Security in food, renewable resources, and natural medicines

SFRN 2019

PROCEEDING

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3rd INTERNATIONAL CONFERENCE ON SECURITY IN FOOD, RENEWABLE RESOURCES, AND NATURAL MEDICINES 2019 (SFRN 2019)

Convention Hall Politeknik Pertanian Negeri Payakumbuh
INDONESIA

QUANTUM-LEAP OF AGRI-FOOD SYSTEM 4.0 AND DELIVERY OF SUSTAINABLE DEVELOPMENTS GOALS (SDGS)

September 25-26, 2019

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Welcome Message
Executive Chairman of The 3rd International Conference on Security in Food, Renewable resources, and Natural Medicines (SFRN) 2019

Dear Honorable ladies and gentlemen,

Good Morning and Assalamu'alaikum wr.wb

On behalf of the SFRN 2019 organizing committee, I am really honoured and delighted to welcome all of you to the 3rd International Conference on Security in Food, Renewable resources, and Natural Medicines (SFRN) 2019 at the State Polytechnic of Agriculture Payakumbuh, West Sumatra Indonesia

Our technical program is rich and varied with 8 keynote speeches and 4 invited talks and more than 170 technical papers split between 8 parallel oral sessions and 1 poster sessions. The speakers and participants came from 8 different countries, consist of Academicians, Scientists, Researchers, Practitioners, Professionals, and Government Officialsin multidiscipline branch of knowledge, who gathered here today to share and discuss new findings and applications of innovations for promoting Food Security, Renewable Energy, Sustainable Resources and HealthCare Free for All, in particular for those who in needs. As the chairman of conference 2019 SFRN, I know that the success of the conference depends ultimately on the how many people who have worked in planning and organizing both the technical program and supporting social arrangements. This year, the conference is jointly organized by the Payakumbuh State Agricultural Polytechnic and Andalas University. We also thank to the steering committee fortheir wise and brilliant advice on organizing the technical program; and also to the the Program Committee, both from the Payakumbuh State Agricultural Polytechnic and Andalas University , for their thorough and timely reviewing of the papersand to the Directorof Payakumbuh State Agricultural Polytechnic and the rector of Andalas University, and the Head of the Institute forResearch and Community Service of Andalas University, and Payakumbuh State Agricultural Polytechnic. Our recognition should go to the Organizing Committee members who have all worked really hard for the details of the important aspects of the conferenceprograms and social activities, and then we extend our gratitude to our students who bore the arduous burden for preparing this event.

We hope this event is also a good step in gaining strengthenn cooperation between our universities as we know that the State Agricultural Polytechnicof Payakumbuh is part of the Andalas University previously, of course the psychological relationship between the State Agricultural Polytechnicand the Andalas University is really close.

Finally on behalf of the committee, we apologize profusely for all the shortcomings and everything that is not properly in organizing this event and hopefully AES-Network contributes significantly to the research and technology for the good of humanity.

Thank you

Fithra Herdian, S.TP, MP

Message from Afro-Eurasia Scientific (AES) Network
3rdInternational Conference on Security in Food, Renewable resources, and Natural Medicines (SFRN) 2019

Dear Honorable and Distinguished guests,
Ladies and gentlemen,

Assalamu'alaikum Warahmatullahi Wabarakatuh and Good Morning

On behalf of the AES Network, I am honored and delighted to welcome you to the 3rdInternational Conference on Security in Food, Renewable resources, and Natural Medicines (SFRN) 2019 at the Agricultural State Poly Technique of Payakumbuh, Indonesia. I believe we have chosen a venue that guarantees a successful technical conference amid the culture, delicacy and scenery of Payakumbuh, the city of "Rendang".

The AES-Network aims to Promote Livelihood Through Food Security, Promote Future Smart and Green Mobility by Using Renewable Energy, Promote Prosperity by Equally Managing and Distributing the Sustainable Resources and Promoting Enjoyable Long-Life by using Natural Medicines With Free Health Care For All. The AES-Network was established in 2018 and already have memberships from 12 countries. Our members consist of Academicians, Scientists, Researchers, practitioners, professionals, and government officials from multidiscipline branch of knowledge, who gathered and contributed their expertise to share and discuss new findings and applications of innovations for promoting Food Security, Renewable Energy, Sustainable Resources and Free Health Care for All.In particular, the network aims to alleviate the condition of those who in dire needs. In the future, we also expect to provide technical demonstrations, and numerous opportunities for informal networking for Promoting Food Security, Renewable Energy, Sustainable Resources and Free Health Care for All. In this opportunity, we invited you to become our members and join our efforts for a better life to all of mankind.

