BUKTI KORESPONDENSI
ARTIKEL JURNAL INTERNASIONAL BEREPUTASI

Judul	:	Investigating the Impact of Soil pH and Texture on Legume Species' Root Nodule Formation
jurnal	:	International Journal of Agriculture and biology
penulis	:	Jamilah

No	perihal	tanggal
1	Bukti konfirmasi submit artikel dan artikel yang disubmit	19 April 2024
2.	Bukti konfirmasi review dan hasil review pertama	27 Agust 2024
3.	Accept	2 September 2024
4.	Bukti konfirmasi pembayaran	3 September 2024
5	Bukti konfirmasi submit revisi kedua, respon kepada reviewer, dan artikel yang diresubmit	11 September 2024
6	Request for provision of names of authors contributed equally for manuscript IJAB-24-0194	11 September 2024
7	request you to provide the name of authors who contributed equally for your manuscript titled "Investigating the Impact of Soil pH and Texture on Legume Species' Root Nodule Formation" with a manuscript ID IJAB-24-0194GP at the earliest.	18 september 2024

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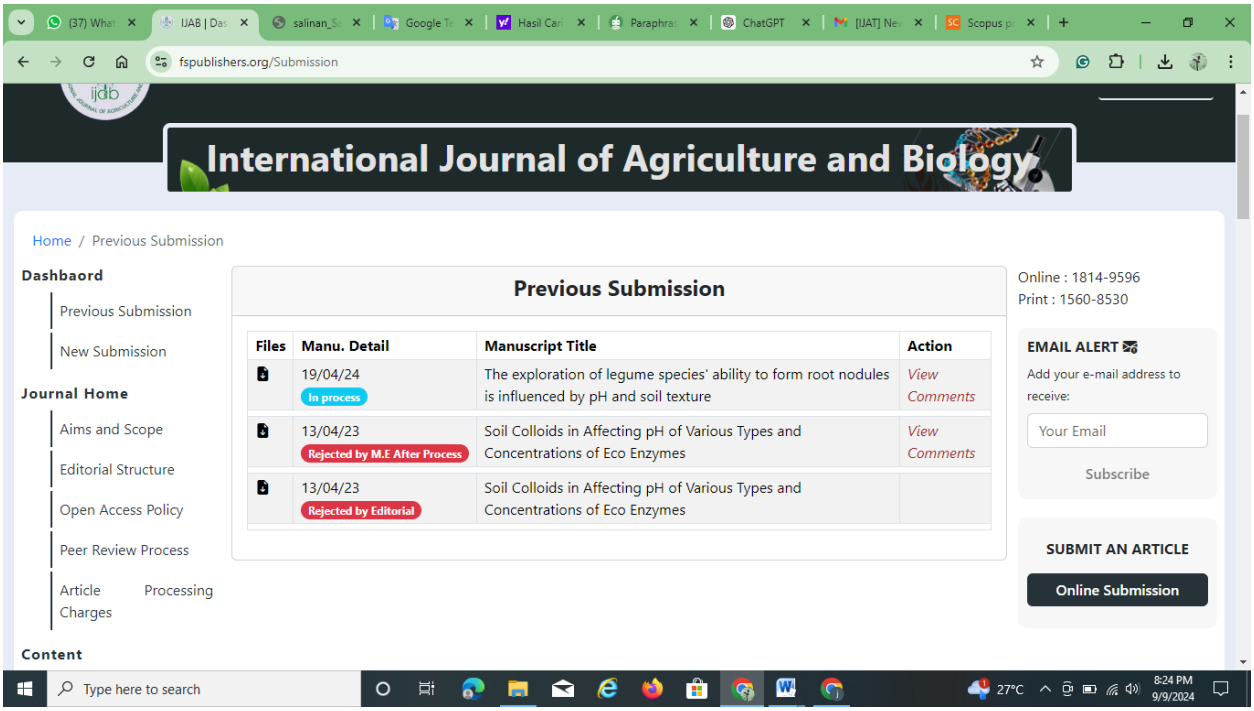

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In reference to your submission IJAB-24-0194 entitled “The exploration of legume species' ability to form root nodules is influenced by pH and soil texture” submitted for possible publication in ‘International Journal of Agriculture and Biology’.

Your manuscript is evaluated by two reviewers in your area of research and by myself in detail. The topic of the study is interesting and falls within the scope of journal. However, there are serious concerns in all sections of the manuscript. The manuscript is not written concisely, particularly the discussion section is about six pages long. Data is presented without statistical analysis in Fig. 4, 7 and 8. The manuscript is not written according to journal format (see attached sample paper as reference). For detailed comments, see the attached evaluation report and annotated file. Likewise, the manuscript is not written according to IJAB format.

Therefore, I invite you to revise your whole paper thoroughly following the comments given in the attached evaluation report and annotated file, and send the substantially improved version within two weeks for re-evaluation. Please label the MS file as IJAB-24-0194R1 while submitting the revised version. Please indicate the revisions in different text color. Moreover, the whole manuscript is needed to be formatted according to IJAB starting from title to the tables.

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Dr. Mubshar Hussain
Professor
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Adjunct Professor
Agriculture Discipline, College of Science, Health, Engineering and Education,
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jamilah jamilah <jamilah@unitas-pdg.ac.id>

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Mubashir Hussain <mubashiragr@googlemail.com> 27 Agustus 2024 pukul 10.22
Kepada: jamilah@unitas-pdg.ac.id, jamilahfatika@gmail.com

Dear Jamilah

In reference to your submission IJAB-24-0194 entitled "The exploration of legume species' ability to form root nodules is influenced by pH and soil texture" submitted for possible publication in 'International Journal of Agriculture and Biology'.

