Utilization of urine and weed of *Chromolaena odorata* as a basic materials for liquid fertilizer

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Abstract. In Indonesia, livestock urine is considered as waste, while weed of *Chromolaena odorata*, which are very toxic to ruminants is abundant in grassland area. These two materials have great potential to improve soil fertility because they can be made to organic fertilizer through fermentation. Fermentation of mixed urine, *Chromolaena*, and water with the proportion of 25:25:50% added with a small proportion of yeast tape, a liquid fertilizer produced with nutrient contents of N, P2O5, and K2O was 2.30, 0.32 and 0.15%, respectively. The research results showed that the application of liquid fertilizer significantly improved (P <0.01) the growth and biomass production of *Panicum maximum*, *Brachiaria decumbens* and *Pennisetum purpureum* whether *Panicum maximum* showed the best response.

1. Introduction
In the goat production system in Indonesia especially in South Sulawesi, farmers are commonly put stressing on kidding (goat meats). Usually, the farmers do not yet use livestock waste as feces and urine. While, if this waste is not properly utilized, it is potentially to cause the disease and pollute the surrounding environment [1]. Actually, goat urine as liquid waste is very potential to be utilized a liquid fertilizer because it contains nitrogen, phosphorus, and potassium [2]. A goat can produce urine about 7-0-16.9 g N liter−1 [3] and nitrogen, phosphorus and potassium concentrations about 21,8 lb/ton, 12,1 lb/ton and 23,6 lb/ton respectively [4]. Optimizing the use of organic fertilizer can improve the ecology of the environment as well as the economy of the farmer concerned [5, 6]. Therefore, it needs a serious handling method to be safe for the environment and should be a valuable thing for the farmer. In addition, pasture as an ecological base and forage source for ruminants has experienced a major problem, due to the rapid growth of *Chromolaena odorata*-weeds which is very difficult to be eradicated. *Chromolaena odorata* is a rapidly growing multi-stemmed shrub which can grow up to 2.5 m tall in open areas [7]. These weeds contain *pyrrolizidine alkaloids* as poison with the smell and bitter taste. If the ruminant consumes that weeds, the ruminant will be poisioning and die. Research [8] reported that some kacang goats feeding *Chromolaena odorata* weeds for one week period caused the goats die. Furthermore, allelopathic process influenced growth of grass plants.

Grasslands in South Sulawesi have been invaded by weeds. As a result, grazing ruminants are forced to consume weeds and poisoning, reduced capacity and complicated grazing management [9]. Therefore it is necessary to find the right solution to handling methods. So that the urine will not pollute the environment and weeds of *Chromolaena odorata* will be utilized as new useful product. One of the methods that can resolve both urine waste and *Chromolaena odorata* weeds is by converting those two materials into liquid organic fertilizer. By combining material waste and fermented yeast *tape*, a liquid-organic fertilizer can be produced which in turn could be utilized as a natural product for the marginal and pasture land. The aims of this research were to provide...
appropriate technology, to improve productivity land and highly fertile soils, furthermore, decrease the material waste for saving the environment, and also increase farmer's income.

2. Research methods

2.1. Production liquid-organic fertilizer
This research was conducted in Bulo Timoreng Village, Pancarijang, Sidrap District, South Sulawesi, Indonesia from February to May 2016. The urine is obtained from etawa goats fed on grasses as the basal feed. *Chromolaena odorata* weeds which were 4-6 months old were obtained from pasture. The weeds then cut into pieces and chopped along 3-4 cm length. About 15 liters of goat urine was added 25 kg *Chromolaena odorata*/50 liter water and 250 of yeast tape. The proportion of each material proportion was 25%: 25%: 50% (volume/mass/volume) and fermented for 21 days. The three-level liquid fertilizer was applied. Three species of grasses namely *Panicum maximum*, *Brachiaria decumbens*, and *Pennisetum purpureum cv Mott*. These grasses were planted in one-hectare area and given three treatments of liquid organic fertilizer namely; T0=Control, T1=20 liter/ha, T2=30 liter/ha and T3=40 liter/ha respectively. The chemical components of liquid-organic fertilizer are presented in Table 1;

| Chemical Component | Percentage |
|--------------------|------------|
| Nitrogen           | 2.30       |
| P2O5               | 0.32       |
| K2O                | 0.15       |

Source: Biochemical Laboratory, Faculty of Animal Science, Hasanuddin University, 2016

2.2. Statistic analysis
The research was arranged factorially. In a factorial experiment based on completely randomized design. The first factor consisted of 3 species of grass. The second factor consisted of different level of liquid organic fertilizer. The replication for each treatment combination was giving the total number of experimental unit of 27 [10]. Data were analyzed by analysis variances using SPSS 16 Software program. The significant effects of treatment were further analyzed using Duncan Multiple Range test. Parameters measured were plant height, number of tillers, leaf area, chlorophyll, and biomass production of grass.

