant will survive in these conditions [159]. 2) using mechanical soil
363 conservation such as making terraces and bed planting which are used to suppress surface water
364 flow and hold back puddles. The terraces are supported and can help in binding soil particles
365 and also to bind water longer whereas bed planting can enhances the water infiltration rate and
366 can maintain mouisture conditions [160]. 3) applying a good irrigation system. Drought and
367 water scarcity conditions need irrigation management, this should be seen within supply and
368 demand management for plant [161]. 4) biological conservation using mulch to improve soil
369 structure and to increase the ability of the soil to hold water. Mulching is one of the important
370 management practice for conserving soil moisture in plants cultivation. That evaporates from
371 soil with mulch will be condenses on the lower surfaces and go back to the soil thus conserving
372 moisture [162]. 5) selecting drought-tolerant plants both in vitro and in vivo by using selector
373 agents such as PEG. The in vitro screening using PEG-6000 is an alternative for the early
374 selection of drought tolerance varieties, it is known through gene markers of varieties that are

375 considered optimal growth in drought stress [163]. 6) applying osmo-protectant compounds,
376 such as glycine betaine. Glycine betaine exogenous application can reducing the aggregation
377 of ROS, that can improving SOD and CAT activities which will result in an osmotic adjustment
378 mechanism [164].

379 **Conclusion**

380 Drought stress causes plant to be in a state of water deficit. Water deficit has an impact on cell
381 division, cell elongation, cell differentiation, and a decrease in CO₂ fixation so that it can reduce
382 photosynthetic results and the accumulation of ROS compounds, thereby decreasing crop
383 production. These condition stimulates plants responses through morphological and
384 physiological changes. Mitigation management can be done by several ways such as use
385 tolerance varieties (early maturing), soil conservation, good irrigation system, use mulch as
386 biological conservation, selection in vitro to screening drought stress tolerance varieties and
387 exogenous application osmo-protectant like glycine betaine.

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390 **Conflict of interest**

391 The authors declare no conflict of interest.

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879 Table 1. Water status relationship between water potential and soil water volume

Water Status	Water Potential Status		Soil Water Status			Availability to Plant
	pF	Mpa	Sand	Clay	Loam	
Saturation	0	0	39%	50%	54%	Unavailable
Field Capacity	(-) 1-2,5	(-) 0,33	8-10%	20-35%	36-49%	Available
Wilting Point	(-) 4,2	(-) 1,5	4%	9%	29%	Unavailable

880 Source: [23,32] - modified

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882 Table 2. Plants responses to drought stress

Drought Stress	Response		
	Morphology	Physiology	Biochemical
	Strengthens the roots system (roots elongated)	Stomatal closure	ABA synthesis
	Reduce leaf surface area	Reduce CO ₂ fixation	Decreased activity of rubisco
	Rolling the leaves	Decreasing photosynthesis	Accumulation of solute compounds (proline, glycine-betaine, sugar)
	Dropping leaves	Increased ROS compounds	Increased antioxidant compounds
	Early flowering		Drought tolerant gene expression

