

EFFECT OF ORGANIC AND COMPOUND BIOFERTILIZER AND PRUNING ON THE PRODUCTIVITY AND RESILIENCE OF RICE PLANTS IN SALINE SOIL

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ABSTRACT

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Saline soil is one of the main problems for increasing rice productivity in Indonesia. One approach that can be taken is to select salt-tolerant varieties and manage crops through pruning and adding organic fertilizer to play an important role in regulating the balance between vegetative and generative growth of rice plants. This study aims to evaluate the effect of various rice varieties and pruning combined with organic fertilizer on the growth, yield, and resistance of rice plants in saline soil. The activity was carried out in Ujung Gagak Village, Cilacap Regency through farmer action research. The results showed that the variety treatment had a significant effect on the number of tillers, plant height, leaf greenness, 100-grain weight, panicle length, and the incidence of bacterial leaf blight. Pruning combined with liquid organic fertilizer had no significant effect on most growth and yield variables, but it affect the percentage of empty grains and plant weight, as well as the incidence of bacterial leaf blight during the generative phase. The combination of pruning and organic fertilizer produced higher growth and yield components compared to treatments without pruning and solid fertilizer. In general, Neunah and Inpari 43 varieties showed relatively good performance in growth parameters, while Neunah and Ngaos Mawar varieties showed a higher yield in crop yield parameters. These findings indicate that selecting varieties that are adaptive to salinity conditions, combined with proper crop management such as pruning and organic fertilizer application, can be a strategy to increase rice productivity in saline soils.

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1. Introduction

Rice (*Oryza sativa* L.) is a fundamental agricultural commodity that sustains the dietary needs of the majority of people in Indonesia. As population numbers continue to rise and per capita rice consumption remains high, national demand for rice steadily increases. As the main source of carbohydrates for most Indonesians, the sustainability of rice production is very important to support the increasing food demand in line with population growth. However, rice productivity in various regions still faces serious challenges due to land degradation and unfavorable environmental factors. One of the main problems is the existence of vast areas of saline land that have not been optimally

utilized for rice production [1], thus requiring innovation in production inputs, cultivation technology, and adaptive varieties to increase rice productivity in marginal lands.

The reduction in the area of prime rice fields for rice cultivation is caused by land conversion, which has resulted in a decrease in productive land. The utilization of marginal land is one alternative that must be pursued to increase rice production. One of the environmental constraints that is an obstacle to the decline in national rice production is salinity [2]. Salinity occurs due to the accumulation of excessive salt in the soil, which makes the soil toxic to most agricultural crops. Saline land is one type of marginal land that can be developed into productive rice fields. Like peatlands, saline land in coastal areas, for example, has considerable potential for increasing rice productivity [3]. Salinity in the soil can cause various growth constraints for plants. High salinity causes a decrease in the number of tillers, chlorophyll content, photosynthesis rate, and harvest index in rice plant [4]. A report by [1] states that more than 800 million hectares of agricultural land worldwide are affected by salinity, including some rice fields in Indonesia, especially in coastal areas. Therefore, technological innovations in cultivation are needed to improve the adaptation of rice plants to such land.

One approach that can be taken is through the use of complex biological fertilizers. The use of complex biological fertilizers consisting of several microbes is known to be more effective than single use, due to the synergy between microorganisms in increasing plant resistance to environmental stress, including salinity [5]. In addition, the use of organic fertilizer charcoal charcoal combined with the use of salt-tolerant rice varieties has been tested with fairly good results. The main ingredient of organic fertilizer charcoal briquettes is compost, which is one of the many sources of organic material available in large quantities. Compost is known to increase moisture retention capacity, maintain sufficient pore space to allow good air circulation, drain excess water, and dilute salt concentrations in soil solutions, thereby reducing salinity levels [6]. The application of complex biofertilizer to saline land is known to affect leaf greenness, the severity of plant symptoms, and plant height due to soil salinity in the field. Based on observations of vegetative and generative characteristics, the Ngaos Mawar variety can be categorized as tolerant, Inpara 08 and Inpari 34 as moderately susceptible, and Inpara 09 as susceptible. The application of compound biofertilizer shows moderate arthropod diversity, with a fairly balanced ecosystem condition (Widiarta et al. 2024).

