Journal of ENVIRONMENTAL Treatment Techniques

J. Environ. Treat. Tech.
ISSN: 2309-1185

Journal web link: http://www.jett.dormaj.com

Formulation of Microorganisms for Cane Plants

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Received: 25/03/2020 Accepted: 29/06/2020 Published: 20/09/2020

Abstract

Sugar is one of the strategic commodities in the Indonesian economy. With an area of around 450 thousand hectares in the 2007-2017 period, the sugar cane-based sugar industry is one of the sources of income for around 900 thousand farmers with the number of workers involved reaching around 1.3 million people. Sugar is also one of the basic needs of the community; the dynamics of sugar prices will have a direct influence on the inflation rate. One effort that can be done to improve sugarcane productivity is to improve soil fertility through sugarcane cultivation techniques by engineering microorganism technology. The potential of nature and the wealth of microorganisms in Indonesia are numerous but have not been explored and utilized to the full Engineering the use of microorganisms has good prospects for restoring land degradation in sugarcane agroecosystem. Microorganism-formulation was designed to get the most suitable microorganism combination for sugarcane. Various types of Nitrogen-fixing microorganisms such as Nitrobacter, Nitrosomonas, Nitrosococcus, and Rhizobium will be combined with Phosphate solvent bacteria such as Pseudomonas, Bacillus, Pseudomonas, Xanthomonas, Acetobacter Thiobacillus, Thrichodema and some decomposer bacteria. Found the most suitable formulation for the growth of sugarcane seedlings, formulation of the microorganisms *Sacharomyces (*S), *Azospirillum sp* (A), *Azotobacter* (Z), *Rhizobium* (R), *Pseudomonas* (P), *Bacillus* dan *Trichoderma* sp (T) which is formulated in a microorganism technology with the popular name Refresh Microorganism (RIM).

Keywords: Cane, Formulations, Microorganisms

1 Introduction

Dependence on chemical fertilizers causes chemical fertilizer subsidies to increase every year. Environmental burden caused by the use of chemical fertilizers continuously in high doses increasingly close the pores of the soil, so that the absorption of rainwater is greatly decreased and resulting in frequent floods and drought [1]. In addition, the use of chemical fertilizers continuously causes the soil to become hard so that the main crop production of sugar cane becomes smaller and the yield of sugar obtained is low [2]. It is time for our farming system to return to nature with organic farming. Microorganism technology will help organic farming systems to be realized easily, quality and inexpensive so it must be prepared on an industrial scale [3].

Synergy between microorganism technologies intended for the development of organic agriculture and sugar cane farmers as users is something that needs to be socialized and implemented in the field. For this reason, continuous research is needed. The potential of microorganisms in Indonesia is extraordinary in terms of species, quantity and function; this is due to the fact that in Indonesia, 2 of these mountain ranges in the world meet, in Indonesia located between 3 continents and the meeting of the Indian and Pacific oceans.

This has the opportunity to build a microorganism industry that has the opportunity to increase crop production and quality, especially sugar cane. Reliable pioneer microorganisms that have been selected by the research team since the 1990s in this study combined into a force that can help sugarcane plants to produce high yields with high yields.

Pioneering microorganism formulations that are reliable in improving polluted environments and helping plants provide nutrients according to plant requirements have been obtained [4], only still need to be modified specifically for sugarcane. The soil health index of Indonesia must also be considered for better plant requirements achieved [5-7]. The purpose of this study is to formulate a consortium of microorganisms that can help sugarcane plants to grow better.

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2 Materials and Methods

This research was conducted from April in the Laboratory of the Department of Agrotechnology, Faculty of Agriculture, Brawijaya University Malang. This formulation research was carried out by mixing various pure cultures of photosynthetic bacteria *Sacharomyces (S), Azospirillum sp (A), Azotobacter (Z), Rhizobium (R), Pseudomonas (P), Bacillus (B) and Trichoderma sp (T)* with natural ingredients such as banana weevil and sugar cane shoots that contain a variety of natural hormones. The formulation trials are used on sugarcane seedlings, the seeds that grow best will be found with the fastest growing indicator of shoots.