883 Source: [52] - modified

884

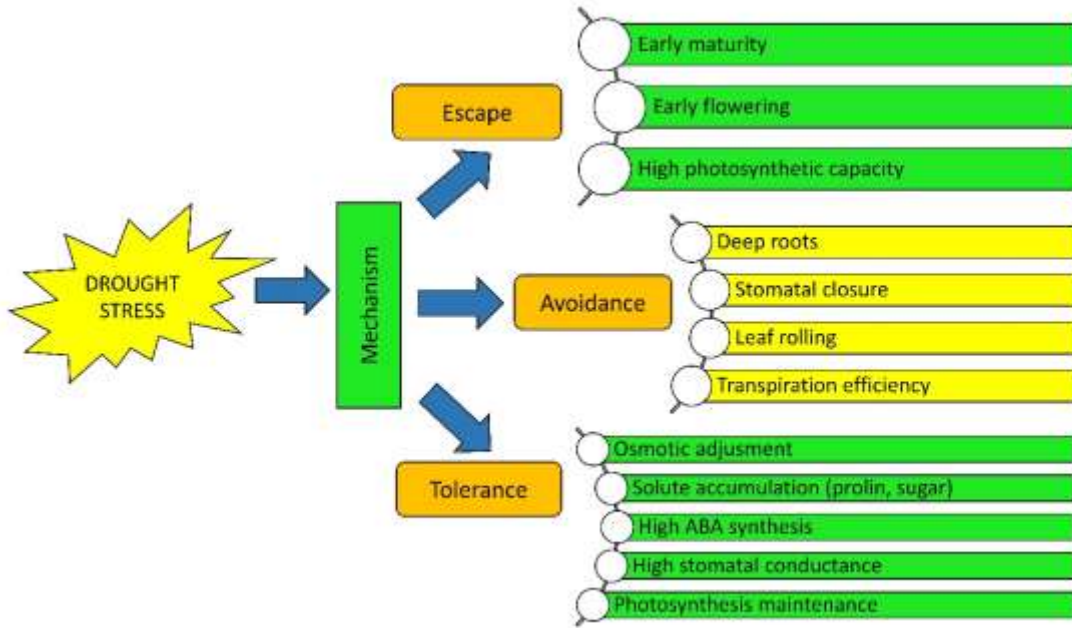
885 Table 3. Relationship between drought stress and the sensitivity of plant metabolic processes

Affected process	Sensitivity															
	Very susceptible					Susceptible					Unsusceptible					
(-) decreased	Pressure (Bar) (-)															
(+) increased	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Cell growth (-)																
Cell wall synthesis (-)*																
Protein synthesis (-)*																
Proto-chlorophyll formation (-)**																
Nitrate reductase (-)																
ABA Synthesis (+)																
Stomatal conductivity (-)																
Fixation of CO ₂ (-)																
Respiration																
Xylem conductivity (-)***																
Proline synthesis (+)																
Sugar synthesis (+)																

886 Note: *= fast growing tissue; **= etiolated leaves; ***= xylem dimension factor

887 Source: [36] - modified

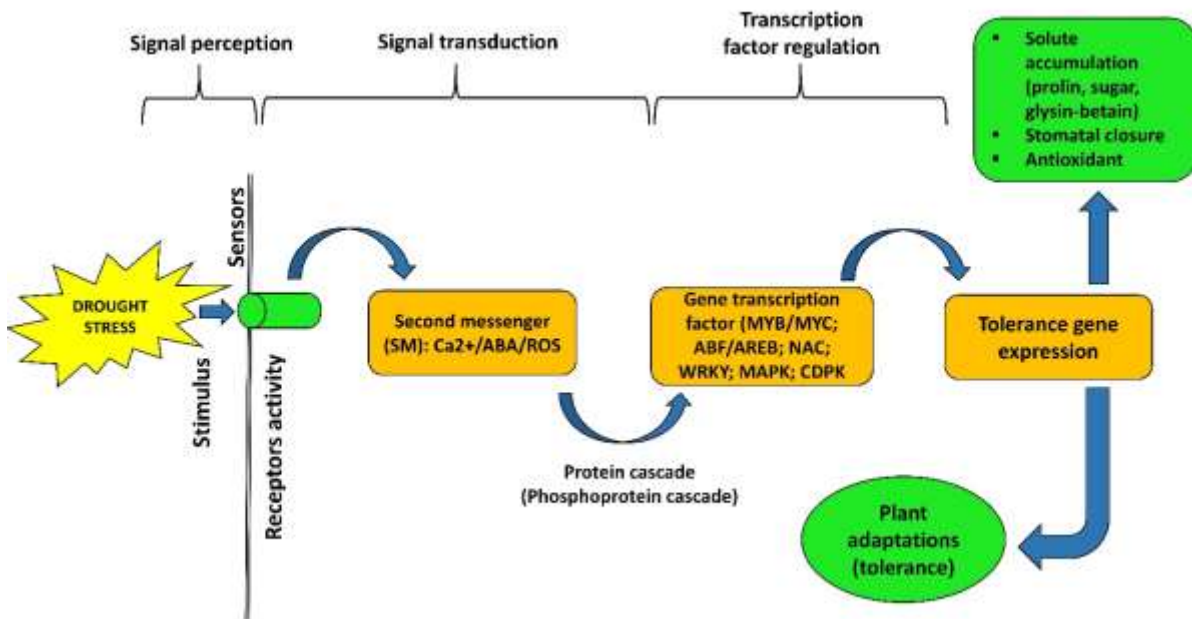
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890 Figure 1. Crops mechanism in drought stress [65] - modified