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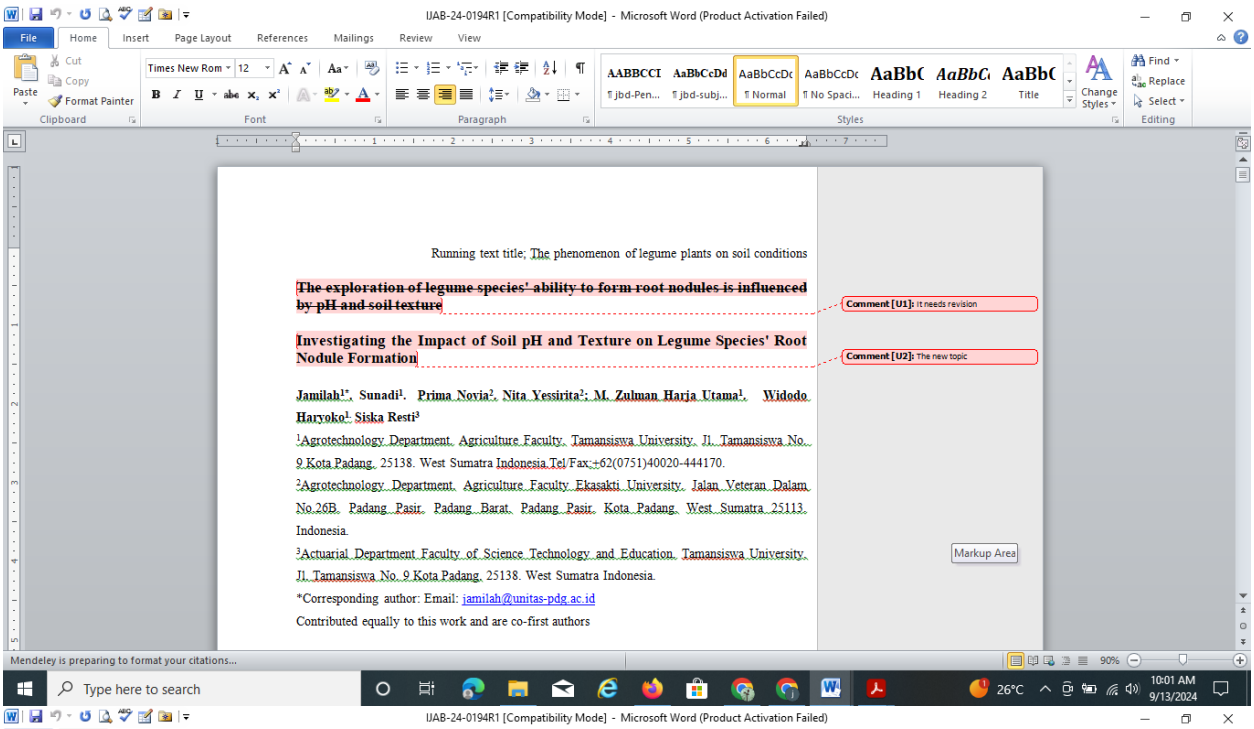

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Running text title: The phenomenon of legume plants on soil conditions

~~The exploration of legume species' ability to form root nodules is influenced by pH and soil texture~~

Investigating the Impact of Soil pH and Texture on Legume Species' Root Nodule Formation

Comment [U1]: it needs revision

Comment [U2]: The new topic

Jamilah[1*], Sunadi[1], Prima Novia[2], Nita Yessirita[2], M. Zulman Harja Utama[1], Widodo Haryoko[1], Siska Resti[3]

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[2]Agrotechnology Department, Agriculture Faculty Eksakti University, Jalan Veteran Dalam No.26B, Padang Pasir, Padang Barat, Padang Pasir, Kota Padang, West Sumatra, 25113, Indonesia.

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*Corresponding author: Email: jamilah@unitas-pdg.ac.id

Contributed equally to this work and are co-first authors

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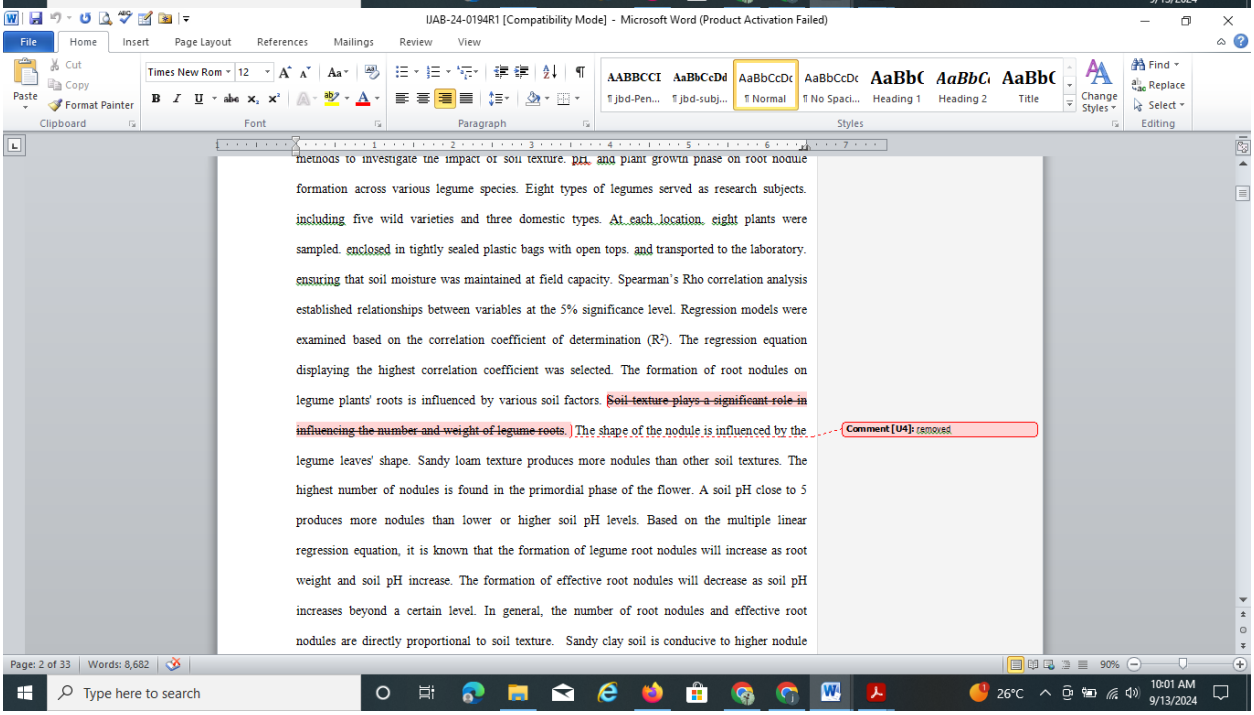

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methods to investigate the impact of soil texture, pH, and plant growth phase on root nodule formation across various legume species. Eight types of legumes served as research subjects, including five wild varieties and three domestic types. At each location, eight plants were sampled, enclosed in tightly sealed plastic bags with open tops, and transported to the laboratory, ensuring that soil moisture was maintained at field capacity. Spearman's Rho correlation analysis established relationships between variables at the 5% significance level. Regression models were examined based on the correlation coefficient of determination (R^2). The regression equation displaying the highest correlation coefficient was selected. The formation of root nodules on legume plants' roots is influenced by various soil factors. ~~Soil texture plays a significant role in influencing the number and weight of legume roots.~~ The shape of the nodule is influenced by the legume leaves' shape. Sandy loam texture produces more nodules than other soil textures. The highest number of nodules is found in the primordial phase of the flower. A soil pH close to 5 produces more nodules than lower or higher soil pH levels. Based on the multiple linear regression equation, it is known that the formation of legume root nodules will increase as root weight and soil pH increase. The formation of effective root nodules will decrease as soil pH increases beyond a certain level. In general, the number of root nodules and effective root nodules are directly proportional to soil texture. Sandy clay soil is conducive to higher nodule

