Performance of local rice varieties under various organic soil fertility strategies in Toraja, Indonesia

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Abstract. This research aims at studying production parameters of two local varieties of Tana Toraja rice and one introduced variety with the application of several types of organic fertilizers. The field research was conducted from May to September 2018 in Bua’tarrung village, Rembong District, Tana Toraja Regency, South Sulawesi Province. The trial was arranged as two-factor split plot design experiment. The varieties Pare Ambo, Barri Rarang, and Inpago Unsoed 1 were the main plots, while organic fertilizer types as sub plots consisted of three types of composts, namely: farmer compost, Tithonia compost, and Azolla compost. The fertilizer treatments did not show significant differences for any of the varieties. The best productivity was in the local variety Barri Rarang, achieving 4.87 tons per hectare with the local compost fertilizer treatment.

1. Introduction

Rice (Oryza sativa L.) is an important food crop commodity in Indonesia and for ninety-five percent of Indonesians it is the preferred and daily consumed staple food. Even though the per capita rice consumption is declining due to increasing affluence, rice still meets 63% of total energy and 37% of protein daily requirements [1]. More than 7,000 rice varieties exist in Indonesia, however most landraces have been replaced by modern high-yielding varieties, which grow on eighty-five percent of Indonesia’s paddy rice fields [2]. In contrast, Tana Toraja is one of regencies in South Sulawesi Province that still cultivates many different rice landraces in both rice systems, paddy and upland rice. Toraja’s rice agrobiodiversity is regarded as potential asset to be used and preserved. Local production statistics of the Agriculture and Fisheries Office of North Toraja Regency document a particular importance of five local rice varieties which are grown in 21 districts. The most popular landraces are Pare Ambo, Pare Lea, Pare Bau’, Pare Lallodo, and Pare Kombong with a planting area of 1,653.44 ha, 1,174.67 ha, 640.25 ha, 425.90 ha, and 425.90 ha, respectively [3].

The productivity of the local rice varieties is rather low ranging from 4.36 to 6.26 tons per hectare [3]. This is caused by the lack of appropriate technical innovations in maintaining soil fertility, such as the inappropriate use of the types and dosages of the fertilizers. Moreover, farmers tend to compensate soil fertility losses by increasing the use of inorganic fertilizers, which has negative impacts on the long-term paddy land productivity [4]. Therefore, new efforts to increase the rice production through
the dissemination of sustainable soil fertility innovations are required. Ecological intensification is regarded as suitable long-term strategy that combines productivity increase with sustainable use of resources. The use of organic materials are required as a source of fertilizer. Organic fertilizers develop through the decomposition of organic materials broken down by microbes. They function as a buffer of physical, chemical, and biological soil properties that are required to increase fertilizer efficiency and land productivity [5].

Green fertilizer technologies using Azolla pinnata, straw and Tithonia diversifolia [1] produce nutrients, particularly Nitrogen (N) during the decomposition process. N nutrients have the biggest influence on vegetative plant growth [6]. The plants’ demand for N is highest compared to other nutrients. N can also become a limiting factor for crop productivity when its availability is low in the soil. N deficiency results in sub-optimal plant growth, while excess N causes plants to grow too fast making them susceptible to diseases. Moreover, N leaching due to excess use contaminates ground water with nitrate [4]. The Azolla plant is an aquatic pteridophyte which is symbiotic with the cyanobacteria Anabaena azollae that binds nitrogen from the air. Previous studies have shown that Azolla green fertilizer substitutes N fertilizer at 30 kg N/ha [7]. An Azolla layer on the surface of paddy fields can save urea use of 50 to 100 kg/ha if Azolla propagates well in the field [8]. Furthermore, the application of Azolla compost at a dose of 6 t/ha resulted in the yield of 12.05 t/ha of paddy rice or increased the weight of grain production by 21% [9].

Through the symbiosis of the blue green algae which lives in the leaf cavity of the aquatic fern, the nutrient quality of the compost is high. Azolla contains high protein content between 24-30%. The essential amino acid content, especially lysine is 0.42% higher compared to corn, bran and broken rice concentrates [10]. At optimal conditions Azolla propagates with a daily growth rate of 35%. Azolla has the ability to reserve 25 kg - 30 kg N per hectare in 30 days [11].