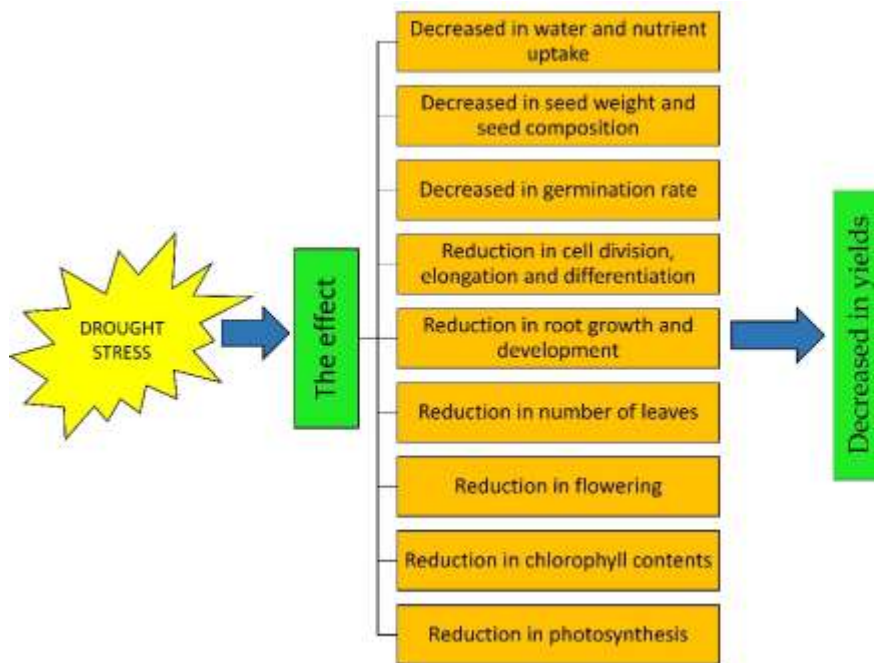
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893 Figure 2. Signaling plant networks against drought stress [11,72] - modified

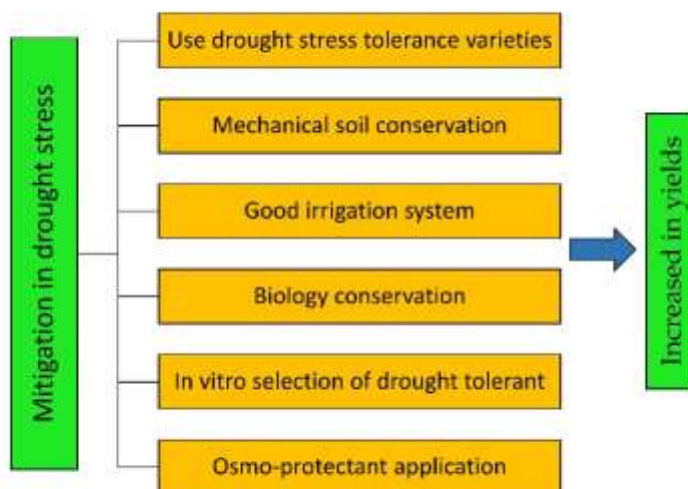
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896 **Figure 3. The impact of drought stress on crops [137] - modified**

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899 **Figure 4. Mitigation in drought stress**

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Dear

Editor in Chief Reviews in Agricultural Science,

I am Saktiyono Sigit Tri Pamungkas, representing on behalf of the manuscript (Suwanto, Suprayogi and Noor Farid). I wish to submit a review article entitled “Drought Stress: Responses and Mechanism in Plants” for consideration Reviews in Agricultural Science.