As a team, we acknowledge the existence of mutual interest among university and college educators, researchers, activists, business sector, entrepreneurs, policy

makers, and all society members. We must promote the need to strengthen cooperation for establishing Security in Food, Renewable Resources, and Natural Medicines in Africa, Europe, and Asia.

The AES-Network believe, a firm foundation for mutual collaboration with the spirit of equality and partnership and thereby contribute towards sustainable development in these three regions.

Therefore, through networking, friendships, and joint efforts, the capacity of our network can be enhanced to address major challenges in securing the Food, Renewable Resources, and Natural Medicines in Africa, Europa, and Asia.Our Network goals areto increase the awareness of educators, researchers, scientific community, business sector, entrepreneurs, and policy makers in Africa, Europa, and Asia, that the future of a better world, lies within their responsibilities, and to improve the networking, mobility and mutual collaboration of scientific community, business sector, entrepreneurs, and policy makers in Africa, Europe, and Asia to energize the delivery of Sustainable Development Goals.

Finally, I hope that, by registering our network, you will be provideda common platform and support the exchange of knowledge, while at the same time, we offer constructive dialogue across and within the various interest and stakeholder groups, including the intended beneficiaries, and arrived at the best solutions to our terminal goal, Promoting Food Security, Renewable Energy, Sustainable Resources and Free Health Care based on scientific evidence in Africa, Europa, and Asianregion.

Thank You for Joining us!

President
Assoc. Prof. Dr. Eng. Muhammad Makky

Welcome Message
Head of Institute for Research and Community Service
Universitas Andalas

Dear Honorable and Distinguished guests,
Ladies and gentlemen,

Assalamu'alaikum Warahmatullahi Wabarakatuh and Good Morning

It is with great pleasure that I welcome the participants of the SFRN 2019 in Payakumbuh, the city of "Rendang", the prime of Indonesian delicacy.

In this esteem event, we share the knowledges, and imparted it to the people. The quest for knowledge has been from the beginning of time but knowledge only becomes valuable when it is disseminated and applied to benefit humankind. It is hoped that this conference will become a platform to gather and disseminate the latest knowledge which can be adopted for securing the food, resources, and health for mankind, in Asian, European and African region.

Academicians, Scientist, Researchers and practitioners from multidiscipline branch of knowledge who gathered here today will be able to share and discuss new findings and applications of innovations for ensuring food security, in particular for those who reside in developing countries. It is envisaged that the intellectual discourse will result in future collaborations between universities, research institutions and industry both locally and internationally. In particular it is expected that focus will be given to issues on environmental and sustainability. Therefore, we urge to all participants, to establish a scientific network that will voice the needs

Researchers in the multi sectoral aspects related to the benefit of mankind have been progressing worldwide. Food is a basic right, while energy drive the world. Human need a lot of resources so the civilization can be flourished. But human is not immune, and thus, ones need to take care of their health regularly. Modern Agri-food systems is the foundations of a decent life, a sound education and the achievement of

the Sustainable Development Goals. Over the past decade, we have witnessed a chain reaction that threatens the very foundations of life for millions of the world's people. Rising energy prices drove up the cost of food and ate away the savings that people otherwise would have spent on health care or education. Unsustainable plantation management induced forest fire and posed haze hazard to the whole Sumatra island and our neighboring countries.

The human cost of the food and energy crisis has been enormous. Millions of families have been pushed into poverty and hunger. Thousands more suffering from the collateral effects. Over the past year, food insecurity led to political unrest in some 30 countries. Yet because the underlying problems persist, we will continue to experience such crises, again and again -- unless we act now. That is why we are here today.

We must make significant changes to feed ourselves, and most especially, to safeguard the poorest and most vulnerable. We must ensure safety nets for those who cannot afford food, or energy, nor even a health service. We must transform agricultural development, markets and how resources is distributed. We must do so based on a thorough understanding of the issues. That is the only possible way we can meet the Goals of Sustainable Development.

Thank You,

Assoc. Prof. Dr.-Ing. Uyung Gatot S. Dinata,MT.