Another suitable type of organic fertilizer is rice straw. Straw is the most abundant organic material from rice fields which is generally an unused by-product or burned after harvest. The application of straw compost provides the better effect on the nutrient uptake of N and K compared to the application of straw in form of dry stover or ash. Straw compost is high in organic carbon C [12]. When applying 5 t/ha straw compost with a 50% reduced N fertilizer dosage increased the soil microbial biomass C from 136 to 258 mg/ kg soil. It resulted in building up of soil organic C and N from 0.471% and 0.039% to 0.545% and 0.064%, respectively after three years of rice production. The fertilizer effect was comparable to the recommended dose of inorganic fertilizers [13].

Adding straw compost increases the soil organic matter content. By consistent use of straw compost soil fertility can be restored, which is an urgent requirement given that 70% of paddy soils in Indonesia have a low organic content of less than 1.5% [14]. Ecological intensification and increase of rice production should therefore also consider soil organic matter restoration by utilization of rice straw as compost [15].

Besides Azolla and rice straw, another new green fertilizer plant has been introduced, namely Tithonia diversifolia. This leguminous plant grows fast, is tolerant to high canopy density, with deep roots, is used as a barrier to erosion, and is a source of soil organic matter. Stems are high in lignin and suitable as firewood. The canopy when pruned can regrow quickly, biomass from pruning can be used as animal feed or returned to the field as green fertilizer. Tithonia has been used as a nutrient source of N and K by Kenyan farmers [16]. In contrast, even though it is a good source of organic matter, Tithonia is not widely used in Indonesia [17]. It is considered as weed and its usefulness as a source of nutrients is rather unknown [18-19]. The nutrient content of dried Tithonia leaves is 2.7-4.00% N [17, 20-21]; 0.35-0.38% P; 3.50-4.10% K; 0.59% Ca, and 0.27% Mg [17]. The stem and leaves can be used as fresh green fertilizer, liquid green fertilizer, or compost [22] and mulch [23]. The advantage of using Tithonia as organic material for soil improvement is the abundance of the biomass production, its wide adaptation to different agro-climatic zones and its ability to grow on marginal land. Tithonia also contains water-soluble compounds (sugar, amino acids, and some starches) and insoluble substances (pectin, protein and complex starch) and insoluble compounds (cellulose and lignin) [21].
In this study the effects of the three types of organic fertilizer, Tithonia, Azolla, and straw, on the growth of rice varieties in Tana Toraja was analysed.

2. Methodology
This research was carried out from May to September 2018 in Bua’tarrung village, Rembong District, Tana Toraja Regency, South Sulawesi Province as on-farm field experiment. The village is located at an altitude of 700 - 855 m above sea level. It has a wet tropical climate with an air humidity between 82-86%, and surface temperatures ranging from 15 -28 °C and an annual precipitation ranging from 1,500 - 3,500 mm/year. In a split-plot design three varieties were set as main plots, namely: Pare Ambo, Barri Rarang, and Inpago Unsoed 1. The type of organic fertilizer was set as sub-plots and consisted of three types, namely: farmers’ compost made from straw, Tithonia compost and Azolla compost. The treatments resulted in total of 9 treatment combinations and three repetitions resulting in 27 experimental units.

2.1. Preparation of the compost, liquid organic fertilizer, and bio-pesticides
Farmers’ compost was made from rice straw from the previous growing season, mixed with cow manure in a ratio of 1: 1 and by adding effective microorganisms (EM4). The mix then was fermented by covering it with plastic tarp until ready to use. Tithonia compost was prepared by mixing Tithonia leaves with straw, cow manure and Gliricidia sepium leaves in a ratio of 1: 1: 1 and fermented. For preparing Azolla compost, a nursery pond was set up in which Azolla (A. pinnata L.) propagated for 2 weeks. Subsequently, Azolla biomass was spread on the experimental plots before soil tillage was conducted. To allow for the decomposition process, compost was applied on the experimental plots one month before planting except for the Azolla compost that was applied two weeks before planting. A dosage of 10 t/ha was used for all three different compost types.

In addition to the application of compost, the rice plants were sprayed with liquid organic fertilizer. The liquid organic fertilizer was made by mixing 7 kg of Gliricidia sepium leaves, 5 kg coconut fiber, 5 kg banana weevil, 5 kg bamboo shoots, snails, 5 L rice washing water, 5 L old coconut water, 25 g shrimp paste, and 1 kg brown sugar in 10 L of water. This mix was stored in a container and left for fermentation one week. The liquid organic fertilizer was 15 times applied in the experimental plot by spraying in split doses in a concentration of 1: 5 once a week.