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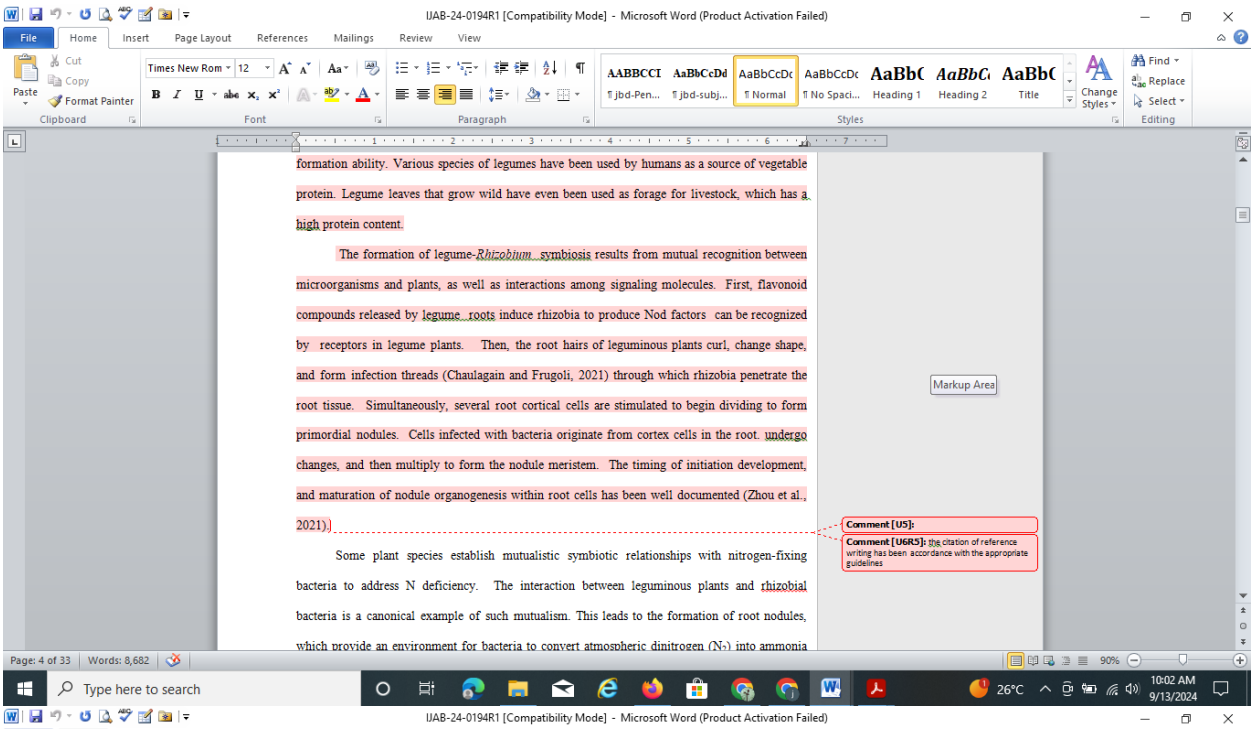
Page: 2 of 33 | Words: 8,682



formation ability. Various species of legumes have been used by humans as a source of vegetable protein. Legume leaves that grow wild have even been used as forage for livestock, which has a high protein content.

The formation of legume-*Rhizobium* symbiosis results from mutual recognition between microorganisms and plants, as well as interactions among signaling molecules. First, flavonoid compounds released by legume roots induce rhizobia to produce Nod factors can be recognized by receptors in legume plants. Then, the root hairs of leguminous plants curl, change shape, and form infection threads (Chaulagain and Frugoli, 2021) through which rhizobia penetrate the root tissue. Simultaneously, several root cortical cells are stimulated to begin dividing to form primordial nodules. Cells infected with bacteria originate from cortex cells in the root. undergo changes, and then multiply to form the nodule meristem. The timing of initiation development, and maturation of nodule organogenesis within root cells has been well documented (Zhou et al., 2021).

Some plant species establish mutualistic symbiotic relationships with nitrogen-fixing bacteria to address N deficiency. The interaction between leguminous plants and rhizobial bacteria is a canonical example of such mutualism. This leads to the formation of root nodules, which provide an environment for bacteria to convert atmospheric dinitrogen (N_2) into ammonia

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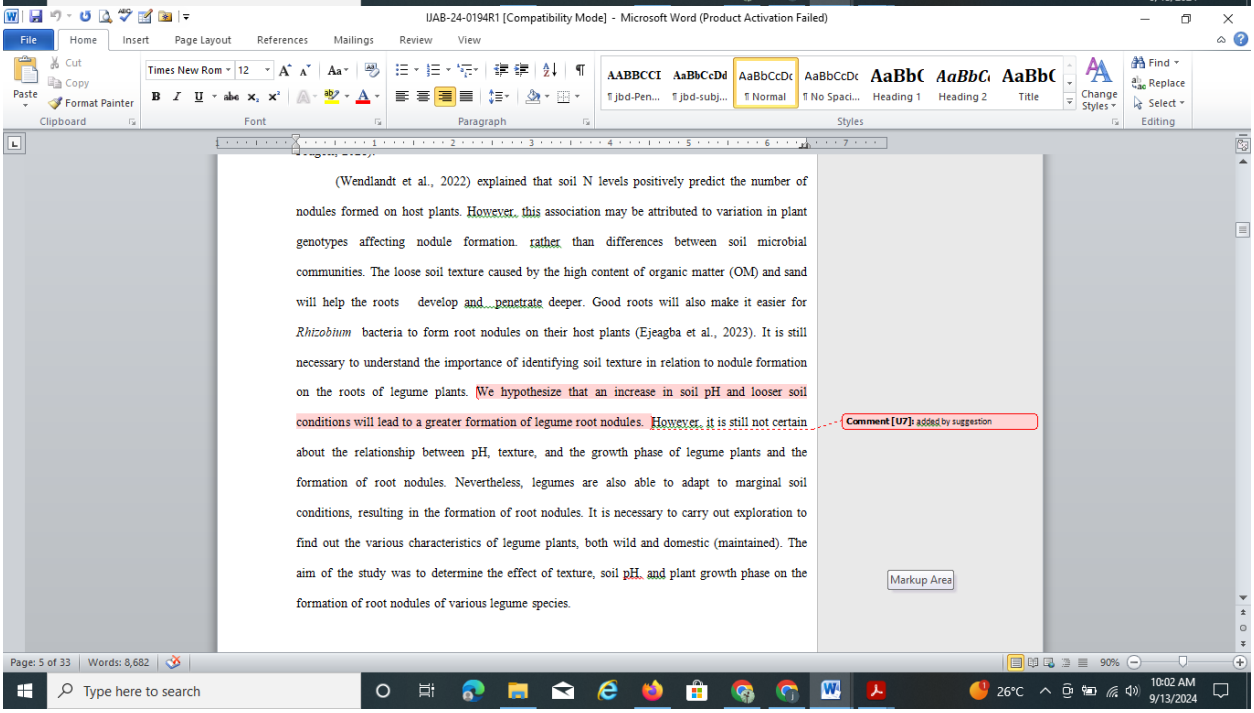