Opening Ceremony
Rector of Andalas University

Dear Honorable and Distinguished guests,
Ladies and gentlemen,

Assalamu'alaikum Warahmatullahi Wabarakatuh and Good Morning

I welcome the opportunity to address you at this important event.

It gives me great pleasure in welcoming you to this 3rdConference on "Security in Food, Renewable resources, and Natural Medicines (SFRN)" 2019. I am delighted that so many have accepted our invitation. I am particularly happy that we have in this room, dedicated individuals from so many stakeholder groups — including our most respected and distinguished guest "The ministry of Agriculture of the Republic of Indonesia". We also welcome the mayor of Payakumbuh and the Regent of Lima Puluh Kota. We extend our welcome to the civil society, the private sector, international organizations; the science community; and others dedicated to help create an environment in which people can escape food insecurity. Imagine what we can do together if we make the security for all as an our top priority, and pull in the same direction. We can make a difference in the lives of millions.

Food is a basic right. Food security are the foundations of a decent life, a sound education and the achievement of the Sustainable Development Goals Access to medicines - a fundamental element of the right to health. Health is a fundamental human right, indispensable for the exercise of many other rights in particular the right to development, and necessary for living a life in dignity. Moreover, human rights principles and language are being used to support resource access claims as rights-based approaches empower individuals and groups to gain or maintain access to natural resources

Much progress has been made during the last decades but much more needs to be done. Millions of people are Insecure worldwide, meaning that they either starve or they do not know from where their next meal, health care or resources will come.

Much of the progress on security has occurred at the expense of our environment. With business as usual, we foresee that the production improvements during the next decade will be less than the last one, while the environmental degradation will continue, and health will deteriorate significantly. Without available resources to seek, mankind will become endanger species in a very short time.

Solutions to the security problems need to be designed and implemented within a new and rapidly changing environment. Globalization and sweeping technological changes offer new opportunities for solving these problems. A number driving forces or trends must be taken into account in developing appropriate action. Some of the action needed, such as appropriate technology for small farms, is not new but it must be cast in the new and changing global and national environment, taking into account new opportunities and risks. I hope that by providing a forum for knowledge exchange, this conference will help identify the action to be taken. Furthermore, this conference will help to provide constructive dialogue across and within the various interest and stakeholder groups, including the intended beneficiaries, and arrive at the best solutions.

In conclusion, even if those responsible give high priority to achieving sustainable security for all and back it up with action, the world may not achieve the goal by 2030. But we will be much closer than with business as usual. I urge all of us to provide the strongest support for this event, to enable securing the food for all in the closest time possible. It is my sincere optimism that through the accomplishment of the objectives of this event, we will come to an important step nearer to secure the food for all.

Finally, I would like to thank the organizing committee who have spent their utmost efforts to prepare and manage this event successfully. Let me conclude my remarks by wishing our guests happiness, good luck and great success in the conference.

May I announce now the opening of the "3rd International Conference on Security in Food, Renewable resources, and Natural Medicines (SFRN) 2019" in Payakumbuh.

Thank you.

Rector,
Prof. Tafdil Husni, SE, MBA, PhD

Welcome Message
Director of Politeknik Pertanian Negeri Payakumbuh

Dear Honorable ladies and gentlemen,

Good Morning and Assalamu'alaikumwr.wb

I congratulate to all participants on the invitation and participate at our beloved campus Payakumbuh StateAgricultural Polytechnic. I feel really honoured to welcome all of you at our event, the 3rd International Conference on Security in Food, Renewable Resources, and Natural Medicines (SFRN) 2019 at thePayakumbuh State Agricultural Polytechnic, Indonesia.

Food security is a very important aspect in a country's sovereignty. Food also determines the future direction of a nation. Many social and political fluctuation can also occur if food security is disrupted. Food availability that is smaller than its needs can create economic instability. This critical food condition can even endanger economic and national stability. In the current situation, there are many challenges in exteriorize food security, such as climate change, population, limited natural resources and other challenges both locally, regionally and globally.

Renewable resources are also our starting point to start sustainable development. Research on renewable resources is also very important as the solution in meeting the principles of sustainable development. As we know that Sustainable development is the development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

Sustainability is the foundation for today’s leading global framework for international cooperation - the 2030 Agenda for Sustainable Development and its Sustainable Development Goals (SDGs)

The discovery of treatment based on local culture also contributes greatly to the good of humanity. Unfortunately, there are still many treatments that have not been carried out by scientific research. So, through this conferencewe hope it can be a trigger to increase in traditional plant-based treatments that not go through complex

chemical processes, so that the effectiveness of the pillars can be further suppressed and also contribute to the community's economy.

