

COLLABORATION INTERCROPPING, PGPM FERTILIZATION, AND CASCARA-COMPOST ON OPTIMIZING PRODUCTIVITY OF SUB-OPTIMAL LAND IN THE TROPICS

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INTRODUCTION



Indonesia is an agricultural country that has abundant natural resources, especially in food commodities. However, land productivity still needs improvement. A cropping system of intercropping sweet corn and peanuts is very suitable to be applied because corn (cereals) and peanuts can be complementary to each other. The advantage of peanuts is that they can fix N from the air, thus reducing the addition of N fertilizers. On the other hand, maize has a strong root system that can create loose soil conditions for peanut growth.



Intercropping success depends not only on plant characteristics but also on soil properties. Therefore, additional material is required to fulfill the best conditions for plant growth. Plant Growth-Promoting Microorganisms (PGPM), as biological agents, have the function of biofertilizers. The contents of biofertilizers are microorganisms that act as phosphate solubilizers, increase nitrogen fixation, and produce IAA as a substrate that can change root morphology, such as root elongation, increased root hairs, and root surface area. The result of microorganism activity in the soil and rhizosphere environment leads to better nutrient absorption.



The interaction between plant roots and PGPM will be more effective through the addition of compost for better microbial growth and improved soil quality. Cascara compost has a special character related to the bio-physico-chemical properties.

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RESEARCH OBJECTIVE



- The objective of this research is to obtain cropping system model in the sub-optimal land to optimise productivity through collaboration of intercropping, Plant Growth Promoting Organisms (PGPM) fertilisation, and application of Cascara-compost

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MATERIALS AND METHODS

The experiment was conducted at the Experimental Farm, Faculty of Agriculture, Hasanuddin University, Makassar, South Sulawesi - INDONESIA, at an altitude of 22.4 m. (asl). The soil type is Alfisol, with an average temperature of 24°C in the morning and 32°C in the afternoon.

The experiment was conducted in the field in 2 m x 2 m plots using a split-plot experimental design. The treatments were arranged with PGPM as the main plots and cascara compost as subplots, with three replications, and applied to the intercropping of sweet corn and peanuts.

The treatment was arranged in 3 levels of PGPM dosage as the main plot (p0 control, p1 49 mL/L water/plot or 81.6 L/ha, and p2 67 mL/L water/plot or 111.6 L/ha). The cascara compost was applied as subplots using treatments of 0 kg/plot as k0 (control), p1 2.4 kg/plot or 4 tons/ha, and k2 3.6 kg/plot or 6 tons/ha. Experimental data were analyzed by Analysis of Variance (ANOVA) using the Statistical Tool of Agriculture Research (STAR) software by IRRI. Further significance tests were applied to treatments or combination treatments when differences between treatments were found.

Preparation of cascara-compost was done by mixing cascara coffee husk, cattle manure, rice husk, bioactivator, molasses, and water into a composter container. Cascara compost was ready for use after approximately four (4) weeks of incubation. The compost was applied at the beginning of planting or after land plowing.

Application of PGPM was done by mixing PGPM solution into water, and it was applied in irrigation based on the dosage. The treatment was done at 2 WAP, 4 WAP, and 6 WAP.

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MAJOR FINDINGS

Parameters	Pr (>F)			CVP (%)	CVC (%)
	PG	CC	PG x CC		
PH 3 WAP	0,00 **	0,00 **	0,58 ns	1,42%	0,93%
PH 5 WAP	0,00 **	0,00 **	0,00 **	0,15%	0,22%
PH 7 WAP	0,00 **	0,00 **	0,10 ns	0,19%	0,14%
SD 3 WAP	0,00 **	0,00 **	0,40 ns	0,92%	0,88%
SD 5 WAP	0,00 **	0,00 **	0,56 ns	0,38%	0,33%
SD 7 WAP	0,00 **	0,00 **	0,36 ns	0,23%	0,23%
JD 3 WAP	0,00 **	0,00 **	0,50 ns	0,05%	0,04%
JD 5 WAP	0,00 **	0,00 **	0,22 ns	0,16%	0,09%
JD 7 WAP	0,00 **	0,00 **	0,00 **	0,05%	0,03%
UB	0,00 **	0,00 **	0,95 ns	0,98%	0,78%
UP	0,00 **	0,00 **	0,11 ns	0,36%	0,28%
DT	0,00 **	0,00 **	0,00 **	0,54%	0,56%
BTK	0,00 **	0,00 **	0,12 ns	0,65%	0,90%
RB	0,00 **	0,00 **	0,00 **	0,38%	0,41%
B1000	0,00 **	0,02 *	0,00 **	1,92%	1,48%
P	0,00 **	0,00 **	0,00 **	2,61%	2,33%
BSB	0,00 **	0,00 **	0,47 **	0,36%	0,45%

Sampling and Parameter Measurements :

- Soil samples : Before and After Treatments
- Plant samples : Vegetative and Generative Growth Period
- Microorganisms samples : Microbes density and type

Soil samples Parameter Measurements :
Soil texture, pH, CEC, and Main macro nutrient

Plant Parameter Measurements :

Sweet corn: plant height (cm) 3, 5, 7 WAP, stem diameter (cm) 3, 5, 7 WAP, number of leaves (blade) 3,5,7 WAP, flowering age (WAP), harvesting age (WAP), cob diameter (cm), shelled cob weight (g), seed yield (%), 1000 seed weight (g), productivity (t.ha⁻¹), biomass fresh weight (g).
Peanut: plant height (cm) 3, 5, 7 WAP, stem diameter (cm) 3, 5, 7 WAP, number of leaves (blade) 3, 5, 7, WAP, flowering age (WAP), harvesting age (WAP), number of pods per plant (fruit), pod weight per plot (g), pod weight per hectare (t.ha⁻¹), 100 grain weight (g), biomass fresh weight (g).

Note : WAP = Weeks After Planting

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CONCLUSIONS

The conclusion of this research that :

Interaction between the treatment of *Plant Growth Promoting Microorganisms* (PGPM) and cascara compost which had a very significant effect on sweet corn of plant height 5 WAP, number of leaves 7 WAP, cob diameter, seed yield, weight of 1000 seeds, and sweet corn productivity,

For peanut, plant height 7 WAP, number of leaf in 7 WAP, number of pods, pod weight per peanut plot, pod weight per hectare , and 100-grain weight of peanut.

This model cultivation system has the highest production of sweet corn and peanut in the treatment combination applications of PGPM at a concentration of 111,6 mL L⁻¹ ha⁻¹ and cascara compost at 6 tons ha⁻¹. The production of sweet corn and peanuts is 14.69 tons ha⁻¹, and peanut is 2.03 tons ha⁻¹.

This study expressed that designing model cultivation system for optimizing product of sub optimal land in the tropis could be done well through the collaboration of intercropping, pgpm fertilization, and cascara compost incorporation