We confirm that this paper is original and has not been published elsewhere, nor is it currently under consideration for publication elsewhere.

In this paper, I explain how the impact of drought stress on plants that will affect growth and development in morphology, physiology and biochemistry, so that it affects crop yields and how to minimize drought stress for agricultural crop cultivation. I hope this paper can be used as a basic knowledge about the impact of drought stress so that early mitigation can be carried out in agricultural crop cultivation. I believe that this manuscript is appropriate for publication by Reviews in Agricultural Science because it matches with journal’s Aims & Scope.

I have no conflicts of interest to disclose.

Please address all correspondence concerning this manuscript to me at skt@polteklpp.ac.id

Thank you for your consideration of this manuscript.

Best regards,

Saktiyono Sigit Tri Pamungkas

Department of Plantation, Vocational Education, Polytechnic of LPP Yogyakarta

Jl. LPP No: 1 A, Balapan, Klitren, Gondokusuman, Yogyakarta, Special District of Yogyakarta, 55222, Indonesia

Dear

Editor in Chief Reviews in Agricultural Science,

I am Saktiyono Sigit Tri Pamungkas, representing on behalf of the manuscript (Suwanto, Suprayogi and Noor Farid). I wish to submit a revision of my paper according to the reviewers comment.

LIST OF CHANGE

Title: Drought Stress: Responses and Mechanism in Plants

Author: Saktiyono S.T. Pamungkas^{1)*}, Suwanto²⁾, Suprayogi²⁾, Noor Farid²⁾

Reviewer 1

No	Reviewer Comment	Response
1.	on abstract: Too long, see author guideline.	Thank you very much for your comment. I have revised it: I have corrected the abstract no more than 300 words according to the guidelines. In the abstract there are 273 word. You can find in line 26 to 46.
2.	on abstract: Try to focus on the main issue and finding.	Thank you very much for your comment. I have revised it: - I have corrected in the abstract. I have written the purpose of writing this review. You can find in line 28. - I have corrected in the abstract. I have focused on the topic of plant responses and mechanisms to drought stress. You can find in line 30 to 43.
3.	on abstract: "Plants manage drought stress by using three mechanisms": this statement is not good because no detail explanation in abstract.	Thank you very much for your comment. I have revised it: I have corrected the statement in the abstract. You can find in line 30.

4.	<p>on abstract:</p> <p>...the conclusion...: I think it is better to not mention "conclusion", but directly state the main finding and implication (briefly).</p>	<p>Thank you very much for your comment.</p> <p>I have revised it: I have corrected the statement in the abstract. You can find in line 43 to 46.</p>
5.	<p>on introduction:</p> <p>Too many "water" for the first word in sentences, you must learn how to diversify it.</p>	<p>Thank you very much for your comment.</p> <p>I have revised it: in the introduction I have tried to improve by reducing the word 'water' in the sentence. You can find in line 57 to 96.</p>
6.	<p>on introduction:</p> <p>no aims is stated in introduction.</p>	<p>Thank you very much for your comment.</p> <p>I have revised it: I have added aims in introduction. You can find in line 54.</p>
7.	<p>on introduction:</p> <p>I'm not sure whether this paper focus on Indonesian case, but author stated that this paper about Indonesian case.</p>	<p>Thank you very much for your comment.</p> <p>I have revised it: I apologize for my mistake in writing the drought stress case in Indonesia. I intend to write about the impact of drought and its response to plants, but I hope this paper can be used as basic information about the impact of drought stress and its management efforts, especially on plant cultivation in Indonesia. I have corrected my cover letter.</p>
8.	<p>on Physiological Effects and Mechanisms:</p> <p>275-276: "one way"? I don't understand this</p>	<p>Thank you very much for your comment.</p> <p>I have revised it: I have corrected the statement. You can find in line 276 to 278.</p>
9.	<p>on result:</p> <p>Figure 1 and other are not clear enough to be read, you must use good colour combination in order to all illustration can be understood.</p>	<p>Thank you very much for your comment.</p> <p>I have revised it: I have corrected figure size and colour combination. I hope these can be understood. You can find in line 889 to 890; 892 to 893; 895 to 896 and 898 to 899.</p>