Finally, I would like to express my gratitude to all people who involved in organizing this event and to all ofstakeholders who have helped to make this event go on succesfully. Please accept my apologize for any shortage, Assalamu'alaikumwr.wb.

Thank you

Ir. Elvin Hasman, MP

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Potential of Indole Acetic Acid Producing Bacteria as Biofertilizer in Increasing Production of Corn (*Zea mays* L.)

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Abstract. Increasing national corn production continues to be the government's priority to meet the needs of the community and the National poultry feed industry. Inoculant-based biological fertilizer is one alternative to optimize the productivity of soil and plants. This study aims to test the ability of IAA-producing bacteria as biological fertilizer in increasing the growth and production of corn. The research took place at the Greenhouse and the Politeknik Pertanian Negeri Payakumbuh Experimental Garden from May to September 2019. The research consisted of two stages. First, the production of biological fertilizers inoculated by bacteria in the Greenhouse. In the first stage, a Completely Randomized Design (CRD) repeated three times with biological fertilizer treatment without bacterial inoculation (K0), inoculated Bacillus cereus (K1), Brevibacillus brevis (K2), Bacillus wiedmannii (K3), Pseudomonas azotoformans (K4), and Pseudomonas nitritireducens K5-is used. Second, the application of biological fertilizer on corn plants using a Randomized Complete Block Design (RCBD) repeated three times. The treatment was the same as the experiment in stage one. Plant height, number of leaves, length and width of leaves, the content of N, P, K leaves, and corn production were the object of observation. The results showed an increase in the growth of all treatments inoculated with IAA-producing bacteria and significantly different compared without bacteria (K0). The best corn production is in the treatment of biological fertilizers inoculated with Bacillus cereus.

Keywords: biofertilizer; Bacillus cereus; indole acetic acid; corn

INTRODUCTION

Corn (*Zea mays* L.) is the third most important food commodity after wheat and rice. Corn plants are of high economic value because all parts of the plant, starting from the roots, stems, leaves, and seeds, can be utilized. The demand for corn in Limapuluh Kota Regency increases along with the development number of people and chicken farming businesses, but this demand cannot fulfill the need for corn in Limapuluh Kota Regency. The biggest demand for corn in the animal feed industry (51.4%), the food industry (cooking oil, cornstarch) and the pharmaceutical industry (ethanol, pentose) (Nuryati et al., 2015). During the period 2010-2016, the average use of corn for the Indonesian animal feed industry increased significantly by 15.81% per year (Sulaiman et al., 2017). To meet the demand for maize, a safe and sustainable technology should be developed to increase production.

At present, the use of inorganic fertilizers is carried out continuously with excessive doses. It results in a decrease in organic matter and soil fertility as well as chemicals from fertilizers, which could harm crop yields. Balai Penelitian Tanah

(2005) states that on soils in Indonesia the impact of excessive N fertilization will result in soil compaction, excessive P fertilization results in the accumulation of P in the soil and cannot be utilized by plants, while depletion of organic matter continues at the time harvest. The main problem of plant nutrient mechanism is the unavailability of nutrients for plants, especially P. Hara P nutrients will affect the availability of macro and micronutrients. The breakthrough that needs a priority is to switch to the use of biological fertilizers and gradually reduce the use of inorganic fertilizers.

Biofertilizer is a fertilizer product that is formulated and contains several microbes (bacteria and fungi) to improve the nutrient status of a plant (Malusa & Vassilev, 2014). The rhizosphere and endophytes of plants are the sources of bacteria. Some characters of plant endophytic bacteria, which produce growth-promoting hormones (Glick, 2012), produce amylase enzymes, proteases, cellulose (Vijayalakshmi et al., 2016), produce special metabolites or bioactive compounds biologically (Liarzi, 2016), phosphate solvent production (Sharma et al., 2013), N2 fixation (Glick, 2012), anti-bacterial and anti-fungal activities (Vijayalakshmi et al., 2016).

