The Effect of The Levels of Liquid Organic Fertilizer from Traditional-Market Waste on The Production and Nutrient Contents of Setaria Grass

E Hendarto, Bahrnun and N Hidayat
Faculty of Animal Science, Jenderal Soedirman University, Purwokerto, Indonesia

E-mail: hendarto_e@yahoo.com

Abstract. Traditional-market waste liquid organic fertilizers can be used to fertilize setaria grass (Setaria splendida Stapf). This research was conducted to get information concerning the best dosage of liquid organic fertilizer utilization. An experimental method using Completely Randomized Design was applied in this study. The treatments were: 6 (six) doses of mixtures of the liquid organic fertilizer : water, of the ratios of 0:0, 1:1, 1:2, 1:3, 1:4, and 1:5, volume by volume, each of which was repeated 4 times. The land area used was 2 m x 1.5 m per plot (experimental unit). The variables measured were the dry matter (DM) concentration, DM production, crude protein (CP), crude fat (CFt), and crude fiber (CFb) contents. The data used were the results of the harvest at second defoliation. The results of the study showed that the doses of water in the fertilizer did not indicate any significant differences on all variables being studied. On the basis of the results, it is suggested that the addition of water into the fertilizer can be applied up to 5 folds the volume of the organic liquid fertilizer in the agronomy management of Setaria grass.

Keywords: liquid fertilizer, traditional market organic wastes, setaria grass, production.

1. Introduction
Ruminant farmings extremely need forages, whose quality is very important for the development of these farmings. The forages and their production will affect the animal performances [1]. Setaria grass (Setaria splendida Stapf) is one of grasses with a moderate amount of production and its quality is greatly good for the development of animal farmings [2].

The product of forage plants is forage that can be used to feed the ruminants, therefore, it functions to support the development of ruminant farmings [3]. As a feed, the forage consists of leaves and twights, which is the most nutritious parts of the forage plants [4].
One of important activities of forage management is fertilization. Some kinds of fertilizers have been used to support the growth and production of forage, including organic and anorganic fertilizers [5]. The examples of organic fertilizers are composts and liquid organic fertilizers [6]. Each of the two kinds of fertilizers has its own positive and negative characters according to its natural condition [7], in which the liquid fertilizer has its positive traits by its low chemically added materials [8]. There are two alternatives of the usages of liquid fertilizers, via root systems as well as via leaves [9]. One of the sources of liquid organic fertilizers is the organic wastes of traditional markets, whose amount is abundant and are available on all regions, sub-urbs as well as urbans areas. These facts suggest, no doubt that the continual availability of traditional market’s organic wastes always exist, therefore, every time the community needs them, they are available at all time.

The convertion of traditional market wastes into liquid organic fertilizer means that there is a hope of change from pollution potential into expectation potential of the organic market wastes, in order to support the sustainability of human existency and life. The usage of the liquid fertilizer via Setaria grass (*Setaria splendida* Stapf) management [10], will support the performances of the plant and environmentally save ruminant farmings [3] and can figure out about plant fertilization diversifications [11]. The performances of plants can be observed from their aspects of growth, fresh matter production, and the contents of their nutrients [12], including fresh matter production, the content and production of DM, and the contents of CP, CFt, and CFb [13], therefore, this study was purposed to investigate the effects of traditional-market-waste liquid organic fertilizer on the production potentials and quality of Setaria forage plant.

2. Methodology
A study of the fertilizer utilization management was conducted involving the traditional-market-waste liquid organic fertilizer and Setaria grass. The study used Completely Randomized Design, consisted of 6 (six) treatments and 4 (four) replicates in each treatment. The treatments were the applications of traditional market waste liquid organic fertilizer that was mixed with water of various concentrations, with the ratios of 0:0, 1:1, 1:2, 1:3, 1:4, and 1:5, volume by volume. Orthogonal polynomial was applied if there was a significant/highly significant differences between/among treatments. The liquid organic fertilizer being used contained 0.038 % total N, 81.748 mg/l P2O5, 0.134 % K2O, and C/N ratio of 0.92. Each plot of land had a size of 2 x 1.5 m². Work procedure included soil processing, planting, fertilizing, harvesting the first defoliation, fertilizing, and harvesting of the 2nd defoliation.