The pests were controlled for by bio-pesticides. The pesticide was made by mixing 0.5 kg tobacco leaves, 0.5 kg suren (Toona sureni (Blume) Merr.) leaves, 2.4 kg Gliricidia sepium leaves, 1.7 kg Tithonia leaves, 1.2 kg papaya leaves, and 2 kg bacl fruit (Aegle marmelos L.) fruits. All the ingredients were chopped and mixed in a container with water and filtered. The bio-pesticides were applied once a week on the trial plots.

2.2. Planting
Prior to planting, seeds were germinated in a nursery bed 20 days before planting for Pare Ambo and Barri Rarang varieties, while for Inpago Unsoed 1 the nursery was set up 10 days before planting. The planting was done according to the principles of the System of Rice Intensification (SRI) and combined with the jajar legowo 2:1 planting pattern system, i.e. the seedlings were planted at a spacing of 25 between and 12.5 cm within a row, and a row spacing of 50 cm after every two consecutive rows. A minimum of water was applied during the vegetative growth stage with several intermittent drying periods of up to five days. Later, during generative growth, a thin water layer was maintained.

2.3. Data collection
Data were collected for each fertilizer treatment and each variety in three replications. For each of the 27 units, 15 rice plants were randomly selected for observation on growth and production parameters. The data were collected by research farmers which were leading in the research and were supported by the Motivator Kondorlan staff and visiting researchers from the university. In the growth stage, growth
parameters were observed fortnightly, and included plant height, number of tillers, and number of productive tillers per plant, flowering and harvest ages. The production parameters which were collected at the harvest age were the length of panicle, number of grains per panicle, the percentage of filled and empty grains, the weight of 1,000 grains and the yield per hectare.

2.4. Data analysis
For the treatments it was tested if the means of growth and production parameters were equal by running an analysis of variance (ANOVA). If there were significant differences of the treatment and the results not homogenous, then further tests were performed using a Least Significant Difference (LSD) test at $\alpha = 0.05$.

3. Results and discussion
The field study reveals that the growth and production parameters of the local Tana Toraja rice varieties and the introduced variety significantly differ from each other. However, for the compost treatment no significant effect could be observed for none of the parameters. The selected growth parameters are shown in table 1.

Table 1. Selected growth parameters of two local Toraja rice varieties and one introduced variety.

| Compost          | Varieties     | Mean     |
|------------------|---------------|----------|
|                  | Pare Ambo     | Barri Rarang | Inpag Unsoed1 |
| Plant height (cm)| 147.87        | 144.00   | 108.67        | 133.51 |
| Farmers’ compost | Tithonia compost | 166.93 | 160.80 | 119.40 | 149.04 |
| Azolla compost   | 160.07        | 154.13   | 104.62        | 139.61 |
| Mean             | 158.29a       | 152.98a  | 110.90b       |
| LSD$_{0.05}$     | 7.57          |          |               |
| Number of tillers per plant (stems plant$^{-1}$) | 13.07        | 22.73    | 16.93         | 17.58 |
| Farmers’ compost | Tithonia compost | 15.53  | 20.67 | 16.60 | 17.60 |
| Azolla compost   | 15.27         | 21.93    | 14.73         | 17.31 |
| Mean             | 14.62b        | 21.78a   | 16.09b        |
| LSD$_{0.05}$     | 1.96          |          |               |
| Number of productive tillers per plant (stems plant$^{-1}$) | 9.93         | 12.27    | 12.13         | 11.44 |
| Farmers’ compost | Tithonia compost | 10.47  | 10.47 | 10.73 | 10.56 |
| Azolla compost   | 12.40         | 13.07    | 10.60         | 12.02 |
| Mean             | 10.93         | 11.94    | 11.15         |
| LSD$_{0.05}$     | Not significant |          |               |
| Flowering age (DAP) | 96.00         | 102.33   | 77.67         | 92.00 |
| Farmers’ compost | Tithonia compost | 98.67  | 102.33 | 77.33 | 92.78 |
| Azolla compost   | 97.33         | 102.33   | 78.67         | 92.78 |
| Mean             | 97.33b        | 102.33a  | 77.89c        |
| LSD$_{0.05}$     | 0.73          |          |               |
| Harvest age (DAP) | 124.33        | 130.33   | 105.67        | 120.11 |
| Farmers’ compost | Tithonia compost | 125.33 | 130.33 | 105.33 | 120.33 |
| Azolla compost   | 125.00        | 130.33   | 106.33        | 120.56 |
| Mean             | 124.89b       | 130.33a  | 105.78c       |
| LSD$_{0.05}$     | 1.23          |          |               |
Numbers followed by the same letters in the same row are not significantly different at the BNT\(0.05\). DAP = days after planting.