(Wendlandt et al., 2022) explained that soil N levels positively predict the number of nodules formed on host plants. However, this association may be attributed to variation in plant genotypes affecting nodule formation. rather than differences between soil microbial communities. The loose soil texture caused by the high content of organic matter (OM) and sand will help the roots develop and penetrate deeper. Good roots will also make it easier for *Rhizobium* bacteria to form root nodules on their host plants (Ejeagba et al., 2023). It is still necessary to understand the importance of identifying soil texture in relation to nodule formation on the roots of legume plants. We hypothesize that an increase in soil pH and looser soil conditions will lead to a greater formation of legume root nodules. However, it is still not certain about the relationship between pH, texture, and the growth phase of legume plants and the formation of root nodules. Nevertheless, legumes are also able to adapt to marginal soil conditions, resulting in the formation of root nodules. It is necessary to carry out exploration to find out the various characteristics of legume plants, both wild and domestic (maintained). The aim of the study was to determine the effect of texture, soil pH, and plant growth phase on the formation of root nodules of various legume species.

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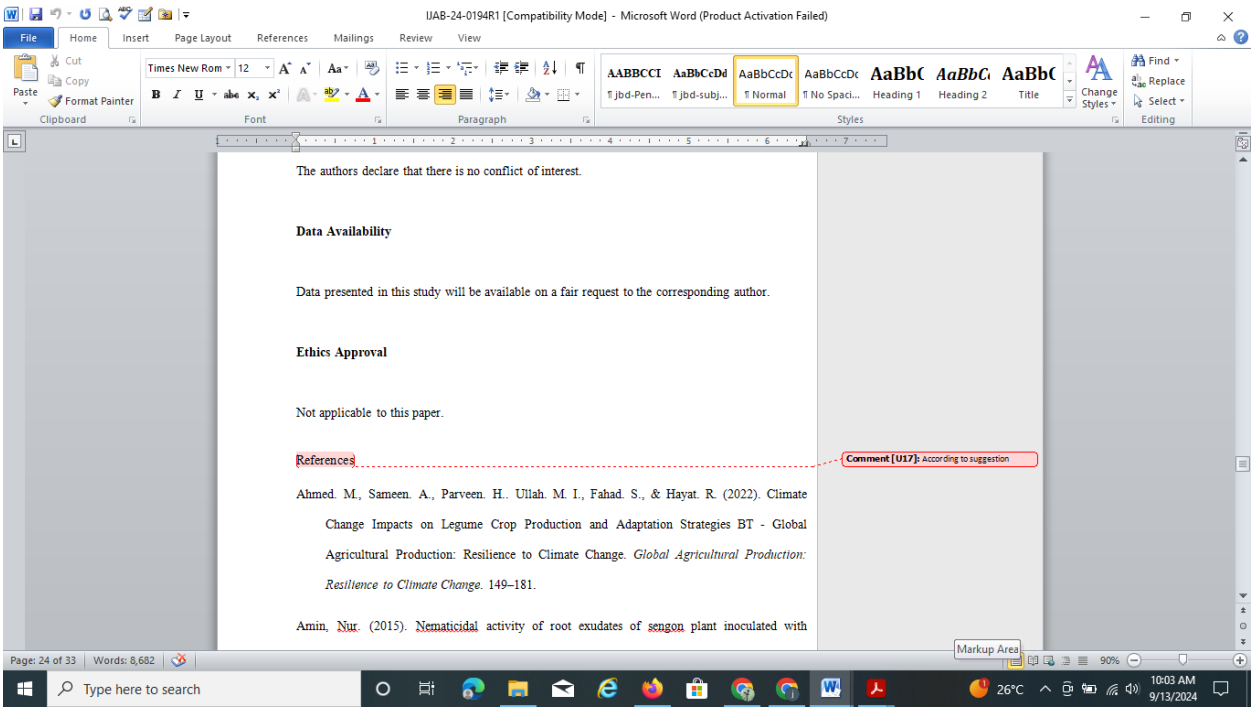

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The authors declare that there is no conflict of interest.

Data Availability

Data presented in this study will be available on a fair request to the corresponding author.

Ethics Approval

Not applicable to this paper.

References

Comment [U17]: According to suggestion

Ahmed. M., Sameen. A., Parveen. H.. Ullah. M. I., Fahad. S., & Hayat. R. (2022). Climate Change Impacts on Legume Crop Production and Adaptation Strategies BT - Global Agricultural Production: Resilience to Climate Change. *Global Agricultural Production: Resilience to Climate Change*. 149–181.

Amin, Nur. (2015). Nematicidal activity of root exudates of sengon plant inoculated with

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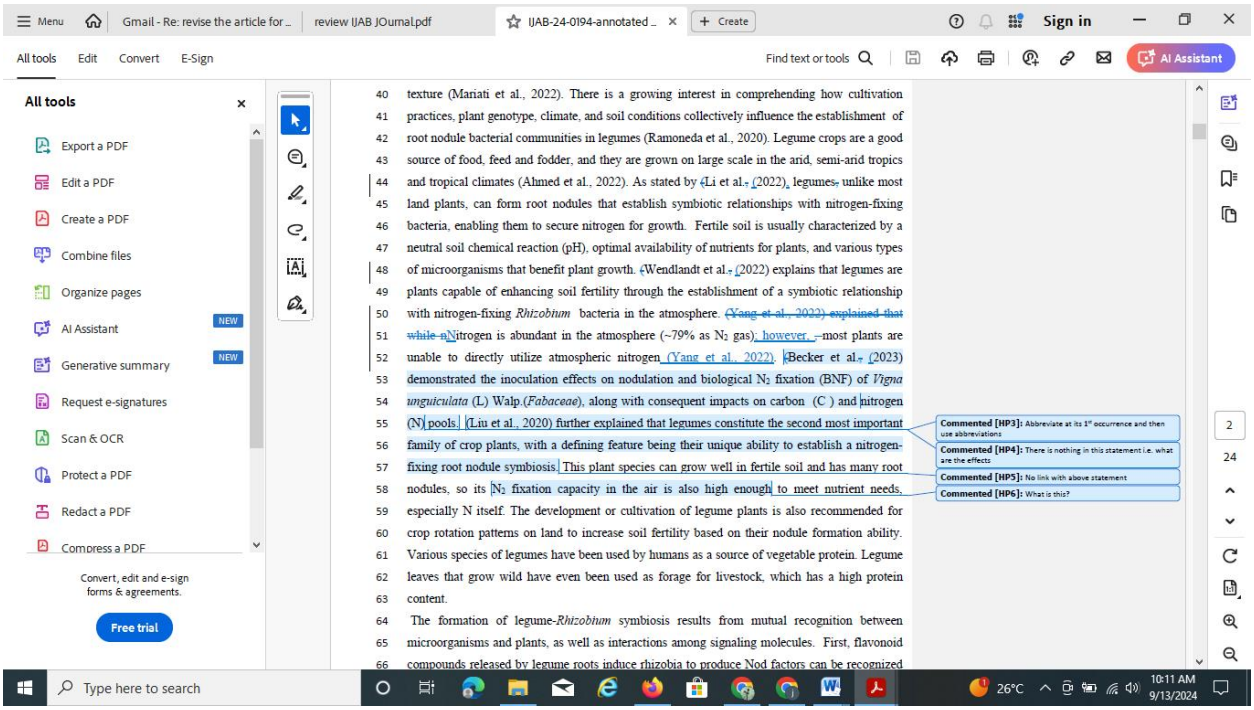