Pruning as a cultivation technique makes plant stems more resistant, thereby preventing lodging [7], as well as having a significant effect on the number of productive tillers, the number of grains per panicle, the number of filled grains per panicle, the dry weight of grain per plot, and the weight of 100 grains of rice in tidal fields [8]. Pruning is recommended during the vegetative stage of rice plants, as pruning at a later stage can reduce crop yield, and effect of pruning in different rice varieties caused differences in yield [7]. According to [9] prune leaves causes wounds that serve as entry points for pathogen infection. On the other hand some biological fertilizers can function as hormones and also improve plant immunity [10]. Reffer to [11] Agrimeth liquid biofertilizer, in addition to being a source of nutrients, can also suppress the onset of type-2 dwarf grass disease transmitted by brown planthoppers. Thus, the application of liquid biofertilizer, in addition to providing nutrients, can also increase plant resistance to pathogen infection. The biofertilizer contain *Rhodopseudomonas palustris* strin PP803 is useful as an ameliorant in saline soils, improving plant growth and reducing CH₄ emissions by 100% and CO₂ emissions by 47% [12]. Based on the findings of [13] the use of a consortium of methane-utilizing bacteria on rice yields increased inorganic fertilizer efficiency by 25%, increased rice production by 33.55%, and reduced CH₄ gas emissions by 37.26% (Pratiwi et al. 2021). Due to [14] the application of biofertilizer to paddy rice can increase paddy rice productivity by 0.37 t/ha located in Banten. This activity was carried out to study the effect of using compound biofertilizer and pruning during the vegetative growth phase to increase the productivity and resistance of rice plants in saline soils.

2. Method

2.1. Location

Field research was conducted as part of JAMTANI's farmer action research program from January to May 2025 on farmland located in Ujung Gagak Village, Nusa Kambangan, Cilacap Regency, Central Java (-7o37'6", 108o50'15", 43.3 m).

2.2. Material

The tools used were a ruler/meter, digital scale, plant shears or sickle, measuring cup, BWD, and insect net. The materials used were rice seeds of the Inpari 34, Inpari 43, Baroma, Ngaos Mawar, and Ngenah varieties, plastic bags 1 kg size, alcohol. The fertilizers used were solid organic fertilizer and compound biological fertilizer/liquid compound biological fertilizer.

2.3. Experimental design

The experimental design uses a factorial experiment with a randomized block design (RBD) with three replicates. The first factor is biofertilizer: solid compound biofertilizer (N0) and liquid compound biofertilizer (N1). The second factor is variety: Inpari 34 (V1), Inpari 43 (V2), Baroma (V3), Ngaos Mawar (V4), Ngenah (V5). The fertilizer dosage was adjusted according to the plot area in the field. Solid biofertilizer was applied to the soil, while liquid fertilizer was applied to the crops in the pruning treatment plots.

The solid compound biofertilizer used is in powder form and contains seven beneficial antagonistic microbes, namely: *Trichoderma viridae*, *Paenibacillus polymixa*, *Azotobacter* sp., *Bacillus subtilis*, *Streptomyces* sp, *Lactobacillus* sp. and *Pseudomonas fluorescens*. Liquid compound biological fertilizer with the same antagonistic microbe content in liquid form is applied by spraying. The liquid fertilizer is applied by dissolving 5 ml in 1 liter of water, then sprayed on the leaves and base of the stems around the plants. Application begins 15 days after planting (DAP) and is carried out once a week. During rice pruning, the fertilizer is sprayed directly onto the plant surface and soil after pruning.

All experimental plots received organic fertilizer treatment in addition to 100 kg of composted manure composed of chicken manure, goat manure, guano, rice husk charcoal, and *Azolla pinata*. Once a week, liquid organic fertilizer from rabbit urine and *azola pinata* was applied. In addition, two applications of botanical pesticides consisting of extracts of galangal, lemongrass, garlic, and brotowali were sprayed on the crops.

Solid compound fertilizer is applied before cutting, while liquid compound fertilizer is applied after cutting on plots that have been pruned.

Irrigation in each plot was carried out using a single gate/single channel system. Control actions for pests and diseases were implemented when population levels beyond the economic injury level. At 45 days after planting, the rice canopy was pruned using plant shears/sickles at a height of ± 15 cm from the ground surface in the treatment plots that were given liquid organic fertilizer, which was carried out in the morning.