Table 1 indicates that most of the growth parameters significantly differ between the varieties. The two local rice varieties, Pare Ambo and Barri Rarang, have a higher plant height with a larger number of tillers and productive tillers compared to the introduced variety, Inpago Unsoed 1. In contrast to these parameters, the introduced variety had a much shorter growing period than the local varieties which was indicated by earlier flowering and harvest age. The local rice varieties of Tana Toraja have a different physical appearance compared to the introduced varieties that have been developed by the plant breeding program carried out by the national research agency for the rice plant. The program aims at new rice varieties, that are generally shorter, can be harvested earlier and have a higher yield. Figure 1 illustrates the physical appearance of the three varieties in the experimental plot, which clearly shows the shorter height of Inpago Unsoed 1 on picture C.

![Figure 1](image-url)

**Figure 1.** Physical appearance of Pare Ambo (A) and Barri Rarang (B), two local varieties of Tana Toraja rice, and introduced Inpago Unsoed 1 (C).

Each variety has different genetic traits that affect the growth performance of the plant [24]. For the plant height parameter, the two local varieties did not show any significant difference, but both are almost a half meter taller compared to the introduced one (table 1). Plant height is one of the growth parameters that is strongly influenced by the genetic traits [25]. In contrast, the number of tillers of the newly introduced Inpago Unsoed 1 variety did not significantly differ from the local variety Pare Ambo. The local variety Barri Rarang had a significant different higher number of tillers.

On the other hand, no significant differences were found between the varieties with regard to the number of productive tillers. This parameter depends not only on genetic traits but is highly affected by environmental factors during the plant growth. According to Krismawati and Arifin [26], plant performance in the number of productive tillers are affected by the interaction between genotypes and environmental factors. Therefore, the parameter may alter depending on the adaptation of different varieties to the growing conditions. Generally, it is assumed that local varieties that have been cultivated for generations by farmers in their local community, are better adapted to the climatic and environmental conditions of the region compared to the introduced varieties [27]. More specifically, unfavourable growing conditions such as the lack of available nutrients in the soil can affect the number of (productive) tillers. The availability of sufficient N during tiller formation affects the number of tillers formed. In fact, the number of tillers formed is almost always proportional to the availability of nitrogen in the soil during tiller formation [28].

Related to the growth period parameters Inpago Unsoed 1 variety was harvested after 106 days. With less than 78 days it had the earliest flowering age and was significantly shorter than the local varieties of Pare Ambo and Barri Rarang, which were harvested 19 days and 25 days after Inpago Unsoed 1. Planting systems that flower earlier will also harvest earlier, both parameters are highly positively correlated [29]. The flowering phase for most rice varieties in tropical regions is generally 35 days and the maturation phase is 30 days [30]. A remarkable finding in this study is that the local rice varieties on the experimental plots were harvested much earlier (after 124 or 133 days after planting).
respectively) than the local varieties that have been planted in the farmers’ field nearby. In the farmers' fields, the local variety of Pare Ambo was harvested at an average age of 160 DAP or 36 days later. The trial result is a relative advantage for farmers. A shorter growth period reduces the probability of harvest losses due to weather-related risks. The shorter growth period can be mainly attributed to the legowo planting pattern combined with the System of Rice Intensification (SRI) which was used in the trial. The intermittent water conditions improve growth conditions, and the land was mainly inundated, when rats attack the field or when the plant showed signs of water shortage. After inundation, it was dried again on the following day. Under this intermittent water conditions, the plants were exposed to a mild water stress. This stress can stimulate earlier flower initiation and therefore shorten the growing period known as plant avoidance mechanism to drought [31].