10.	<p>on result:</p> <p>Maybe it is better to add chapter about the drought stress management.</p>	<p>Thank you very much for your comment.</p> <p>I have revised it: I have added chapter about the drought stress management. You can find in line 354 to 378.</p>
11.	<p>on conclusion:</p> <p>I think the purpose of this paper need to be clearer, about drought stress or dryland plantation? Focus on theoretical framework of drought stress or optimizing dryland plantation?</p>	<p>Thank you very much for your comment.</p> <p>I have revised it: I have corrected and focus on theoretical framework of drought stress impact and response to plants, but I added some management to reduce the impact of the drought stress. You can find in line 379 to 387.</p>

Reviewer 2

No	Reviewer Comment	Response
Overall Comments		
1.	<p>The topics of your article is very important for crop production in arid area and climate. But the purpose of your paper is not clear as review article.</p>	<p>Thank you very much for your comment.</p> <p>I have revised it: I have written purpose in the abstract and introduction. You can find in line 28 and 54.</p> <p>I have corrected and focus on theoretical framework of drought stress impact and response to plants, but I added some management to reduce the impact of the drought stress. You can find in line 379 to 387.</p>
2.	<p>You had better describe your original strategy, opinion and propose for crop production especially in the chapter of "conclusion".</p>	<p>Thank you very much for your comment.</p> <p>I have revised it:</p> <ul style="list-style-type: none"> - I have added chapter about the drought stress management. Line 354 to 378. - The conclusion chapter briefly describes the impact of drought and some mitigation efforts that can be done. mitigation that is written is a conclusion from drought stress management. You can find in line 354 to 378 (chapter drought stress management) and 379 to 387 (chapter conclusion).

Best regards,

Saktiyono Sigit Tri Pamungkas

Department of Plantation, Vocational Education, Polytechnic of LPP Yogyakarta

Jl. LPP No: 1 A, Balapan, Klitren, Gondokusuman, Yogyakarta, Special District of Yogyakarta,
55222, Indonesia

Dear,

Editor in Chief Reviews in Agricultural Science,

I am Saktiyono Sigit Tri Pamungkas, representing on behalf of the manuscript (Suwarto, Suprayogi and Noor Farid). I wish to submit a second revision of my paper according to the reviewers comment.

LIST OF CHANGE

Title: Drought Stress: Responses and Mechanism in Plants

Author: Saktiyono S.T. Pamungkas^{1)*}, Suwarto²⁾, Suprayogi²⁾, Noor Farid²⁾

Reviewer 1 and 2

No.	Reviewer Comment	Response
Overall Comments		
1.	Reviewer 1 Figure 1, 2, 3. Use clearer color, red color cannot be seen clearly. And use high resolution picture for all figures, I check that the quality still too low.	Thank you very much for your comment. I have revised it: - I have changed all the red color of the figures (1,2 and 3), I hope this is clearer. You can find in line 889, 892 and 895. - I have corrected and have changed all the resolutions of the figures (1,2,3 and 4) to use the dimensions of 10240 x 5760 pixels and a resolutions of 768 dpi. You can find in line 889, 892, 895 and 898.
2.	Reviewer 2 Improve the format of all figures and tables while referring the published article of this journal.	Thank you very much for your comment. I have revised it: - I have have changed all the resolutions of the figures (1,2,3 and 4) to use the dimensions of 10240 x 5760 pixels and a resolutions of 768 dpi. You can find in line 889, 892, 895 and 898. - I have improve the all of tables (1,2 and 3) by increasing the font size, I hope all the tables can be read clearly. You can find in line 879, 882 and 885.

Best regards,

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