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Effect Of Biopriming With Padina Minor Seaweed Extract With Amino Acid Addition On Germination Of Several Varieties Of Rice (Oryza Sativa L.)

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Abstract – Seed germination is a crucial step in plant propagation, as it controls seedling production, stand establishment, and crop yield. The current study evaluated the effect of seaweed extract (Padina minor) with the addition of amino acids biopriming on the seed germination of three (Cinta, Banang Pulau, and upland rice UNSOED 1) rice varieties. This study used a Randomized Completely Factorial Design consisting of 2 factors and four replications. Factor A (Biostimulant) consisting of a0) distilled water, a1) P.minor extract, a2) P.minor extract + amino acid (Glycine 250 ppm, Alanine 20 ppm, Cysteine 50 ppm, Arginine 50 ppm). Factor B (Rice variety) consists of b1) upland rice Unsoed 1, b2) Cinta (Solok local varieties) , and b3) Banang Pulau (Solok local varieties). The germination responses of the bio-primed seeds were measured using six parameters, including the percentage of germination, vigor index, maximum growth potential, hypocotyl, and root length. This study showed that P.minor extract is effectively used as bio-priming for several rice varieties. Upland rice variety Inpago UNSOED 1 gave the best response to priming treatment compared to Solok rice varieties Cinta and Banang Pulau.

Keywords – seed priming, seaweed extract, Amino Acid, Germination, Rice.

I. INTRODUCTION

Priming is a pre-soaking treatment that helps the physiological process, so that seeds germinate faster [1]. It is known that there are several kinds of seed priming methods, one of which is biopriming. Biopriming is a seed treatment utilizing biological assimilation and physiological aspects that are useful for increasing seed germination, and seedling vigor, as mobilization of soil macro and micro elements [2] [3]. Some research results related to seed priming provide positive results in increasing plant germination. The use of seaweed extract as seed priming is reported to increase germination in wheat, pea, and corn plants [4][5][6]. Seaweed extracts contain essential plant macro and micronutrients and several plant growth regulators, such as IAA, kinetin, zeatin, and GA3, which play a significant role in seed germination [7][8]. The application of *Sargassum liebmanni* seaweed extract increased the germination percentage of *Trigonella foenum-graecum* seeds [9]. Then, priming Phaseolus vulgaris seeds using *Ascophyllum nodosum* also increased the germination speed index [10].

Besides seaweeds, amino acids have been widely used for seed priming as they act as hormone precursors, nitrogen sources, and stress reducers [11]. Applying seed priming with amino acids can result in better plant development, as the molecules can act as signals of plant physiological processes [12]. The application of seed priming with amino acids has been carried out on wheat and pepper plants [13] [14]. In this study, biopriming of 3 rice varieties was carried out with *Padina minor* extract with the

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addition of amino acids. This study aimed to examine the effect of *P.minor* extract with the addition of amino acids as biopriming in increasing the germination of 3 rice varieties, namely Cinta, Banang Pulau (local varieties) and upland rice UNSOED 1.

II. RESEARCH METHODS

Tools and Materials

This research was conducted at the Plant Physiology Laboratory, Andalas University, Padang, West Sumatra. The research was conducted in July 2022. This study used a Randomized Completely Factorial Design consisting of 2 factors and four replications. Factor A (Biostimulant) consisting of a0) distilled water, a1) P.minor extract, a2) *P.minor* extract + amino acid (Glycine 250 ppm, Alanine 20 ppm, Cysteine 50 ppm, Arginine 50 ppm). Factor B (Rice variety) consists of b1) upland rice Unsoed 1, b2) Cinta (Solok local varieties) , and b3) Banang Pulau (Solok local varieties)

III. METHODS

Seaweed was collected in Nirwana Beach, Padang, West Sumatera, Indonesia. Seaweed was cleaned with seawater to remove sand and impurities and stored in a polythene bag during transport. Upon arrival at the laboratory, samples were thoroughly washed with tap water, drained, cut into small pieces, dried for four days, and crushed into powder. Thirty grams of seaweed powder were added to 300 ml of distilled water and left for two days. The filtrate was centrifuged at 4250 rpm for 15 minutes and filtered through Whatman No. 1 filter paper. Priming treatment was carried out by soaking rice seeds with 50 ml *P. minor* extract and adding amino acids according to the treatment. Parameters observed included germination rate, vigor index, maximum growth potential, root length, and hypocotyl length. Analysis of variance (ANOVA) was used to analyze the observation data, followed by Duncan's New Multiple Range Test (DNMRT) to determine if the treatment had a significant effect.

IV. RESULT AND DISCUSSION

The effect of biopriming treatments conducted with *P. minor* extract with the addition of amino acids on the germination of several rice varieties (*Oryza sativa* L.) is presented in Table 1.

Table 1. Average Percentage of Germination, Vigor Index, and Maximum Growth Potential, Hypocotyl and Root length of Rice treated with *P.minor* extract with amino acid addition.