2.4. Measurements

Experimental observations included leaf greenness level, number of productive tillers, plant height, number of panicles per clump, weight of 100 grains, number of filled grains per panicle, number of empty grains per panicle, root length and volume, and dry grain yield. Observations were also made on the severity index of plants affected by saline soil stress during the vegetative and generative phases, referring to [15] with the following criteria:

Score 1. Growth and tillers are almost normal

Score 3. Growth is almost normal but there is some reduction in tillers and some leaves are rolled up

Score 5. Growth and tillers are reduced; leaves are whitish and rolled up (salt); only a few are elongated

Score 7. Growth is completely stopped; most leaves are dry; some plants are dying

Score 9. Almost all plants are dead or dying

Observations were made of pest and disease attacks at the location, including brown planthoppers, stem borers, leaffolder, dwarf grass, leaf and neck blast, and bacterial leaf blight.

2.5. Statistical Analysis

All observation data were analyzed using analysis of variance (ANOVA) with SAS 9.1 for Windows. If there was an interaction between treatment, a comparison of the interaction effect was

made. Otherwise, treatment mean effects were compared based on Duncan's multiple range test at $P < 0.05$.

3. Results and Discussion

3.1. Effect treatment to land condition

The study was conducted on rice fields located near the coastline affected by salinity due to seawater intrusion or overflow. During high tide, the land may experience an increase in soil salinity, which directly affects rice plant growth. The results of salt content observations in the planting environment are shown in Table 1, which explains that the salt content at the location decreased over time. In general, there was a decrease in salinity in the field from two observation times of around $0.9 \mu\text{S/cm}$ from the vegetative to generative phase. The decrease in salt content was possibly due to washing by rainwater and organic fertilization treatment at the beginning before planting. According to rainfall data at the planting site, rainfall was low but high at the end before harvest. The higher the rainfall in an area, the lower the salinity of the water, and conversely, the lower the rainfall, the higher the salinity [16]. In soils with high salt levels in coastal areas, rainfall has a relatively high effect on soil conditions and plant growth [17]. The application of organic fertilizer to plants at the beginning of the activity may have contributed to the reduction of salinity levels in the location so that the plants grew normally. The addition of external organic matter can improve the physical and chemical properties of the soil, support plant growth and microbial activity in salinity-accumulated land. Organic fertilizers have a good long-term effect on the soil [18]. According to [19], organic matter functions as a soil conditioner and meets plant nutritional needs by providing various nutrients.

According to salinity data, the average salinity during the vegetative phase reached $2.3004 \mu\text{S}$. According to [20] stated that rice plants are sensitive to salt, except for several genotypes that have been widely used in salt-tolerant rice breeding. The critical salinity threshold for rice is around 3 dS/m ($3000 \mu\text{S/cm}$), so in general, the land at the location is still within the tolerance limit for plant growth. Problems that arise at the location have an impact at the beginning of planting, namely during the transplanting phase from the nursery, because young plant roots are highly sensitive to salinity [21]. Another indication of low salinity stress on field crops is shown by the results of observations of the severity of plant symptoms due to salinity stress, which show a range of 1-1.3 (Table 3).

Table 1. Salinity level

Sample	Vegetative ($\mu\text{S/cm}$)	Generative ($\mu\text{S/cm}$)
Sample 1	2.217	1.474
Sample 2	2.663	1.528
Sample 3	2.309	1.427
Sample 4	2.501	1.183
Sample 5	1.812	912

Tabel 2. Climate Data

Variabele	Month				
	January	February	Maret	April	May
Temperature ($^{\circ}\text{C}$)	27.91	28.13	28.28	27.95	27.76
Humidity (%)	82.35	81.46	84.45	84.90	87.13
Rainfall (mm)	8.75	6.37	5.68	8.21	13.60
Sunlight (Hour)	4.54	4.74	5.71	6.65	6.05

Source: BMKG

3.2. Vegetative and Generative Variables of Plants

The results of observations of the number of tillers showed a significant effect of variety, but were not significantly affected by pruning treatment and fertilizer type, or the interaction between the two (Table 3). The Inpari 43 variety produced the highest number of tillers (24.4), followed by Inpari 34 (21.8) and Ngeunah (22.1). Conversely, the Ngaos Mawar variety recorded the lowest number of

tillers (15.46). The ability to form tillers under saline stress conditions is one indicator of variety adaptation. The low number of tillers in the Ngaos Mawar variety is likely due to metabolic disturbances caused by salinity, such as disruption of ion balance and decreased enzyme activity involved in new shoot growth.