The advantage of using P-solvent bacteria is its dual role, namely, to increase the availability of P and the production of IAA compounds. IAA is a phytohormone with auxin activity that regulates the process of plant cell development (Bharwadj et al., 2014). IAA produced by bacteria around the roots will enter the plant and stimulate root hair growth and increase nutrient uptake. This underlies the use of bacteria for the manufacture of biological fertilizers. Genera Bacillus and Pseudomonas are antagonistic bacteria that are used as biocontrol agents and produce antibiotic compounds such as chitinase enzymes that can hydrolyze fungal cell walls, siderophore, and other antibiotics that inhibit the development of pathogens.

This study aims to determine the potential of some IAA-producing bacterial isolates as biofertilizers in increasing the growth and production of corn.

MATERIAL AND METHOD

The research took place at the Greenhouse and Experimental Field of Politeknik Pertanian Negeri Payakumbuh from May to September 2019. The study consisted of two stages, namely the manufacture of biofertilizers and the application of biofertilizers in corn cultivation.

Making Bacterial Suspensions

The source of IAA-producing bacteria used is the result of isolation and identification from various locations the plants of bamboo, maize, and rice in Limapuluh Kota Regency. Take one scratch of the bacterium Bacillus cereus and dissolve in 100 ml of water in an Erlenmeyer, turn it clockwise until it dissolves, and incubate for 24 hours. All bacteria went under the same procedure.

Production of Biofertilizer

Experiments on the manufacture of biofertilizers with the composition of manure and water hyacinth took place at the Greenhouse of Politeknik Pertanian

Negeri Payakumbuh. The experiment used a Completely Randomized Design (CRD) with six bacterial inoculation treatments repeated three times so that there were 18 combinations of treatments (volume 18 kg). Treatment without bacterial inoculation (K0), inoculated with *Bacillus cereus* (K1), *Brevibacillus brevis* (K2), *Bacillus wiedmannii* (K3), *Pseudomonas azotoformans* (K4), and *Pseudomonas nitritireducens* (K5). Making solid biofertilizer is done by chopping water hyacinth as much as 20 kg with a size of ± 2 cm. Chicken manure prepared 20 kg should not be too dry. The water hyacinth was mixed with cow dung with a ratio of 1: 1 and was put in a black plastic bag as much as 18 bags. Inoculation of a mixture of ingredients with bacteria under the treatment then it was fermented for one month.

Application of Biofertilizer in Corn Cultivation

The application of biofertilizer took place at Politeknik Pertanian Negeri Payakumbuh Experimental Field. The experiment used a Randomized Block Design (RCBD) with six bacterial inoculation treatments repeated three times so that there were 18 treatment combinations. Treatment without bacterial inoculation (K0), inoculated with *Bacillus cereus* (K1), *Brevibacillus brevis* (K2), *Bacillus wiedmannii* (K3), *Pseudomonas azotoformans* (K4), and *Pseudomonas nitritireducens* (K5).

Corn seeds soaked in bacterial suspension according to treatment for 24 hours. The planting media were prepared in polybags in the form of topsoil and biofertilizer with a ratio of 1: 1. The topsoil is sterilized by steaming in a steamer for 1 hour. The soil is allowed to cool for 30 minutes, then mixed with biofertilizer. Corn seeds that have been soaked with bacterial suspension were planted one seed/polybag.

The bacterial suspension, according to the treatment of biofertilizer, is splashed to the soil at the age of 10, 20, 30, 40, and 50 days after planting.

Plant height, number of leaves, length and width of leaves, the nutrient content N, P, K of leaves, and corn production were observed.

RESULTS

The results of observations of vegetative growth such as plant height, number of leaves, leaf length, and leaf width are in the following Table 1.

Table 1.Growth of plant height, number of leaves, leaf length and leaf width

Biofertilizer	Plant height (cm)	Number of leaves (leaf)	Leaf length (cm)	Leaf Width (cm)
Without bacteria (K0)	216 b	11,8 b	99.7 b	8.90 c
Bacillus cereus (K1)	238 a	13,3 a	102.5 a	10.13 a
Brevibacillus brevis (K2)	243 a	13,0 a	103.8 a	10.00 a
Bacillus wiedmannii (K3)	229 a	12,8 a	102.5 a	9.50 b
Pseudomonas azotoformans (K4)	232 a	13,0 a	100.5 a	9.50 b
Pseudomonas nitritireducens (K5)	236 a	13,0 a	102.5 a	10.13 a