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texture (Mariati et al., 2022). There is a growing interest in comprehending how cultivation practices, plant genotype, climate, and soil conditions collectively influence the establishment of root nodule bacterial communities in legumes (Ramoneda et al., 2020). Legume crops are a good source of food, feed and fodder, and they are grown on large scale in the arid, semi-arid tropics and tropical climates (Ahmed et al., 2022). As stated by (Li et al., (2022), legumes, unlike most land plants, can form root nodules that establish symbiotic relationships with nitrogen-fixing bacteria, enabling them to secure nitrogen for growth. Fertile soil is usually characterized by a neutral soil chemical reaction (pH), optimal availability of nutrients for plants, and various types of microorganisms that benefit plant growth. (Wendlandt et al., (2022) explains that legumes are plants capable of enhancing soil fertility through the establishment of a symbiotic relationship with nitrogen-fixing *Rhizobium* bacteria in the atmosphere. ~~(Yang et al., 2022) explained that while a~~Nitrogen is abundant in the atmosphere (~79% as N_2 gas); however, ~~,~~most plants are unable to directly utilize atmospheric nitrogen (Yang et al., 2022). (Becker et al., (2023) demonstrated the inoculation effects on nodulation and biological N_2 fixation (BNF) of *Vigna unguiculata* (L) Walp.(*Fabaceae*), along with consequent impacts on carbon (C) and nitrogen (N) pools. (Liu et al., 2020) further explained that legumes constitute the second most important family of crop plants, with a defining feature being their unique ability to establish a nitrogen-fixing root nodule symbiosis. This plant species can grow well in fertile soil and has many root nodules, so its N_2 fixation capacity in the air is also high enough to meet nutrient needs, especially N itself. The development or cultivation of legume plants is also recommended for crop rotation patterns on land to increase soil fertility based on their nodule formation ability. Various species of legumes have been used by humans as a source of vegetable protein. Legume leaves that grow wild have even been used as forage for livestock, which has a high protein content.

The formation of legume-*Rhizobium* symbiosis results from mutual recognition between microorganisms and plants, as well as interactions among signaling molecules. First, flavonoid compounds released by legume roots induce rhizobia to produce Nod factors can be recognized

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100 **Materials and Methods**

101

102 **Research area and material**

103 The research was conducted from January to February 2024 in Padang City, West Sumatra
104 Province, Indonesia. The study site was Padang City in a tropical climate, located at latitude -
105 0.9470832 and longitude 100.417181, encompassing several sub-districts, namely: Koto Tangah
106 (A) at latitude -0.2247033 and longitude 100.4170024, Kuranji (B) at latitude -0.9022492 and
107 longitude 100.4397156, Nanggalo (C) at latitude -1.2203803 and longitude 100.4577502, and
108 Padang Utara (D) at latitude -0.89708125 and longitude 100.349850855803 (Fig. 1).

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109

110 **Procedures:** This research employed a qualitative research design with an exploratory
111 descriptive method. The objective was to explore various types of legumes growing in four sub-
112 districts in Padang City. Sampling of legume plants was conducted randomly across several sub-
113 districts. Eight types of legumes served as research objects, including five types of wild legumes
114 (*Mimosa invisa* Mart. ex Colla, *Crotalaria incana* L., *Calopogonium mucunoides* Desv and Wit,
115 *Macroptilium atropurpureum* (DC.) Urb. and three types of domestic legumes (*Leucaena*
116 *leucocephala*, *Glycine max* (L.) *Merr*, *Vigna unguiculata* (L.) Walp., and *Arachis hypogaea* L.).
117 To collect the legume plants, a shovel was used to dig up the plants completely, including the
118 roots and rhizosphere soil, which were then transported to the laboratory. Five plants were
119 sampled at each location (Figure 1) and placed in tightly closed plastic bags with open tops. The
120 soil and plant samples' moisture were maintained at field capacity during transportation to the
121 laboratory.
122 The tools utilized in this research included earth-digging tools, shovels, a cell phone camera

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280 macro pores. Despite the presence of abundant organic matter, organic soil is not capable of
281 producing more nodules than sandy or clay-textured soil. It is suspected that organic soil already
282 contains sufficient nutrients for plants, potentially inhibiting the development of *Rhizobium*
283 bacteria.

284

285 **Discussion**

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Explain the results logically and try to correlate the results rather than discussing each trait separately

