

# Effect of Inorganic Fertilizer and Brown Alga Solid Ectract on Growth and Yield of Rice Plants

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# Effect of Inorganic Fertilizer and Brown Alga Solid Extract on Growth and Yield of Rice Plants

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**Abstract.** High dose application of inorganic fertilizer in agriculture creates several problems, such as high cost production, reduce farmers income and solid fertility, and harm our environment. Therefore, it is needed to understand a fertilizer which is cheap, abundant raw material and adaptive to environment. Many author reported that macroalga could be used as raw materials for developing organic fertilizer as it contains phytohormones and essential elements stimulating growth and production of plants. This article reports the effect of anorganic fertilizers and brown alga solid extract on growth and yield of rice plants. The experiments consisted of two factors, dose of anorganic fertilizer (0,25,50, and 100%), and brown alga solid extract (P0 and P1). Since there was eight combinations, and each combination was repeated three times, then the experiment consisted of 24 experimental pot. The results shown application of 25% anorganic fertilizer in combination with solid axtract increased growth and yield of rice plants on the similar value when the rice plants supplied with 50% or 100% dose of anorganic fertilizer. This suggests that the application of 25% anorganic fertilizer in combination with solid extract could increase efficiency in using organic fertilizer into 75%.

## INTRODUCTION

The application doses of anorganic fertilizer increase continuously into the level of 300 kg per hectar. Since fertilizer is an important production component on agriculture production, the this application increase the production cost, which ultimately reduce farmers income. In addition, application of high doses of anorganic fertilizer reduces soil fertility and killed the soil microorganism, which ultimately decreases agricultural production [1].

In many literature, it was reported that maximum mineral absorpbtion of rice root is 46% [2][3]. This means that 54% of the fertilizer could not be absorbed by the plants, it is leaching as several ions, such as nitrate, ammonium, phosphate, K2O3 which can harm the environment. This leaching goes to irrigation water, whale water and vegetation. It is well known that water and vegetation contain more ion like nitrate, when it is boiled, the nitrate is contain more ion like nitrate, when it is boiled, the nitrate is converted into nitrate which poison to human [3].

Based on the fact, then developing organic fertilizers increasing growth and production of plants and adaptive to our environment is an important task recently. Many authors reported that extract macroalga increased germination, seedling, growth and yield of several species of plants. In addition, many authors developed organic fertilizers as solid extract of macroalga contain essential elements which could support growth and yield of plants based on this report [4], many authors reported that organic fertilizer containing seaweed could increase growth and production of vegetable plants [5][6] and soybean [7].

It has also been reported that solid extract of brown alga could increase growth and yield of rice plants [8], cucumber plants [9]. However, there is no outhors reported how solid extract could substitute the use of anorganic fertilizer an agriculture system. This article reports that anorganic fertilizer and solid extract of brown alga affected growth and yield of rice plants. The growth and yield increased simultaneously with the increase of anorganic dose supplied. Hoeever, the dose could be educed when anorganic fertilizer applied in combination with solid extract of brow n alga. The maximum growth rate and yield of rice plant could be reached when it was supplied with 25% inorganic fertilizer in combination with solid extract of brown alga. This indicates that application of solid extract could reduce the application dose of anorganic fertilizer.

## MATERIALS AND METHODS

### Experimental Design

Experiment was designed as completely randomized design. It emdised <sup>1</sup> of two factors: dose of anorganic fertilizer (0,25,50, and 100%), and solid extract (P0, no P0; P1, supplied with P0). Since there is eight combination and each combination was reperted three times. Therefore, there were 24 experimental pot. Growth parameter measured was plant height, tiller number, shoot and root dry weight. Moreover, yield parameter measured was penicle number and grain weight (g). the data are expressed as mean of three replicator + SD.

### Sample Collection and Extraction

*Sargassum crassifolium* was collected from Batulayar coastal beach West Lombok, rinsed using sea water anf dried in shadow place for three days. After dry, seaweed was cutted into small peace using seisor. Then, seaweed was extracted using water [10]. Seaweed (500 g) was placed in 3L chemical flash. After it added with 1.5L distilled water, the mixture was homogenized. Then, the mixture was placed in 95°C.

## RESULTS AND DISCUSSION

### The Effect Inorganic and Organic Fertilizer <sup>2</sup> on Growth

The effect of inorganic <sup>2</sup> and organic fertilizer on growth of rice plants can be seen on table a (plant heigh), table b (tiller number), table c (shoot dry weight) and table d (root dry weight). The plant height was increased simultaneously with the increase of application dose of inorganic fertilizer until until 50% dose. The application of inorganic fertilizer more than 50%, could not increase the plant height of rice plant (Table 1). However, the similar plant height with the plants supplied with 50% or 100% could be reach in lower inorganic dose application, like 0% and 25% when the fertilizers were applicated in combination with organic fertilizer containing *Sargassum crassifolium* solid extract. This indicates that the application of organic fertilizer containing solid extract can reduce the dose application of inorganic fertilizer. On the other word organic fertilizer containing seaweed could substitute the use of inorganic fertilizer.