The numbers in the column followed by the same small letters are not significantly different at 5% level of LSD

Plant growth is strongly influenced by growth hormones that stimulate the canopy and root parts of plants. Auxin plays a role in helping the synthesis of indol-3 acetic acid (IAA). IAA helps many physiological processes such as elongation of the stem, multiplication of the number, and magnification of leaf cell size. Bacteria isolated from plant endophytes (*Bacillus cereus*, *Pseudomonas azotoformans*) and rhizosphere (*Brevibacillus brevis*, *Bacillus wiedmannii*, *Pseudomonas nitritireducens*) can stimulate plant growth. Endophytic bacteria (Lestari et al., 2015; Santoyo et al., 2016) and rhizosphere bacteria (Glick, 2012) can stimulate plant growth through direct or indirect mechanisms. All inoculation treatments of bacteria significantly influence the growth of plant height, leaf number, length, and width of leaves, when compared to bacteria without inoculation. Leaves are the most important organ of plants that carry out photosynthesis. Photosynthesis involves many chemical reactions that make leaves for reaction media. Leaves grow well because of the increase in N and chlorophyll that form proteins and amino acids as constituents of the plant body. According to Hassan et al. (2018) inoculation of *B. cereus* bacteria alone increases the activity of chlorophyll, phytohormone, proline, and antioxidant enzymes, Wong et al. (2015) stated that biological fertilizers play a very important role during vegetative growth of a plant.

Bacillus cereus found in bamboo roots in the Taram area of Limapuluh Kota Regency can increase plant growth and productivity through the phytohormones it produces. Widowati et al. (2018) stated that IAA is one of the phytohormones that contributes to the development of plant cells. *Brevibacillus brevis* inoculated into seeds, will reduce the disease caused by *F. oxysporum* and *F. licopersici* in tomato plants, increase plant height, and root growth (Chandel et al. 2010). Brevibacillus brevis bacteria contain IAA, ARA, antifungal activity, and ammonia production (Nehra et al. 2016). *Bacillus wiedmannii* found from the bamboo rhizosphere is a type of strain of B. Cereus bacterium, which can hydrolyze casein and starch (Miller et al., 2016). *Pseudomonas azotoformans* originating from endophytic of corn plants are phosphate solvent bacteria that produce IAA as a result of association with plant tissue. The results of *P. nitritireducens* culture showed halozone, which was wide enough, which indicated the concentration of phosphate solvent was quite high.

Biofertilizers contain microbes that are beneficial to the soil and plants. Microbes help to bind N from the air and dissolve P and K, which are bound to colloidal of soils (Glick, 2012). In this experiment, the bacteria were suspected of secreting IAA, which functions as a stimulus for plant growth. Spaepen, Vanderleyen & Remans (2007) stated that IAA produced by bacteria, apart from being dependent on species and bacterial strains, is also influenced by the growth phase and availability of substrates. Widowati et al. (2018), some bacterial isolates isolated from the rhizosphere have the potential to produce IAA in vitro with or without Triptopan. Two bacterial genera (Bacillus and Pseudomonas) inoculated into biological fertilizer include bacteria that can stimulate plant growth (Sondang et al., 2018). These genera are bacteria that can produce phytohormones, especially IAA, in large numbers (Khakipour et al. 2008). The results of the research of Wong et al.

(2015) confirms that biofertilizer is very important during the vegetative growth of plants.

Table 2.Effects of biofertilizer application on leaves N, P, K nutrient content

Biofertilizer	N	P	K
		%	
Without bacteria (K0)	2,01 b	0.200 d	1.60 c
Bacillus cereus (K1)	2.16 a	0.264 a	1.69 ab
Brevibacillus brevis (K2)	2.15 a	0.218 d	1.67 ab
Bacillus wiedmannii (K3)	2.11 b	0.233 bc	1.75 a
Pseudomonas azotoformans (K4)	2.14 ab	0.230 c	1.69 ab
Pseudomonas nitritireducens (K5)	2.13 ab	0.243 b	1.65 b

The numbers in the column followed by the same small letters are not significantly different at 5% level of LSD.