286 The results of the exploration indicate that legume leaflet shapes, such as those found in Mimosa

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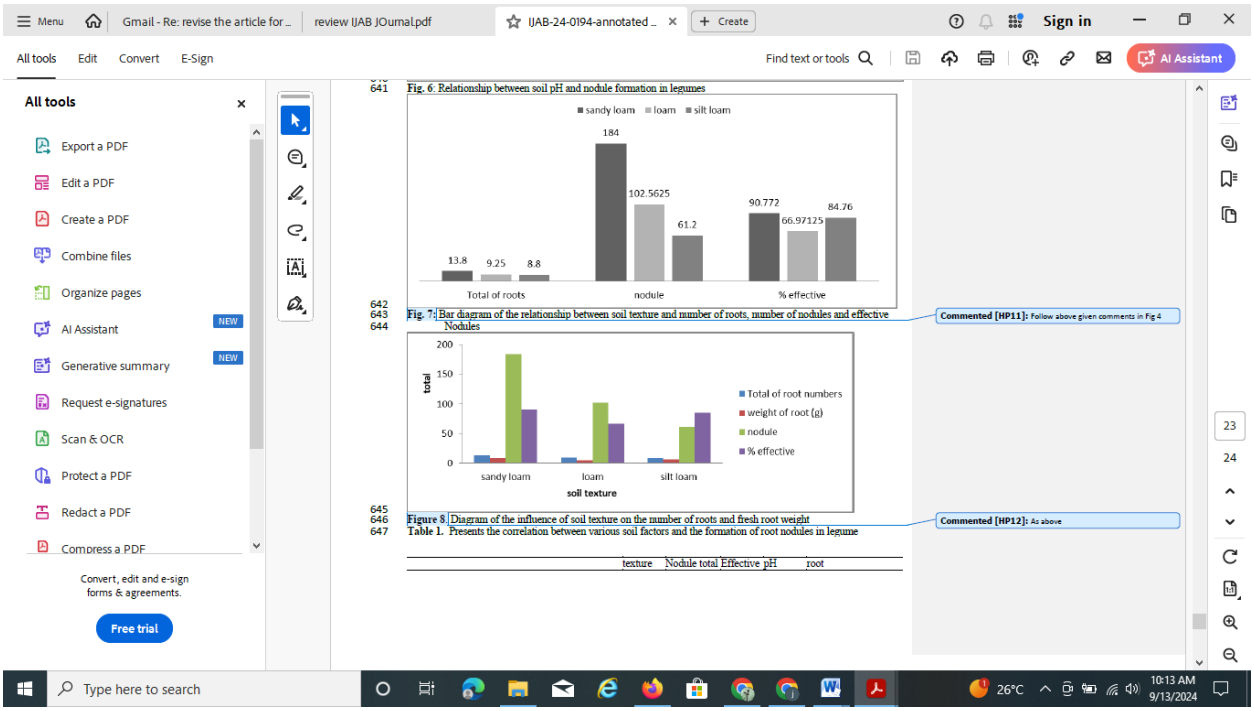

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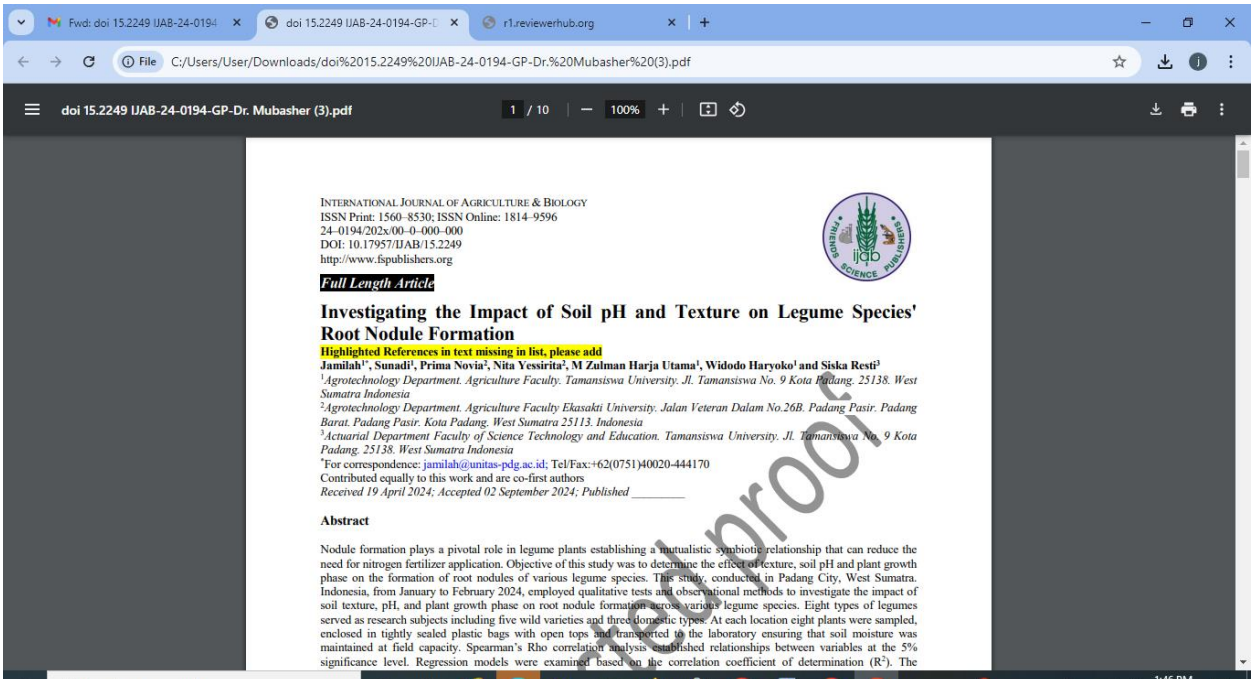

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Full Length Article

Investigating the Impact of Soil pH and Texture on Legume Species' Root Nodule Formation

Highlighted References in text missing in list, please add

Jamilah[1*], Sunadi[1], Prima Novia[2], Nita Yessirita[2], M Zulman Harja Utama[1], Widodo Haryoko[1] and Siska Resti[3]
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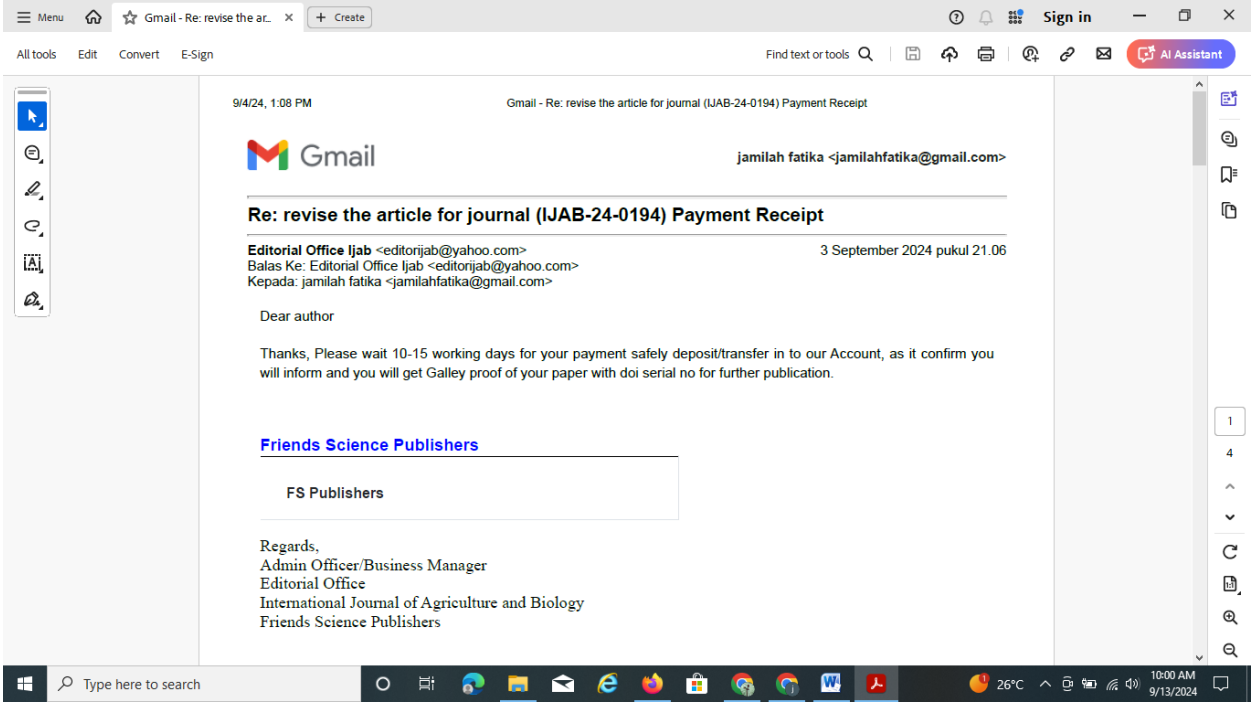
Contributed equally to this work and are co-first authors
Received 19 April 2024; Accepted 02 September 2024; Published _____