Plant height is significantly influenced by variety. The Ngeunah variety recorded the highest plant height (96.05 cm), which is significantly higher than other varieties, while the Inpari 43 variety produced the lowest value (80.7 cm). The response of varieties to plant height variables may be influenced by plant genetic factors, although it is possible that salinity stress may also suppress plant height growth. Increased salinity reduces plant height, effective tillers, seed weight, and rice yield [21].

The leaf greenness variable, measured as an indicator of chlorophyll content and plant physiological health, also showed significant differences between varieties. The Baroma and Inpari 34 varieties had the highest leaf greenness levels, at 3.3 and 3.2, respectively. Meanwhile, the Ngaos Mawar variety had the lowest value (2.6). Leaf greenness is related to chlorophyll content, which is an indicator of plant nitrogen status [22]. The results obtained show that the response of varieties varies in terms of leaf greenness status. It is possible that this difference is influenced by the nutrient content of plants that are directly deficient in nutrients. In this study, no inorganic fertilizers were applied to all experimental plots, so the plants relied on nutrient intake from the soil and the availability of nutrients in the form of organic fertilizers, which affected the physical, biological, and chemical properties of the soil. Good physical, biological, and chemical properties of the soil are environmental conditions that positively affect plant growth and crop yields [23]. Organic fertilizer treatments of various types contribute to plant growth. Based on the nutrient content of the types of organic materials applied at the beginning, it is known that goat manure, chicken manure, *Azolla pinnata*, and guano fertilizer have a fairly high nitrogen content. The average value obtained shows that the average level of leaf greenness of green plants is moderate or in critical condition, but still sufficient for plant growth. The application of organic fertilizer at the beginning of planting and regular application can supply plant nutrients to maintain their growth.

Observations of the severity of symptoms caused by salinity stress indicate that the crops are not severely affected by salinity, as indicated by a stress level of 1-3 based on [15] scale, which shows normal plant growth, and slightly affected, as indicated by curled leaves. It is estimated that the land conditions are not too affected by salinity, as indicated by an average salinity value of 2,300.4 μS in the vegetative phase and 1,304.8 μS , resulting in normal plant growth. Fertilization treatments at the beginning and regularly carried out at the location may reduce salinity stress at the location. In addition, weather factors are also a determining factor in dealing with the problem of soil salinity stress at the location. The problem in the field in cultivating saline land at this location at the beginning of planting from the nursery to the field is that the plants are still weak, so intensive transplanting is required. The application of organic fertilizer to the soil is a solution to reduce salinity at this location.

Pruning and fertilizer application (both liquid and solid) did not show a significant effect on all plant growth parameters. The results for plant growth variables were not significantly different between fertilized and unfertilized blocks. Liquid fertilizer, which is generally more easily absorbed by plants, is expected to have a better impact on saline land. However, if root absorption has been disrupted due to salt accumulation, fertilizer efficiency remains low. Similarly, pruning aimed at stimulating new shoot growth was not effective enough in mitigating the effects of salinity stress.

No significant interaction was found between variety and pruning and fertilizer treatments, which means that the response of each variety to these additional treatments was consistent and not specific to the type of fertilizer or pruning. This shows that variety selection is a key factor in rice cultivation management on saline land. Based on the observations, it can be concluded that variety has a significant effect on rice plant growth on saline land, particularly in terms of tiller number, plant height, and leaf greenness. Ngeunah and Inpari 43 varieties showed relatively better performance in growth parameters.