The application of 50% inorganic fertilizer in combination with organic fertilizer could not increase plant height. In addition, the application of 100% inorganic fertilizer in combination with organic fertilizer inhibited growth of plant height (Figure 1). This indicates that excessive mineral nutrition in media inhibit absorption of mineral wich ultimately reduce the growth [10].

Similar phenom also occurred in tiller number of rice plants (Figure 1). Tiller number increased when dose application of inorganic fertilizer also increased. <sup>1</sup> lower, when inorganic fertilizer in combination with organic fertilizer, tiller number was response differently. The application of 25% inorganic fertilizer in combination with organic fertilizer produced similar number when it was supplied with 50% inorganic fertilizer in combination with organic fertilizer. Eventhough, the application of 100% inorganic fertilizer in combination with organic fertilizer containing *Sargassum crassifolium* solid extract inhibit mineral absorption which finelly reduced the formation of tiller number. This indicates that the application of organic fertilizer could reduced substituted the use of inorganic fertilizer, these phenomena could be seen in several species of plants, such as x, y, and z [8] [9][10].

Since the application of inorganic fertilizer in combination with org<sup>2</sup>ic fertilizer containing seaweed increased plant height and tiller number, therefore, those treatments also effected shoot dry weight of shoot and root dry weight (Figure 2). These phenomena indicating that organic fertilizer, or it can substitute the use inorganic fertilizer-partly.

### Effect of Inorganic and Organic Fertilizer on Yield

As effect of fertilizer on growth, inorganic and organic fertilizers effected yield of rice Plants, such as penicle number and grain weight (Figure 2). Penicle number increased simultaneously as the increase dose inorganic fertilizer application 50%. The application of 100% inorganic fertilizer produced similar tiller number with rice plants supplied with 50% inorganic fertilizer. This suggests that it does not need to supply 100% inorganic fertilizer, dose to it did not increase tiller number.

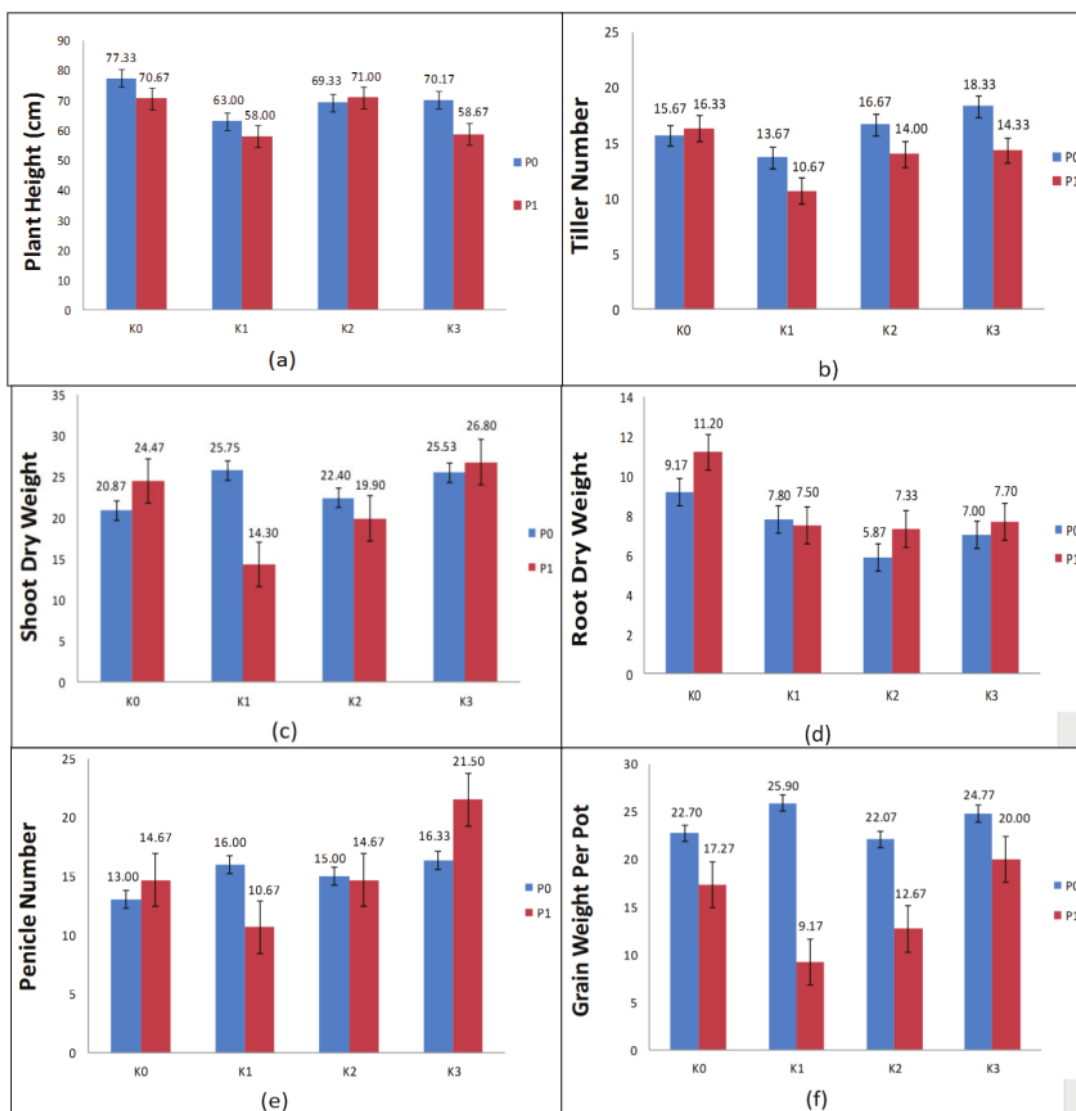
In addition, if it is compared the tiller number of the plants supplied with 50% and 100% inorganic fertilizers, there were no different tiller number produced by those plants (Figure 2). It was very small different also the number of tiller of the plants supplied with 25%, 50%, and 100%. Therefore, the application of 25% inorganic fertilizer is enough to support the production of penicle. This indicates that the application of 25% inorganic fertilizer can induce the rice plants to produce maximum tiller number. However, when inorganic fertilizer supplied in more than 25% dose, it did not increase tiller number significantly compared with 50% and 100% application of inorganic fertilizer. This phenomena deal with enzyme activity mechanism as documented in many literatures [11].