Abstract

Nodule formation plays a pivotal role in legume plants establishing a mutualistic symbiotic relationship that can reduce the need for nitrogen fertilizer application. Objective of this study was to determine the effect of texture, soil pH and plant growth phase on the formation of root nodules of various legume species. This study, conducted in Padang City, West Sumatra, Indonesia, from January to February 2024, employed qualitative tests and observational methods to investigate the impact of soil texture, pH, and plant growth phase on root nodule formation across various legume species. Eight types of legumes served as research subjects including five wild varieties and three domestic types. At each location eight plants were sampled, enclosed in tightly sealed plastic bags with open tops and transported to the laboratory ensuring that soil moisture was maintained at field capacity. Spearman's Rho correlation analysis established relationships between variables at the 5% significance level. Regression models were examined based on the correlation coefficient of determination (R^2). The



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Bahauddin Zakariya University Multan, **Pakistan**
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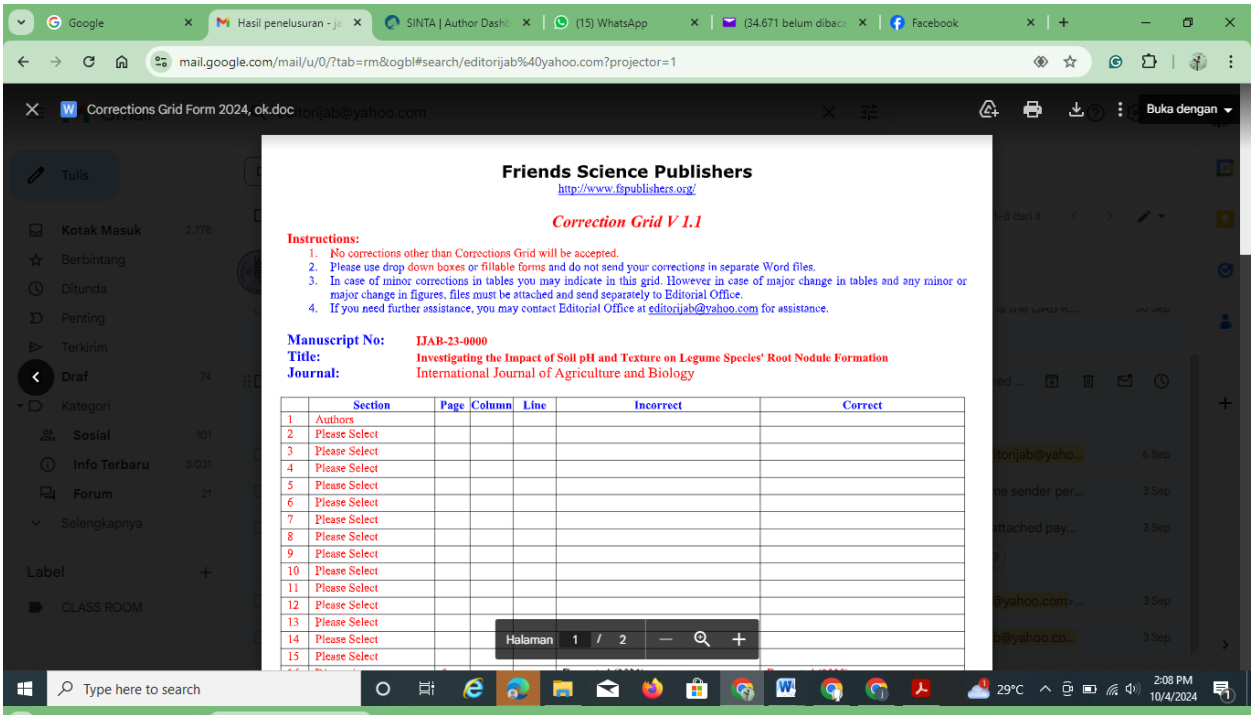