Table 3. Effect of variety and pruning on the agronomic characteristics of rice plant growth

Treatment	Number of productive tiller ^t	Plant height (cm)	Leaf greenness	Severity of symptoms
Variety	*	**	**	ns
Inpari 34	21.80ab	93.40ab	3.20ab	1
Inpari 43	24.40a	80.70c	3.20ab	1.3
Baroma	17.90bc	84.30bc	3.30a	1.3
Ngaos Mawar	15.46c	89.10abc	2.60c	1
Ngenah	22.10ab	96.00a	3.00b	1
Organic Fertilizer and Pruning	ns	ns	ns	ns
Liquid Fertilizer + With Pruning	20.64	89.50	3.20	1.3
Solid Fertilizer + Without Pruning	20.10	88.00	3.00	1.3
Interaction	Ns	ns	ns	ns
CV	10.94	8.20	6.23	45.56

Note: *Significant at the 5% level of Duncan's multiple range test, **Significant at the 1% level of Duncan's multiple range test; ns not significant, t data transformed with sqrt

Table 4. Effect of variety and pruning on agronomic characteristics of crop yields in saline soils

Treatment	Weight of 100 grains (g)	Panicle length (cm)	Number of filled grains ^t	Empty Grain ^t (%)	Weight/plot (kg)
Variety	**	**	ns	*	ns
Inpari34	2.64b	29.16ab	151.90	24.19b	2.94
Inpari43	1.84c	23.48c	129.63	37.18a	3.09
Baroma	2.58b	29.93a	133.10	35.75a	2.98
Ngaos Mawar	2.99a	30.73a	186.83	29.53ab	3.40
Ngenah	2.52b	28.01b	146.50	34.38a	3.61
Organic Fertilizer and Pruning	ns	ns	ns	*	ns
Liquid Fertilizer + With Pruning	2.57	28.4	160.47	29.444a	3.33
Solid Fertilizer + Without Pruning	2.46	28.09	138.72	34.979b	3.08
Interaction	ns	ns	ns	ns	ns
CV	8.71	4.41	13.09	21.91	15.32

Note: *Significant at the 5% level of Duncan's multiple range test, **Significant at the 1% level of Duncan's multiple range test; ns not significant, t data transformed with sqrt

The analysis results show that variety treatment has a significant effect on 100-grain weight, panicle length, and percentage of empty grains, but no significant effect on grain weight or yield per plot. Meanwhile, pruning treatment only shows a tendency to increase yield, but no significant difference in almost all yield parameters except for the percentage of empty grains. Similarly, the interaction between variety and pruning did not have a significant effect.

The 100-grain weight variable showed that the Ngaos Mawar variety was significantly heavier than other varieties. The Ngaos Mawar and Baroma varieties had the longest panicles with values of

30.7 cm and 29.9 cm, which were significantly different from Inpari 43 (23.4 cm). The Ngaos Mawar variety had more plump grains than other varieties, resulting in a higher grain formation rate and greater yield, although the yield was not significantly different. For the variable of empty grain percentage, the Inpari 34 variety has the lowest empty grain percentage, the same as the Ngaos Mawar variety and significantly different from Inpari 43, Baroma, and Ngeunah (Table 4). It is possible that the Inpari 34 and Ngaos Mawar varieties are more efficient in grain filling, in contrast to Inpari 43. Based on the results of production variable observations, the Ngenah and Ngaos Mawar varieties showed a higher yield trend with values of 3.6 kg and 3.4 kg, or 5.76 tons/ha and 5.44 tons/ha. Ngaos Mawar, in particular, had a higher yield supported by its grain weight and higher 100-grain weight value. Based on previous results, the Ngaos Mawar variety is a local variety that has good adaptability in saline-affected locations. The results of research by [24] show that saline-tolerant varieties produce higher grain yields than salt-sensitive varieties under salt stress, due to a higher total number of spikelets and a higher rate of grain formation. The use of organic fertilizer without the addition of inorganic inputs to support rice plant growth shows good prospects for supporting organic farming. The results obtained by [25] show that organic fertilizer treatment significantly increases yield components such as panicle length and 1000-grain weight in rice cultivation on saline soil.

The results of observations for pruning and liquid fertilizer treatments showed significant figures for the percentage of empty grains compared to without pruning and solid fertilizer. This description shows that liquid fertilizer is more effective in reducing grain filling failure because nutrients are more readily available to plants. On the other hand, pruning reduces photosynthetic competition for new shoots, so that more assimilates are channeled to the grains. The observation results for yield components showed that pruning produced higher weights and better yield components compared to no pruning, although statistically there was no difference.