Treatments	Germination Parameters				
	G (%)	VI (%)	MGP (%)	Hypocotyl Length (cm)	Root length (cm)
Aquadest x Inpago UNSOED 1	70 a	70 a	70 a	1.72 ab	3.96 bc
Aquadest x Cinta Variety	90 ab	90 ab	90 ab	2.75 d	5.89 c
Aquadest x Banang Pulau Variety	80 ab	80 ab	80 ab	2.26 bcd	2.36 ab
P.minor x Inpago UNSOED 1	100 b	100 b	100 b	2.75 d	5.43 c
P.minor x Cinta Variety	95 ab	95 ab	95 ab	2.24 bcd	5.65 c
P.minor x Banang Pulau Variety	80 ab	80 ab	80 ab	1.82 abc	1.09 a
P.minor + AA x Inpago UNSOED 1	95 ab	95 ab	95 ab	2.34 bcd	5.74 c
P.minor + AA x Cinta Variety	95 ab	95 ab	95 ab	2.47 cd	4.77 c
P.minor + AA x Banang Pulau Variety	80 ab	80 ab	80 ab	1.37 a	1.32 a

Noted : Values with different letter are significantly different from each other according to DNMRT at $p \leq 0.05$. AA = Amino acid, G = Germination, VI = Vigor Index, MGP = Maximum Growth Potential. Means within a column with different letters are significantly different from each other according to DNMRT at $p<0.05$.

The results of the germination tests (Table 1) showed that the effects of priming treatments, variety of rice and the interaction of these two factors on percentage of germination, vigor index, maximum growth potential, hypocotyl and root length were statistically significant ($p < 0.05$).

Cinta and Banang Pulau varieties showed no statistically significantly different responses from the bio priming treatment. In contrast, Inpago Unsoed 1 variety gave quite different responses on the parameters of the percentage of germination, vigor index, and maximum growth potential (Table 1). The percentage of germination, vigor index, and maximum growth potential of the Inpago Unsoed 1 variety was best with *Padina minor* extract compared to distilled water extract.

P.minor extract contains phytohormones such as auxins, gibberellins and cytokinins that function to stimulate and accelerate cell division, elongation, differentiation and protein synthesis [15, 9]. Auxin plays a role in triggering amylase activity and facilitating the biosynthesis of gibberellic acid. Gibberellic acid will encourage the germination process [16]. At the same time, Gibberellin plays a role in activating hydrolytic enzymes in embryo development in seeds and mobilizing food reserves contained in the endosperm to increase germination in rice [17]. In addition, the exogenous application of gibberellin acid affects the process of physiological changes in seeds, such as embryo maturation which is a response to growth regulators contained in *P.minor* extract. Gibberellin will encourage the activity of hydrolytic enzymes in the germination process of developing seeds. Gibberellin will go to the aleurone layer to form α-amylase and protease enzymes and enter the endosperm to hydrolyze starch and food reserves that help embryo development. Priming of *Capsicum annum* seed with 8% *Padina gymnospora* extract can increase the germination process and the presence of phytochemicals in *C.annum* [19].

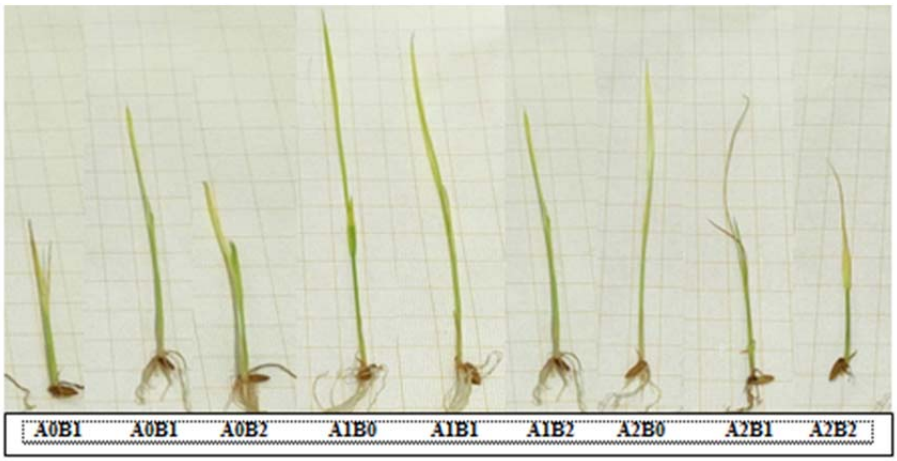

Figure 1. Effect of seed priming with *P.minor* extract and amino acids on germination of three rice varieties. A0 = Aquadest, A1 = *P.minor* extract A2 = *P.minor* extract + amino acids. B1) upland rice Unsoed 1, B2) Cinta (Solok local varieties), and B3) Banang Pulau (Solok local varieties)

Biopriming treatment with *P. minor* extract and adding amino acids to three rice varieties statistically affect hypocotyl and root length. Observation data on hypocotyl length and root length parameters Banang Pulau variety showed the lowest response compared to Cinta and Inpago UNSOED 1 varieties. The character of each rice variety is one of the factors causing biostimulants not to affect the root and hypocotyl length of the sprout. Cinta variety has thinner skin, making it easier to break the dormancy process. The composition of cotyledons, such as protein, skin thickness, and fat, influences the imbibition process. The thicker the seed coat, the slower the water process to fill the rice husk layer cavity. The permeability of the seed coat associated with the seed coat influence the imbibition process [20]

V. Conclusions

This study showed that *P.minor* extract is effectively used as bio-priming for several rice varieties. Upland rice variety Inpago UNSOED 1 gave the best response to priming treatment compared to Solok rice varieties Cinta and Banang Pulau. Given that seed biopriming may exert a carry-over effect on the seedling growth and yield and biochemical parameters, the further investigation remains pertinent.

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