N > 0,75% : very high
P > 60,0 ppm /0.006% : very high
K 1,5-2,0% : high

The content N, P, K of corn leaves increases with the soaking of corn seeds in bacterial suspension and bacterial inoculation on biofertilizers. The nutrient content of N leaves has a very high criterion> 0.75% (Balai Penelitian Tanah, 2009) due to the raw material of biological fertilizer derived from water hyacinth plants whose N content is quite high, where N in organic matter is broken down into ammonium ($NH4^+$) by bacteria through the process of mineralization. Biological fertilizers which are inoculated by bacteria show higher nutrients N, P, K than biological fertilizers that are not inoculated by bacteria, due to N capture, P and K dissolution around the root parts by bacteria so that there is an increase in nutrient absorption by the roots and translocated to all parts of the plant, and on the leaves are used for the formation of chlorophyll for photosynthesis. Kandel et al. (2017) Endophytic bacteria increase plant growth through N fixation, phytohormone production, increase nutrient uptake, and reduce abiotic and biotic pressure. Glick (2012) states IAA-producing bacteria will increase root growth and help provide nutrients for plants and bacteria of the rhizosphere.

Some Bacillus genera can bind N from the air, dissolve P and K, produce growth stimulants, and suppress the growth of pathogens (Ahmad et al., 2018). Phosphate solubilizing bacteria can convert insoluble phosphate to dissolve by secreting organic acids (Prijambada et al. 2006) or dissolving inorganic soil phosphates through the production of organic acids, siderophores and hydroxyl ions (Sharma *et al.*, 2013). Bacterial based inoculants can function as biofertilizers (Qasim et al., 2014), increase nutrient uptake, stimulate plant growth, protect plants from pests and diseases, and replace chemical fertilizers (Ahmad et al. 2018).

Table 3. Corn production per hectare

Biofertilizer	Production (t/ha)
Without bacteria (K0)	8.60 c
Bacillus cereus (K1)	11,99 a

Biofertilizer	Production (t/ha)
Brevibacillus brevis (K2)	11,20 a
Bacillus wiedmannii (K3)	8,91 c
Pseudomonas azotoformans (K4)	10,27 b
Pseudomonas nitritireducens (K5)	9,38 b

The numbers in the column followed by the same small letters are not significantly different at 5% level of LSD

Corn production increases with inoculation of IAA-producing bacteria that act as plant growth stimulants. *Bacillus cereus* had the best effect (11.99 t/ha), followed by *Brevibacillus brevis* with a production of 11.20 t/ha. An increase in corn production of 3.6%–39.42% with bacterial inoculation compared without bacterial inoculation. Increased corn yields indicate an interaction between IAA-producing bacteria and corn plants.

Bacterial culture in suitable media indicates the presence of halozone around the bacterial colony, which indicates the presence of phosphate solvents. Overall the Bacillus and Pseudomonas genera have the potential to produce IAA and play a role in increasing corn production. Production of IAA from endophytic bacteria several Bacillus genera ranges from 6.632–50.053 mg/l in the presence of tryptophan (Lestari et al*.,* 2015). IAA production from the rhizosphere of the Pseudomonas genera ranges from 23.4 to 53.2 mg/ml. The halozone area around the bacterial colony shows the ability of bacteria to dissolve phosphate qualitatively. The wider the halozone, the greater the ability of bacteria to dissolve phosphate (Rahayu et al., 2014).

In this study, bacterial inoculation on biofertilizers and planting media can increase plant growth, nutrient content of N, P, K of leaves, and corn production. Bacteria help to bind N from the air and dissolve P, which is bound to colloidal of soils. Bacteria can secrete IAA, which functions as a stimulus for plant growth. Genera *Bacillus* spp and *Pseudomonas* spp are inoculated in soaking seeds, including beneficial bacteria that can increase germination and stimulate the growth of corn seeds (Sondang et al. 2018). Souza, Ambrosini & Passaqlia (2015) stated that the interaction between plants and microbes around the rhizosphere would affect the health and productivity of plants and determine the fertility of the surrounding soil.

CONCLUSIONS

Some bacterial isolates from the genera Bacillus and Pseudomonas can dissolve phosphate and have the potential to produce Indol Acetic Acid, which has a role in increasing plant height and corn leaf growth, increasing nutrient N, P, and K of leaves, and corn production.

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Almighty so that I can finish the article with the title " Potential of Indole Acetic Acid Producing Bacteria as Biofertilizer in Increasing Production of Corn (*Zea mays* L.)." Hopefully, this article will be useful for readers.

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