3.3. Root and crown components of plants

The results of observations on post-harvest components are presented in Table 5. There were no significant differences between treatments of varieties in terms of the root length. However, the Baroma variety showed the highest root length (27.7 cm), followed by Ngaos Mawar (25.8 cm). This indicates that Baroma and Ngaos Mawar may be more adaptive to saline conditions because they have longer roots, which can help absorb water and nutrients in compacted soil. In terms of root volume and weight, the Ngaos Mawar and Baroma varieties had the highest values with root volumes of 96.6 ml and 88.3 ml, respectively, and root weights of 92.8 g and 86.3 g, this indicating these two varieties were able to develop a better root system than other varieties in saline conditions. Plants that have the ability to adapt morphologically and physiologically to saline conditions have, among other things, better root systems [26]. Optimally grown roots make it easier for plants to absorb nutrients, making them more adaptive to salinity conditions [27].

The Baroma variety had the highest crown weight (120.2 g), but with the lowest crown/root ratio of 3.4 g. Baroma allocated more biomass to the crown, but with lower efficiency compared to other varieties such as Inpari 43 with a ratio of 5.4. In terms of biomass weight, Ngaos Mawar produced the highest biomass with 324.4 g than other varieties. Data from the Baroma and Ngaos Mawar varieties show better adaptation to saline environments with more optimal root and crown development. Previous research results at the same location showed that the Ngaos Mawar variety had better growth and yield compared to other varieties.

Pruning and liquid fertilizer treatment resulted in higher hill weight, with 79.9 g compared to without pruning (50.1 g), but with lower biomass weight (221.6 g). Liquid fertilizer may support vegetative growth but does not significantly increase total biomass. As is known, liquid fertilizer treatments with other contents were also applied to all plants during the vegetative stage.

The treatment without pruning and solid fertilizer produced the highest root weight with a value of 316.8 g. This value indicates that solid fertilizer is more effective in increasing overall plant productivity in saline soils. The results of observations on the distribution of the canopy and plant roots from treatments that had been pruned and fertilized with liquid fertilizer produced a lower ratio of 4.6 compared to those without pruning (5.1). This described that pruning can reduce biomass allocation to the canopy, but not to the yield, which was almost entirely insignificant. The interaction between variety and treatment was not significant for all post-harvest parameters, indicating that the response of varieties to pruning and fertilizer type was not statistically different. However,

numerically, varieties such as Baroma and Ngaos Mawar still showed better performance in all treatments.

Table 5. Effect of variety and pruning on agronomic root characteristics in saline soils

Treatment	Root length (cm)	Root volume ^t (ml)	Weight root ^t	Hill weight ^t (g)	Plant biomass weight ^t (g)	Shoot–root ratio ^t
Variety	ns	ns	ns	ns	ns	ns
Inpari34	21.58	50.83	52.12	42.31	235.33	5.02
Inpari43	23.25	45.83	42.6	48.07	207.5	5.46
Baroma	27.70	88.33	86.63	120.24	285.5	3.48
Ngaos Mawar	25.87	96.67	92.88	61.59	324.42	5.24
Ngenah	23.87	69.58	66.55	53.03	293.42	5.23
Organic Fertilizer and Pruning	ns	ns	ns	ns	*	ns
Liquid Fertilizer + With Pruning	23.78	64.83	61.74	79.96	221.60	4.63
Solid Fertilizer + Without Pruning	25.14	75.67	74.58	50.14	316.87	5.14
Interaction	ns	ns	ns	ns	ns	ns
CV	16.13	25.61	23.99	39.01	19.46	9.43

Note: *Significant at the 5% level of Duncan's multiple range test, **Significant at the 1% level of Duncan's multiple range test; ns not significant, ^t data transformed with sqrt

3.4. Pests and Plant Diseases in Vegetative

The types of pests found during the vegetative growth phase of the plants prior to pruning and liquid biofertilizer treatment were populations of brown planthoppers (BPH), symptoms of stem borer (PB) attacks, and leaf folder.

Table 6. Effect of variety and organic fertilizer on pest and disease in rice plants during the vegetative phase.