Table 2. Selected production parameters of two local Toraja rice varieties and one introduced variety.

| Compost          | Varieties          | Length of panicle (cm) | Number of grain per panicle (grain) | Percentage of filled grain (%) | Percentage of empty grain (%) | Weight of 1000 grain (g) | Production per hectare (ton ha⁻¹) |
|------------------|--------------------|------------------------|-------------------------------------|-------------------------------|-------------------------------|--------------------------|----------------------------------|
|                  | Pare Ambo          | Barri Rarang           | Inpago                              |                               |                               |                          |                                  |
| Farmers’ compost | 25.31              | 20.70                  | 22.82                               | 84.49                         | 97.22                         | 120.13                   | 3.30                             |
| Tithonia compost | 25.47              | 21.98                  | 22.73                               | 109.04                        | 124.33                        | 105.18                   | 3.80                             |
| Azolla compost   | 25.91              | 21.62                  | 22.53                               | 101.24                        | 107.67                        | 106.69                   | 4.15                             |
| Mean             | 25.56a             | 21.43b                 | 22.70b                              | 98.26                         | 109.74                        | 110.67                   | 3.75                             |
| LSD0.05          | 1.08               |                        |                                     |                               |                               |                          | 8.41                             |
| Farmers’ compost | 80.52              | 59.36                  | 43.34                               | 80.52                         | 59.36                         | 43.34                    | 19.48                            |
| Tithonia compost | 84.95              | 58.97                  | 48.73                               | 84.95                         | 58.97                         | 48.73                    | 15.05                            |
| Azolla compost   | 84.30              | 60.82                  | 49.18                               | 84.30                         | 60.82                         | 49.18                    | 15.70                            |
| Mean             | 83.26              | 59.72                  | 47.08                               | 83.26                         | 59.72                         | 47.08                    | 16.74b                           |
| LSD0.05          | Not significant    |                        |                                     |                               |                               |                          | 8.41                             |
| Farmers’ compost | 19.48              | 18.96                  | 46.84                               | 19.48                         | 18.96                         | 46.84                    | 3.30                             |
| Tithonia compost | 15.05              | 17.34                  | 30.02                               | 15.05                         | 17.34                         | 30.02                    | 3.80                             |
| Azolla compost   | 15.70              | 14.11                  | 26.18                               | 15.70                         | 14.11                         | 26.18                    | 4.15                             |
| Mean             | 16.74b             | 16.80b                 | 34.35a                              | 16.74b                        | 16.80b                        | 34.35a                   | 4.29                             |
| LSD0.05          | 8.41               |                        |                                     |                               |                               |                          |                                  |
| Farmers’ compost | 24.84              | 25.87                  | 25.14                               | 24.84                         | 25.87                         | 25.14                    | 3.30                             |
| Tithonia compost | 23.97              | 25.52                  | 26.42                               | 23.97                         | 25.52                         | 26.42                    | 3.80                             |
| Azolla compost   | 24.67              | 26.61                  | 25.87                               | 24.67                         | 26.61                         | 25.87                    | 4.15                             |
| Mean             | 24.49b             | 26.00a                 | 25.81a                              | 24.49b                        | 26.00a                        | 25.81a                   | 4.29                             |
| LSD0.05          | 0.91               |                        |                                     |                               |                               |                          |                                  |
| Farmers’ compost | 3.30               | 4.87                   | 4.18                                | 3.30                          | 4.87                          | 4.18                     | 3.75                             |
| Tithonia compost | 3.80               | 4.73                   | 4.65                                | 3.80                          | 4.73                          | 4.65                     | 4.79                             |
| Azolla compost   | 4.15               | 4.78                   | 3.94                                | 4.15                          | 4.78                          | 3.94                     | 4.26                             |
| Mean             | 3.75               | 4.79                   | 4.26                                | 3.75                          | 4.79                          | 4.26                     |                                  |
Similarly, the ANOVA test of the production parameters shows that there was no significant effect of the various compost treatments on production. In fact, no differences were found for most of the tested parameters, which are the number of grains per panicle, the percentage of filled grains, and the production per hectare (table 2). On the other hand, the table also illustrates that three parameters significantly varied between the varieties, which are the length of panicle, the proportion of empty unhulled grain and the 1,000-grain weight.

The panicle length is an important variable for determining productivity. The longer the panicle, the greater the chance of the plant to form the number of grain per panicle [32]. This study reveals that the Pare Ambo variety has the longest panicle length of 25.56 cm which is significantly different from the Barri Rarang variety with an average panicle length of 21.43 cm and the Inpago variety with an average panicle length of 22.70 cm. According to Sirappa et al. [33], the panicle length is influenced by both, the genetic factors of the variety and the adaptability of the variety to the plant growing environment.

The two parameters panicle length and number of grain per panicle did not show a positive correlation, which means that the plant with the longest panicle was not necessarily producing the highest number of grains per panicle. The parameter grain density per panicle turns out to be more important than the panicle length [34]. If the grain is more closely attached to the panicle, the number of grains per panicle increase. This study shows that the Inpago Unsoed 1 variety had with 110.67 grains the highest number of grains per panicle compared to Barri Rarang variety with 109.74 and Pare Ambo with 98.25 grains, respectively.