Penicle number response differently when the plants were supplied with in organic fertilizer in combination with organic fertilizer (Figure 2). The maximum tiller number produced by the plants supplied with 25% inorganic fertilizer in combination with organic fertilizer. However, addition of organic fertilizer on plants supplied with 50% and 100% inorganic fertilizer decreased tiller number. This indicates that addition 25% inorganic fertilizer in combination with organic fertilizer is an optimum availability of mineral nutrition in soil, increase uptake, growth and production. This suggests that the optimum condition for maximum enzyme activity to absorb mineral nutrition is when the plants are supplied with organic fertilizer and 25% inorganic fertilizer. Application of organic fertilizer on plants supplied with more that 25% inorganic fertilizer inhibit production of plants, as also occur in several plants, such as x, y, and z[8][9][10][11][12].

As tiller number, grain weight also was response similarity with tiller number of the plants supplied with inorganic and organic fertilizer on table f (Figure 1). The grain weight increased until the application of 50% inorganic fertilizer. However, the application of 100% of inorganic fertilizer did not increase the weight of rice plants supplied with 50% inorganic fertilizer.

The application of organic fertilizer induced the grain weight, especially when it was added to the plants supplied with 25% and 50% of inorganic fertilizer. However, when organic fertilizer was added to the plants supplied with 100% inorganic fertilizer grain weight of the plants decreased significantly.

Since there were no different affect of organic fertilizer addition on grain weight of the plants supplied with 25% and 50%, then the addition of organic fertilizer could be done in the plants supplied with 25% inorganic fertilizer. The data penicle number and grain weight (Figure 1) indicates that the addition organic fertilizer reduce the use of inorganic fertilizer until 75%. Addition of organic fertilizer in combination of 25% organic fertilizer increase availability of mineral nutrition on the level optimum to be up taken by root system in maximum rate [13].



**FIGURE 1.** (a) Plant height (b) Tiller Number (c) Shoot Dry Weight (d) Root Dry Weight (e) Penicle Number (f) Grain Weight Per Pot



## CONCLUSION

<sup>1</sup> Effect of Inorganic Fertilizer and Brown Alga Solid Extract on Growth and Yield of Rice Plants. The application of 25% inorganic fertilizer is enough to support the production of panicle and induce the rice plants to produce maximum tiller number. The maximum tiller number produced by the plants supplied with 25% inorganic fertilizer in combination with organic fertilizer. However, addition of organic fertilizer on plants supplied with 50% and 100% inorganic fertilizer decreased tiller number. This indicates that addition 25% inorganic fertilizer in combination with organic fertilizer is an optimum availability of mineral nutrition in soil, increase uptake, growth and production and then when organic fertilizer was added to the plants supplied with 100% inorganic fertilizer grain weight of the plants decreased significantly.

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