Treatment	sundep	Neck blast	Leaf blast ^t	Bacterial Leaf Blight
Variety	ns	ns	ns	ns
Inpari34	1.04	1.05	1.17	1.05
Inpari43	1.05	1.07	1.22	1.05
Baroma	1.05	1.06	1.20	1.07
Ngaos Mawar	1.04	1.06	1.19	1.06
Ngenah	1.06	1.08	1.22	1.04
Organic Fertilizer and Pruning	ns	ns	ns	ns
Liquid Fertilizer + With Pruning	1.06	1.07	1.20	1.06
Solid Fertilizer + Without Pruning	1.05	1.06	1.20	1.06
Interaction	ns	ns	ns	ns
CV	2.95	4.28	8.26	2.26

Note: *Significant at the 5% level of Duncan's multiple range test, **Significant at the 1% level of Duncan's multiple range test; ns not significant.

The only disease found was grassy stunt virus disease type II (RGSV-II), which is transmitted by BPH. The pest population density and disease presence in the vegetative phase of rice plants were below the control threshold [28]. The population density and symptoms of pest and disease different between varieties.

Brown planthopper. The population density of BPH is very low, ranging from 0.33 to 1.33 insects per plot. The type of biopesticide affects the density of immigrant populations and the reproduction rate of the invading generation to the first generation of brown planthoppers [11]. The BPH population density varies between varieties, with the lowest density found in Inpari 43, Inpari 34, and Ngaos Mawar, increasing in Baroma, and highest in Ngenah (Figure 1). The BPH population density was higher in the Ngenah variety before the application of liquid compound fertilizer.

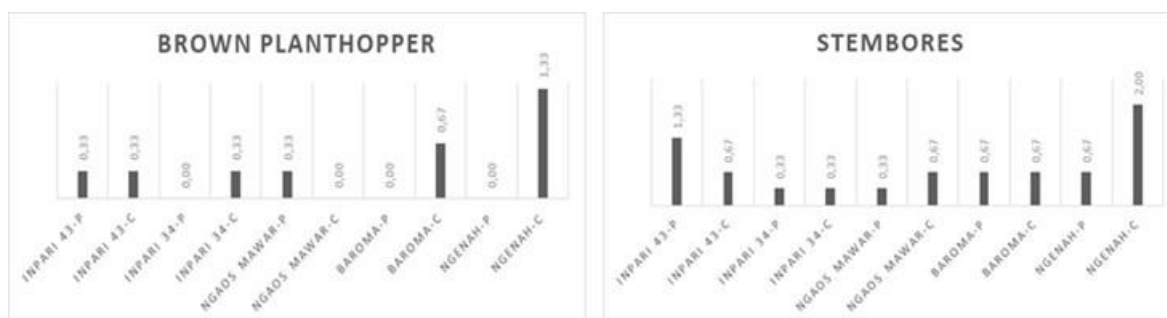


Fig 1. BPH population density (1a) and stem borers (1b). Number of plants per plot: 200 plant

Stem borer. Symptoms of stem borer were found in almost all plots with a range of attack symptoms per plot of 1.33-2.0 clumps. The lowest symptoms of attack were found in the Inpari 34 variety, followed by Ngaos Mawar, Baroma, Inpari 34, and the highest in Ngenah (Figure 1b). The tendency for sundep symptoms differnt in the Inpari 43 and Ngenah varieties before the application of liquid biofertilizer.

Leaffolder. This attack symptoms were higher than stem borer, ranging from 2.0 to 8.67 clumps per plot. The highest symptoms of attack were found in the Inpari 34 variety, followed by Ngaos Mawar, Ngenah, Inpari 34, and Baroma (Figure 2a). Symptoms of leaffolder attack were higher in the Inpari 43 and Inpari 34 varieties before the application of liquid compound fertilizer, whereas the opposite was true for Ngaos Mawar and Ngenah.