While having the highest grain density, the Inpago variety had with 34.35% the highest average percentage of empty unhulled grains. This is more than twice as much as for the local varieties, which had 16.74 and 16.80% empty grains, respectively. Adverse environmental factors during the grain filling phase, such as pest disruptions, highly determine the occurrence of empty grains. The distinct aroma of Inpago rice variety may have caused an increased pest infestation. The highest pest attack risk occurs at the stage of grain maturity [35]. One of major rice pests which causes the high proportion of empty grains is the infestation with rice bug (Leptocorisa acuta Thunberg) by sucking out the contents of developing rice grains.

The size of the grain is major factor that influences the 1,000-grain weight. Larger grains are heavier and contain more endosperm and a larger embryo size [36]. The grain size is genetically determined [37]. Some multiple genes are known to control this agronomical important trait [38]. The results show that the Barri Rarang variety had a higher 1,000-grain weight of 26.9 g compared to Pare Ambo and Inpago varieties which had an average weight of 24.49 and 25.81 g, respectively.

In this study, there was no significant effect of the compost treatment on all parameters of growth and production in all rice varieties. Nevertheless, the use of Tithonia and Azolla organic fertilizers tend to result in better growth and production parameter values compared to the use of farmers’ style organic fertilizer with straw-manure only. The plant response on the use of Tithonia and Azolla compost was more evident for the production parameters. Plants applied with Tithonia organic fertilizer showed slightly increased plant height, more number of tillers per plant, longer panicle, and higher grain number per panicle, while the application of Azolla fertilizer resulted in higher productive tillers per plant, higher percentage of filled unhulled grain, lower percentage of empty unhulled grain and higher weight of 1,000-grain.

The insignificant effect of the application of various types of organic fertilizer might be due to the nature of the organic fertilizer itself which requires longer time to decompose in the soil. The Azolla compost was incorporated in its fresh form into the soil which does not allow an immediate utilization of the nutrients for plant growth. This also applied for the farmers’ compost with rice straw as main material for compost which was freshly applied to the soil. The properties of rice straw with higher C/N ratio caused a longer-lasting decomposition process. Generally, the speed of nutrient absorption
by plants is slower than the nutrient absorption of inorganic fertilizers. According to Pranata (2010), one other constraint of organic fertilizers in the solid forms are the required large quantities [39]. A constraint for farmers are the expensive or cumbersome transport costs for fertilizer application. The rice straw residue, however, when incorporated in the soil as straw compost, does not cause transport costs and the utilization of 2.5 to 5 t/ha of composted straw would ameliorate the soil organic carbon by 20% annually [14]. After three years a so-called sick soil with organic carbon of less than 1.5% could be restored to 2.0-2.5% organic carbon.

Given the above, the effect of organic matter on soil quality and crop yield will be only become evident after several years of continuous use. Yet long-term studies carried out in wetland and dryland land systems in different parts of the world regarding the continuous use of organic materials at affordable prices did not reveal a noticeable increase in yield compared to a well-managed system and balanced use of inorganic fertilizers [40]. The relatively low nutrient content of organic fertilizers could cause a suboptimal nutrient situation and influence crop productivity negatively. An undersupply of nitrogen negatively affects the formation of new cells, which can result in the cessation of plant growth and yield.

4. Conclusion
The results obtained from this study show that local Tana Toraja rice varieties can compete with the improved variety Inpago in terms of productivity and yield. The highest productivity was obtained by Barri Rarang variety with the farmers’ compost variant of a rice straw-manure mix with a yield 4.87 t/ha. One constraint of local varieties is the longer production period of up to three weeks longer than for the introduced variety. Farmers which depend on stable rainfall in the growing season may see this as an increased production risk to be overcome, particularly in the face of climate change, in which onset, decease of the rainy season as well as rainfall distribution becomes more unreliable. A positive observation was the reduction of the harvest age up to five weeks through the legowo 2:1 system with intermittent irrigation system compared to the traditional planting pattern with permanent inundation. As local rice varieties, particularly when produced in organic systems, enjoy great popularity on the markets and thus achieve good prices, it is recommended to conduct further studies on local varieties and how to optimize their production and growth traits through environmental factors. Planting patterns that follow the SRI principles should be investigated in farmers’ fields to gain evidence on the potentials of a faster flowering stage and hence harvest.

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