The fertilizations according to the dosages of treatment were conducted at the time the plants were14-day old after harvesting of the first defoliation, and at 50-d post 2nd defoliation the plants were cut again, 14 days later the plants were fertilized again according the treatment dosages, and 40 days later the plants were cut/defoliated, and weighed for DM content and production measurements. A hundred gram of DM/plot was sampled for measurements of the contents of CP, CFt, and CFb, respectively. The data were analysis of variances, continued by using the Honesty, and regression analysis for the doses of fertilizer.

3. Result and Discussion
The conditions of experimental site
The study was conducted at a field without tree canopy. The results of soil laboratory analysis showed that the soil content of Nitrogen was 49.35 ppm (very high), available P2O5 was 0.198 ppm (very low) and available K2O was 0.496 percent (fair). The texture class was sandy loam, containing sand fraction as much as 24.63 %, dust fraction of 9.15 % andclay of 66.22 %, with a soil pH of 5.61 (The Laboratory of Soil Science, Faculty of Agriculture, Jenderal Soedirman University, Indonesia).
On the basis of pH, the soil was acidic [13], however, on the basis of its mineral contents, especially its high N content, the soil fairly support the growth of grasses. According to [9] nitrogen is a macro mineral that highly required by plants. Related to the above condition, according to [15] and the land in this study is capable of supporting the growth of certain plants, including grasses [16]. Setaria (Setaria splendida Stapf) grass is able to grow under heavy condition of soils, therefore, better soil condition gave a more beneficial information of the study, especially in relation with the fertilization management [17].

The fresh matter production of setaria grass

Reports that organic liquid fertilizers made of the processed traditional market wastes represent natural resources as the results of human activities, have an added value of the disposed wastes [18]. Forage production represents an accumulation of the whole plant fractions, except the roots.

The grand mean value of fresh matter production of Setaria grass per square meter at the second defoliation was 2.809 kg, which meant that for each square meter, the production was 0.936 kg, equaled to 9,363 kg/ha/defoliation or 84,269 kg/ha/y from 9 times of defoliations. This figure was relatively high for Setaria grass of the second defoliation.

The control grass without fertilization showed the highest mean value of fresh matter production relative to those of other fertilization treatments. These figures showed that there was no effect of the levels of liquid organic fertilizer. The more the volume of water mixed with the fertilizer, the lower the content of N of the mixture per unit volume, therefore, no effect on the production of Setaria grass was detected. On the other hand, the soil content of N might be enough to support the growth requirement of the Setaria grass.

Table 1. Effect of traditional-market-waste liquid organic fertilizer on the productions and nutrient contents of Setaria grass at the second defoliation

| Treatment | Fresh matter (FM) production (kg/3m²) | DM content (%) | DM production (kg/3m²) | CP content (%) | CFt content (%) | CFb content (%) |
|-----------|----------------------------------------|----------------|------------------------|---------------|----------------|----------------|
| S-0 = without fertilizer | 2.856<sup>a</sup> | 14.67<sup>b</sup> | 0.4186<sup>c</sup> | 5.18<sup>d</sup> | 1.07<sup>e</sup> | 25.97<sup>f</sup> |
| S-1 = mixture 1 | 2.780<sup>a</sup> | 14.58<sup>b</sup> | 0.4044<sup>c</sup> | 5.45<sup>d</sup> | 2.27<sup>e</sup> | 25.58<sup>f</sup> |
| S-2 = mixture 2 | 2.800<sup>a</sup> | 15.41<sup>b</sup> | 0.4316<sup>c</sup> | 5.57<sup>d</sup> | 2.17<sup>e</sup> | 30.27<sup>f</sup> |
| S-3 = mixture 3 | 2.828<sup>a</sup> | 15.39<sup>b</sup> | 0.4348<sup>c</sup> | 5.51<sup>d</sup> | 2.65<sup>e</sup> | 25.71<sup>f</sup> |
| S-4 = mixture 4 | 2.756<sup>a</sup> | 15.44<sup>b</sup> | 0.4309<sup>c</sup> | 5.45<sup>d</sup> | 2.65<sup>e</sup> | 21.99<sup>f</sup> |
| S-5 = mixture 5 | 2.832<sup>a</sup> | 14.45<sup>b</sup> | 0.4124<sup>c</sup> | 5.74<sup>d</sup> | 2.27<sup>e</sup> | 30.87<sup>f</sup> |
| Mean value | 2.809 | 14.99 | 0.4221 | 5.48 | 2.18 | 26.72 |