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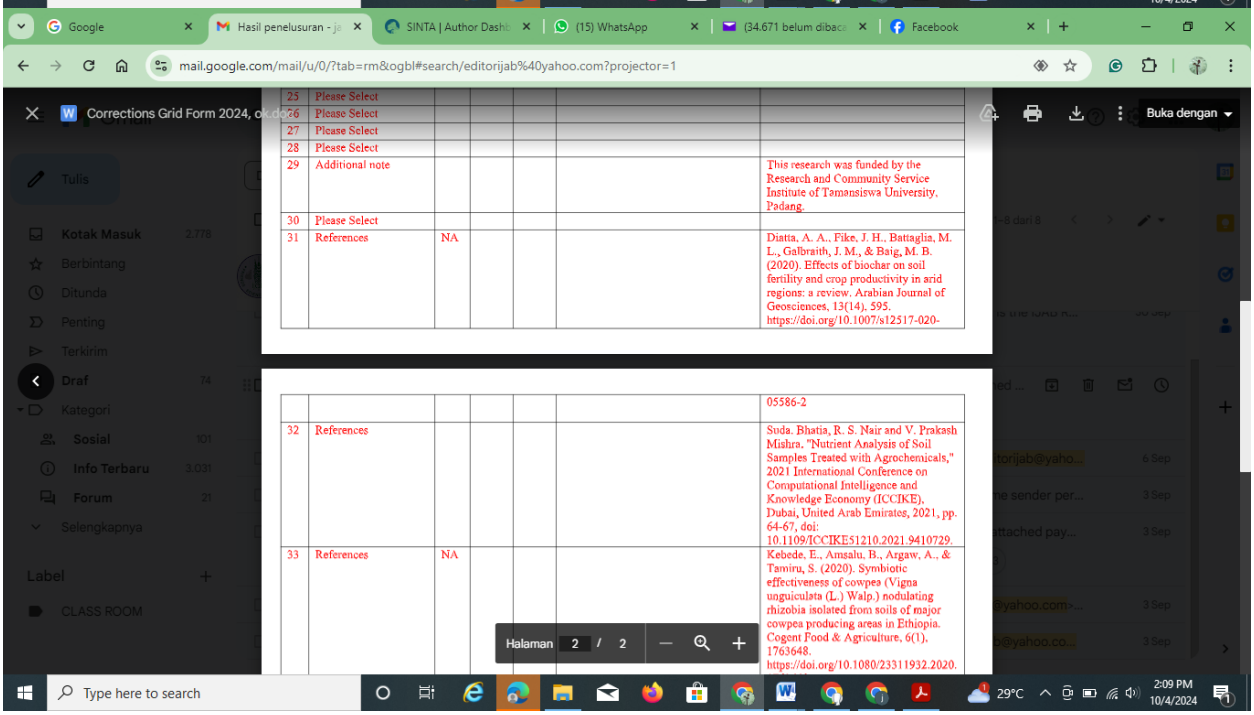

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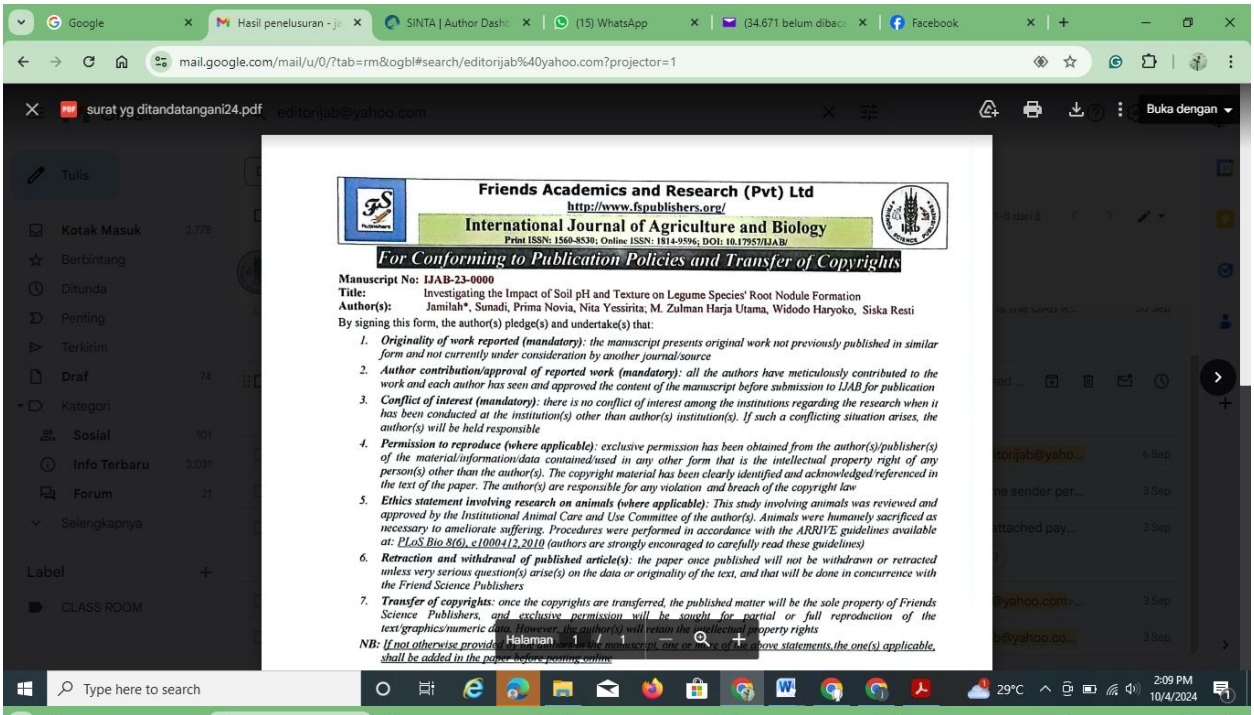

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Full Length Article

Investigating the Impact of Soil pH and Texture on Legume Species' Root Nodule Formation

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Abstract

Nodule formation plays a pivotal role in legume plants establishing a mutualistic symbiotic relationship that can reduce the need for nitrogen fertilizer application. Objective of this study was to determine the effect of texture, soil pH and plant growth phase on the formation of root nodules of various legume species. This study, conducted in Padang City, West Sumatra. Indonesia, from January to February 2024, employed qualitative tests and observational methods to investigate the impact of soil texture, pH, and plant growth phase on root nodule formation across various legume species. Eight types of legumes served as research subjects including five wild varieties and three domestic types. At each location eight plants were sampled, enclosed in tightly sealed plastic bags with open tops and transported to the laboratory ensuring that soil moisture was maintained at field capacity. Spearman's Rho correlation analysis established relationships between variables at the 5% significance level. Regression models were examined based on the correlation coefficient of determination (R^2). The regression equation displaying the highest correlation coefficient was selected. The formation of root nodules on legume plants' roots is influenced by various soil factors. The shape of the nodule is influenced by the legume leaves' shape. Sandy loam texture produces more nodules than other soil textures. The highest number of nodules is found in the primordial phase of the flower. A soil pH close to 5 produces more nodules than lower or higher soil pH levels. Based on the multiple linear regression equation, it is known that the formation of legume root nodules will increase as root weight and soil pH increase. The formation of effective root nodules will decrease as soil pH increases beyond a certain level. In general, the number of root nodules and effective root nodules are directly proportional to soil texture. Sandy clay soil is conducive to higher nodule formation, followed by clay texture and silt loam clay. The effectiveness of nodules was nearly consistent across each soil texture but reached its peak in clay-textured soil. Sandy-textured soil produces legume plants with the highest nodule formation compared to clay soil and exhibits high levels of organic matter. Generally, sandy soil has the potential for up to twice the nodule formation compared to clay soil and six times more than organic soil. It has been demonstrated that sandy soil possesses a higher macro-pore content than clay soil. However organic soil also has a high macro-pore content, along with optimal macro pores. Despite the presence of abundant organic matter, organic soil is not capable of producing more nodules than sandy or clay-textured soil.

Keywords: Growth phase; Legume; Root nodules; Soil pH; Soil texture; West sumatra