3 Results and Discussion

Based on the synergy test between a consortium of microorganisms between photosynthetic *bacteria Sacharomyces (S), Azospirillum sp (A), Azotobacter (Z), Rhizobium (R), Pseudomonas (P), Bacillus (B) and Trichoderma sp (T)* with a comparison, the formula obtained F1, F2, F3, F4 and F5 that are used can synergize with one another. From the results of incubation for 24 hours, each formula contained dominance and which could blend (Table 1).

3.1 Antagonist

Bacterial consortium is a collection of bacteria that work together to form a community, to produce significant products.

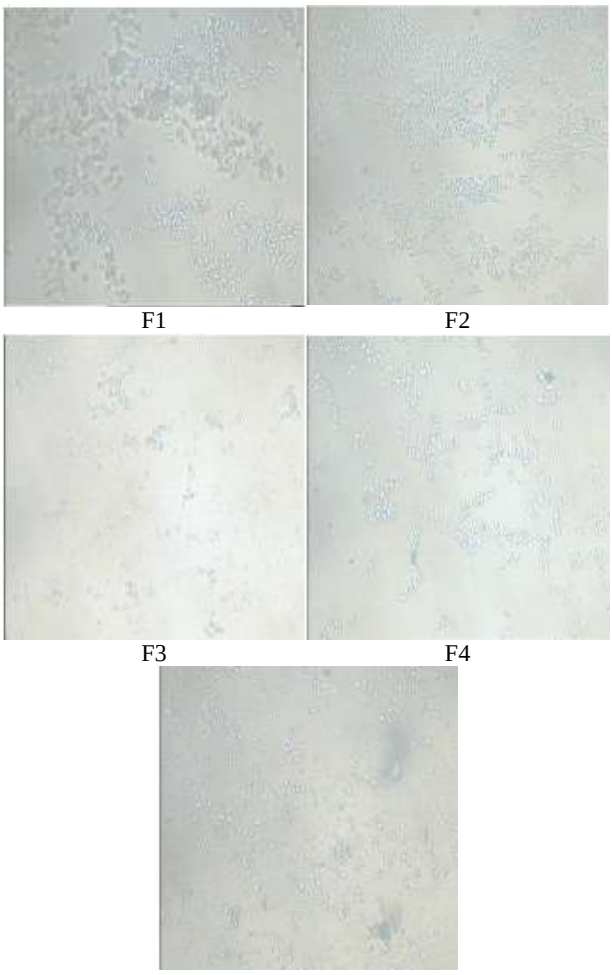

Figure 1: Observation of a 5 Formula microorganism consortium

The compatibility or synergism of two or more inoculated bacteria is a very important factor so that the bacteria can work well together. Bacteria with the same genus or species can interact and synergize, and share sources of nutrients that can be donated to their environment.

Table 1: Synergy between *Azotobacter* isolates

Formula	R	S	A	Z	P	B	T
R	+	+	+	+	+	+	+
S	+	+	+	+	+	+	+
A	+	+	+	+	+	+	+
Z	+	+	+	+	+	+	+
L	+	+	+	+	+	+	+
P	+	+	+	+	+	+	+
B	+	+	+	+	+	+	+
T	+	+	+	+	+	+	+

+: Synergistic

Among the 5 formulas above can be seen how the synergy, dominance and speed of growth of each microorganism. Specifically the speed of growth of each microorganism is obtained by seeing the movement of microorganisms and their propagation directly using a hanging preparation on a microscope connected to the television layer. Between 5 formulas, it turns out that there are 3 Formula which are better for the cooperation of microorganisms with indicators of the spread of microorganisms and there is no domination of microorganisms chosen F1, F4 and F5.