Note: The laboratory of Nutrition and Feedstuff, Faculty of Animal Science, Unsoed. S-1: ratio of 1:1, S-2: ratio of 1:2, S-3: ratio of 1:3, S-4: ratio of 1:4, S-5: ratio of 1:5. Similar superscripts in the same columns showed similar values (P > 0.05).

That the N is able to enhance the growth and production of plants. The analysis of variances also showed that there was no significant effect (P > 0.05) of treatments on the fresh matter production of Setaria grass [5] and [2].

Dry matter content of setaria grass

The mean value of DM content of Setaria grass in Table 1 showed a high number, 14.99%. Stated that DM content of Setaria grass was 13.95% [2] and [17]. The content of DM does not extremely affected by environmental factors [19]. It was added that the effect of environment for instance sun
light (solar energy) does not significantly affect the initial growth of plant which influences DM content of the plant [20]. Liquid fertilizers that have some superiorities one of which is the easily absorbed nutrients due to their ready-to-use mineral compounds in the fertilizers were assumed to trigger the greater absorption of minerals [21] and [22], therefore in addition to the greater absorption of minerals from the soil and the fertilizer, the results of photosynthesis also trigger the absorption of those minerals, as to result the dumping of DM [23]. The lower the contents of N in the fertilizer-water mixtures [18], which then, was assumed to affect the contents of DM.

Table 1 showed, DM contents among treatments were not significantly different. A study by [19] also showed, different levels of N in a fertilizer that were applied to millet did not show any significant differences in DM contents. [24] and [25] reported, that the content of DM affects DM production of forage, mean while DM represents substrate that will be used and to be metabolized in the body of animals [19] and [26]. There are CP, CFT, CFb and other simpler carbohydrates, vitamins, minerals, and other trace compounds in DM.

**Dry matter production of setaria grass**

The production of forage DM is affected by the amount of FM production and DM content of the forage. It is mentioned by [27], the greater the numbers of FM production and DM content, the greater the production of DM. Table 1 shows that the mean value of Setaria DM production was 0.4221 kg/3m$^2$/defoliation (1407 kg/ha/defoliation), or 12,663 kg/ha/year from 9 defoliations.

On the basis of the mean value, a 300-kg cattle which requires 9 kg of forage DM/day, a ha of land that is cultivated with Setaria grass is able to support 3.7 or 4 heads of cattle, which is in line with the statement of [28] and [27], that cattle is able to consume a hundred percentage of its feed in the form of forage. It is added by [27] the forage in the form of grass will be better if it was added with leguminous forage, such as beans. Basically, Setaria grass (*Setaria splendida* Stapf) has amoderate texture, therefore, it is more targetted to be fed to the small ruminants such as goat and sheep [29] with a greater number of goat or sheep per ha of land, relative to those of cattle. Table 1 shows that the highest FM production was that of control tratment (no fertilizer), however, the highest DM production was that of fertilizer: water ratio of 1 : 3, althought DM content of this treatment was not the highest. These facts showed that there are relationships among FM production, DM content, and DM production, which is in line with the statement of [19] that the amount of DM production depends on the content of DM and FM production.