3. Results and discussion

3.1. The component of grass growth
The components of grass growth after fertilization measured in this research were plant height, number of tillers, leaf area, leaf chlorophyll, and biomass production (table 2).

The treatment of liquid fertilizer significantly increased the height of both *Panicum maximum* and *Brachiaria decumbens* but no effect on that of *Pannicum maximum* (table 2) the height value was observed for T3 compared to other treatments. Moreover, the treatment of liquid fertilizer increased the number of tillers in both *Pannicum maximum* and *Brachiaria decumbens* but no effect on that of *Pannicum maximum*. However, the treatment of liquid fertilizer had no effect on the leaf area and chlorophyll. The results indicated that the content of different nitrogen on liquid organic fertilizers can increase the growth component (plant height, number of tillers, leaf area, and green leafy substance). Nitrogen is the main nutrient for plant growth which is necessary for the formation of vegetative parts of plants such as leaves, stems, and roots.
Table 2. The component of grass growth

| Grass Species          | Parameters           | Treatment |
|------------------------|----------------------|-----------|
|                        |                      | T0        | T1        | T2        | T3        |
| Panicum maximum        | Plant Height (cm)    | 176.86a   | 177.73a   | 184.66b   | 194.00c   |
|                        | Number of Tiller     | 4.66a     | 9.33b     | 10.00b    | 11.33b    |
|                        | Leaf Area (mm)       | 123.23a   | 141.57ab  | 166.36b   | 174.76b   |
|                        | Chlorophyll (unit)   | 30.53a    | 32.00a    | 37.00b    | 39.00b    |
| Brachiaria decumbens   | Plant Height (cm)    | 87.10a    | 110.60b   | 110.43b   | 126.93c   |
|                        | Number of Tiller     | 20.00a    | 24.00b    | 26.00b    | 26.00b    |
|                        | Leaf Area (mm)       | 38.33a    | 39.11a    | 45.41a    | 46.37a    |
|                        | Chlorophyll (unit)   | 34.40a    | 34.53a    | 34.76a    | 36.30a    |
| Pennisetum purpureum cv Mott | Plant Height (cm) | 71.06a    | 73.13a    | 76.43a    | 77.73a    |
|                        | Number of Tiller     | 5.66a     | 5.66a     | 6.33a     | 6.33a     |
|                        | Leaf Area (mm)       | 153.44a   | 143.42a   | 146.70a   | 188.97a   |
|                        | Chlorophyll (unit)   | 27.80a    | 35.26b    | 36.03b    | 36.96b    |

Nutrient needs for plants are not sufficient to obtain the optimal growth of the seedling. Nutrients are obtained by liquid organic fertilizer. Liquid fertilizers can be categorized as conventional mineral, organic, or organo-mineral [11] improving soil structure and enhance soil biological activity.

The results showed that the growth components of *Pennisetum purpureum, cv Mott* were not affected the application of liquid fertilizer. This might be caused by that the absorption of parts of *Pennisetum purpureum, cv Mott* has not been optimal, especially the absorption of nutrients through the roots because the time required in absorption is still short and another factor may be related to the frequency of fertilizer application which is only given once. If it is done twice, the results may better.

3.2. The biomass production content of grass
The Biomass production measured on the three species of grass is presented in table 3;

Table 3. The Biomass Production Content of Grass

| Grass Species          | Treatments |
|------------------------|------------|
|                        | T0         | T1         | T2         | T3         |
| Panicum maximum        | 9360c      | 12060c     | 20790c     | 17820c     |
| Brachiaria decumbens   | 19080c     | 12420b     | 21600c     | 19170c     |
| Pennisetum purpureum cv Mott | 17820a     | 16560a     | 24300b     | 20150c     |

Description: T0 (Control) T1 (20% of fertilizing level), T2 (30% of fertilizing level), T3 (40% of fertilizing level). Means sharing different superscript in the same column was significantly different (P<0.01).

Table 3 showed that the highest biomass production of *Panicum maximum* and *Brachiaria decumbens* was obtained for the T2 and T3 while the highest biomass production content of *Pennisetum purpureum, cv Mott* was observed for the treatment T3. The result was influenced by nitrogen content in liquid organic fertilizer. N fertilization was more important for biomass production [12]. Biomass production and roots are the primary connection between soil and soil water to plants [7,13]. Plant biomass production positively responds to annual precipitation [14] and the seasonal precipitation pattern is a key factor in determining perennial grass establishment and biomass yield [15,16].
4. Conclusions
Based on the results and discussion, it can be concluded that the three species of tropical grass in marginal land response differently to the application of liquid organic fertilizer. The higher the level of fertilizer, the higher the growth and productivity of the grass. Application of liquid organic fertilizer increases the productivity of the marginal grazing land. Among the grasses, the one which is very responsive to the application of liquid organic fertilizer in terms of growth is the *Brachiaria decumbens* grass.

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