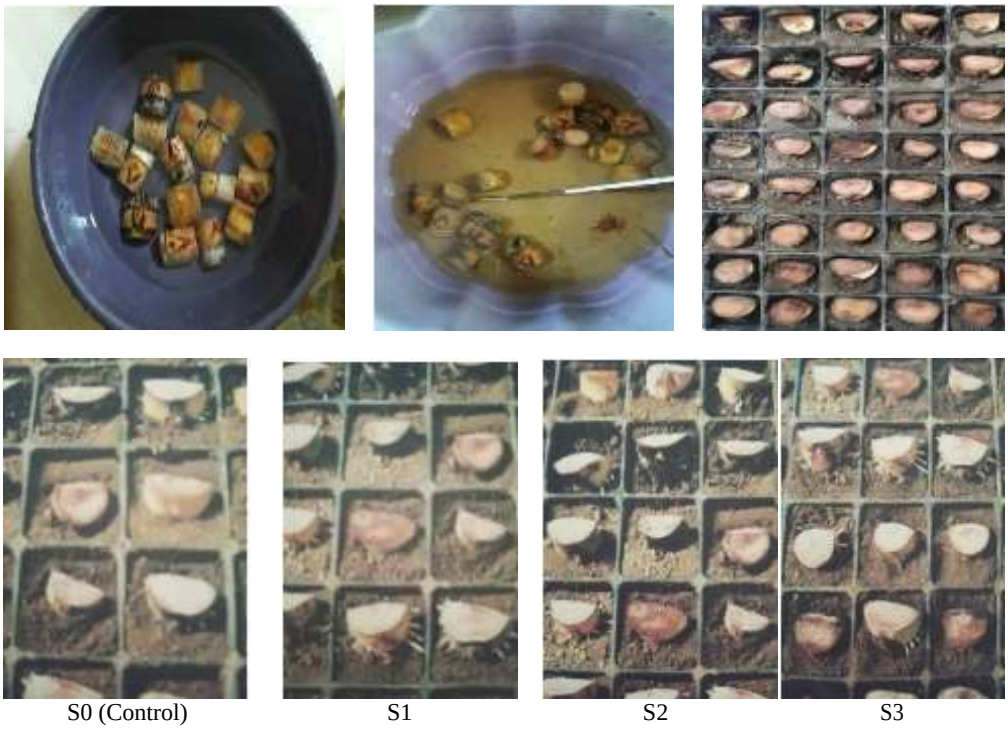

Figure 2: Sugarcane seedlings tested with various selected formulas

3.2 Direct testing with sugarcane seedlings

Each formula 5 ml is melted in 500 ml of pure aqua, and then the sugar cane seeds are soaked in the formula for 24 hours. This study is in addition to 3 formulas compared to control (not given a consortium of microorganisms) so there are 3 sample treatments namely: S0 (control), S1 (with formula 1). S2 (with formula 4) and S3 (with formula 5). Then observed the development of growing shoots. The results obtained are then planted on the same planting medium as the composition of sand, soil and manure 1: 1: 1 in gasil which can be different between the treatments of Sample 0 (S0).

Based on this Test and Formulation, a formula is obtained that can increase the speed of growth of sugarcane seedlings and is expected to be used for biological fertilizer for sugarcane, ant this is in agreement with Pereira et al. [8]. However, it still needs to be studied in more detail whether the formula is true in the soil biology laboratory, then proceed with the test of the best formula content which is named RIM (Refresh Microorganism) and get the results of the Plant Disease Laboratory test.

4 Conclusion

The formulation obtained was most suitable for the growth of sugarcane seedlings, formulations of microorganisms *Sacharomyces (S), Azospirillum sp (A), Azotobacter (Z), Rhizobium (R), Pseudomonas (P), Bacillus (B) and Trichoderma sp,* which is formulated in a microorganism technology with the popular name Refresh Microorganism (RIM). Still need to be continued research trials using this RIM microorganism technology for the growth and production of sugar cane on agricultural land.

Acknowledgment

Submission of thanks to DRPM Ristekdikti for providing National Scale Applied Research funding for Fiscal Year 2019 and 2020.

Ethical issue

Authors are aware of, and comply with, best practice in publication ethics specifically with regard to authorship (avoidance of guest authorship), dual submission, manipulation of figures, competing interests and compliance with policies on research ethics. Authors adhere to publication requirements that submitted work is original and has not been published elsewhere in any language.

Competing interests

The authors declare that there is no conflict of interest that would prejudice the impartiality of this scientific work.

Authors' contribution

All authors of this study have a complete contribution for data collection, data analyses and manuscript writing.

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