The analysis of variances and differences test showed, there was no significant differences among the treatments on DM production of Setaria grass. These facts resulted in a temporary conclusion that all treatments in this study can be applied. The ratio of 1:3 (fertilizer to water) can be applied, which resulted in moderately high values of means of variables being studied [18]. It is supported that in the management of plants [6], the efficiency aspect of commodity utilization must be taken into account, especially in term of fertilization viewed from some numbers of considerations [30].

**Crude protein content of setaria**

The mean value of CP content of Setaria (*Setaria splendida* Stapf) in Table 1 was 5.48 % (DM basis), which was classified into low value. That in general, the content of CP of Setaria grass was 8.82 % [17]. This was assumed to be due to the low content of N in the applied fertilizer that support the plant growth. This case was in line with the study concludes that fertilizers N is useful to support the growth and production of plants, including plants CP [31].

The results of anova showed that the treatments had no significant effect on the CP content of Setaria grass which indicated that all treatments in this study can be applied in the field for Setaria grass, especially in relation with its CP content. However, the 1: 3 ratio of fertilizer to water was suggested in relation with efficiency and the quality of the fertilizer, because more diluent the
The lower the fertilizer quality. In line with this case, the fertilizer quality is more principal in relation with the aspects of growth and production of forage plants [32].

**Crude fat content of setaria**

The mean value of CFt content of Setaria (*Setaria splendida* Stapf) in Table 1 was 2.18 % (DM basis), which was classified into very high value. That in general, the content of CFt of Setaria grass was 1.48 % [17].

Table 1 shows that the highest value of CFt content was that from the 1:3 and 1:4 ratios of fertilizer to water, and the lowest was that of fertilizer without water addition. This fact shows that the additions of water resulted in higher CFt contents of Setaria grass, even higher than 2 folds, which is contradictory with the idea of [33] that the lower dosages of fertilizer resulted in lower mineral contents, which in turn, decreased the responses of the given plants, namely carrot.

The anova showed that the treatments and the doses of water in the water-fertilizer mixtures did not give any effect on the CFt contents of Setaria grass, which indicated that basically all fertilization treatments of this study can be applied to fertilize Setaria grass. However, on the basis of the data in Table 1, the treatment of traditional-market–waste liquid organic fertilizer would be better to be used in the ratios of 1:3 up to 1:4, fertilizer to water.

**Crude fiber content of setaria**

The mean value of CFb content of *Setaria splendida* Stapf in Table 1 was 26.72 % (DM basis), which was classified into low value, which was assumed to be due to the low N content in the fertilizers. The content of CFb of Setaria grass was 31.75 % [17].

Table 1 shows that the highest value of CFb content was that from the 1:2 ratio of fertilizer to water, and the lowest was that of fertilizer-water with 4 folds of water addition. These facts are not in line with those of [6], [7] and [31] that dilutions of fertilizers decrease the contents of minerals in the liquid fertilizers which in turn, decrease the growth and nutrient contents of the given forage.

The anova showed that the treatments and the doses of water up to 5 folds the volume of concentrated liquid organic fertilizer in the fertilizer-water mixtures did not give any effect on the CFb contents of Setaria (*Setaria splendida* Stapf). However, on the basis of the data in Table 1 and the efficiency considerations, the treatment of traditional-market-waste liquid organic fertilizer would be better to be used in the fertilizer to water ratio of 1:3. Study says that the decrease in mineral content due to dilutions resulted in the decrease of plant growth [8].

Traditional-market–organic wastes represent the sources of pollutants especially of urban societies as a result of human culture in the form of market, however, they are basically abundant natural resources that are useful for human life. They can be converted into liquid organic fertilizers that can be used in the management of plants, therefore, they have economic values that support human life.

4. Conclusion

On the basis of the discussion, the conclusion is, the production and quality of Setaria (*Setaria splendida* Stapf) forage can be supported by the application of traditional-market-waste liquid organic fertilizer plus water as much as 5 times the volume of the fertilizer in order to increase the performances of ruminant animals.

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