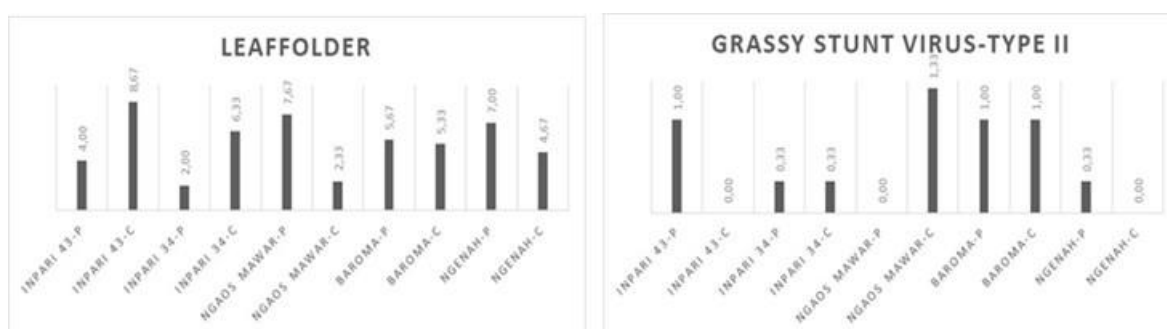


Fig 2. Symptoms of Leaffolder (2a) and Grassy stunt virus (2b). Average number of plants per plot: 200

Grassy Stunt Virus Disease type II. Symptoms of RGS-II disease attacks are almost the same as SB symptoms, ranging from 0-1.33 clumps per plot. The highest symptoms were found in the Ngaos Mawar variety, followed by Baroma and Inpari 43 with almost the same level of symptoms, and the lowest in Inpari 34 (Figure 2b). Symptoms of RGS type II before the application of liquid compound fertilizer were higher in Inpari 43 and Ngenah, but lower in the Ngaos Mawar variety. The development of rice tungro virus disease-resistant rice varieties has been relatively successful,

however, the development of RGS-II-resistant varieties remains challenging due to a lack of genetic resources for improving rice resistance [29].

3.5. Pests and Plant Diseases in Generative

The types of pests found during the generative phase of plants were BPH, SB, green stink bugs, and leafhoppers with low populations. The symptoms of stem borer pest attacks and blast and bacterial leaf blight diseases also differed between varieties and treatments of liquid and solid organic fertilizers.

Table 6. Effect of variety and organic fertilizers on rice plant pest and disease attack parameters

Treatment	deadheart	neck blast	leaf blast ^t	Bacterial leaf blight
Variety	ns	ns	ns	**
Inpari34	0.62	0.35	1.40	1.95a
Inpari43	0.55	0.38	1.40	1.96a
Baroma	0.54	0.30	1.41	1.70b
Ngaos Mawar	0.64	0.43	1.49	1.96a
Ngenah	0.53	0.33	1.29	1.60b
Organic Fertilizer and Pruning	*	ns	ns	ns
Liquid Fertilizer + With Pruning	0.51b	0.34	1.39	1.74b
Solid Fertilizer + Without Pruning	0.64a	0.37	1.41	1.83a
Interaction	ns	ns	ns	**
CV	28.51	22.53	15.71	5.59

Note: *Significant at the 5% level of Duncan's multiple range test, **Significant at the 1% level of Duncan's multiple range test; ns not significant, t data transformed with $\sqrt{t}+1$

Table 6 shows that variety had no significant effect on the incidence of deadheart, neck blast, and leaf blast, but did affect the incidence of bacterial leaf blight (BLB) in generative observations. Varieties such as Baroma and Ngenah showed lower levels of bacterial leaf blight than Inpari 43 and Ngaos Mawar. Meanwhile, the effect of fertilizer treatment shows that liquid organic fertilizer is more effective in suppressing deadheart and bacterial leaf blight attacks than solid fertilizer. For neck blast and leaf blast, there is no significant difference. There is an interaction between variety and fertilizer type on bacterial leaf blight. This indicates that the effectiveness of liquid and solid fertilizers depends on the variety. Varieties that are more tolerant to salinity may benefit more from liquid fertilizer. Resistant varieties remain very effective and economical in controlling the bacterial leaf blight (BLB) of rice [30]. As well as research has highlighted the potential of using antagonistic microbes which can suppress the BLB pathogen [31].

4. Conclusion

1. Variety treatment affects the number of tillers, plant height, leaf greenness, 100-grain weight, panicle length, and the incidence of bacterial leaf blight in the generative phase.
2. Pruning combined with liquid fertilizer does not significantly affect growth and yield variables, but it does affect the percentage of empty grains, plant weight, and the incidence of bacterial leaf blight in the field during the generative phase. However, it produced higher growth and yield components compared to without pruning and solid fertilizer.
3. Ngeunah and Inpari 43 varieties showed relatively better performance in growth parameters, while the Ngenah and Ngaos Mawar varieties showed a higher yield trend in crop yield parameters.

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