Concentration of sheep urine solution as watering media and organic fertilizer to production of corn fodder (*Zea mays*) by Hydroponic system

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Abstract. The purpose of this study was to determine the concentration of urine solution as a watering medium and organic fertilizer on the productivity of hydroponic corn fodder. The research materials were corn, sheep urine, and water, while the method used was field experiments. The treatments, namely T0 (0% urine), T1 (5% urine), T2, (10% urine), T3 (15% urine), T4 (20% urine). The variables were the percentage of germination, percentage of normal sprouts, number of leaves, plant height, fresh production and dry matter production. The data obtained were analyzed using analysis of variance, if there is an effect, then continue with the LSD test. The results showed that the treatments had a very significant effect (P <0.01) on the percentage of germination, percentage of normal germination, number of leaves, plant height, fresh production, and dry matter production. The highest germination percentage was found in T1 (91.60%), normal germination percentage T1 (86.78%), number of leaves T1 (3.0), plant height T0 (31.6 cm), forage production T1 (646.6 grams), dry matter production T1 (568.41 grams). Based on the results, it was concluded that watering with 5% concentration of sheep urine solution gave the best value for the productivity of hydroponic corn fodder.

1. Introduction

The problem in developing ruminants is the difficulty of forage availability, especially during the dry season. This can cause a decline in livestock productivity and many farmers sell their livestock at a price that is relatively cheaper than the rainy season. One way that can be used as a solution to maintain feed production with minimal soil or land conditions is through hydroponic media. Hydroponics is a way of planting without using soil media. Soil media can be replaced with water, gravel or even charcoal can be used as a hydroponic medium. Hydroponics has many advantages, among others, it does not require too much space, maintenance is not too complicated and the possibility of pest disturbance is less.

Hydroponics can be used as an alternative technology for producing forage feed. Hydroponic fodder has advantages, does not require soil media, does not require large areas of land and has high nutrient content, namely protein content reaching 22.6% [1]. The hydroponic system does not depend on the season so that plants can be planted throughout the year and can be planted in narrow and less fertile land, making it possible to get very good crop yields [2]. But in its application, hydroponics also still requires fertilization to get optimal results. One of the efforts to fulfill these nutrients is by providing liquid organic fertilizer with urine solution.
Some research results show that there is a good effect on plants from the utilization of livestock urine. Giving cow urine with a concentration of 5% has an effect on the increase in the number of oil palm fronds, dry weight and nutrient uptake of N, P, K, Ca, and Mg in oil palm seedlings [3]. Another study concerning the provision of fermented goat urine organic fertilizer with a concentration of 200 ml / l provided the best vegetative growth in pepper [4]. The use of soil media and coffee husk compost with a ratio of 2: 1 or 3: 1 and giving rabbit urine gave the best effect on plant height, stem diameter and number of leaves of coffee plants, and the use of soil media and leaf compost (3: 1) with urine rabbits [5]. The use of several types of animal urine as liquid organic fertilizer with different concentrations of oil palm (*Elaeis guineensis* Jacq.) In the main nursery has the best effect on root volume and leaf area [6]. Based on this, research is needed on the effect of different concentrations of sheep urine solutions as watering media and organic fertilizers on the productivity of corn fodder (*Zea mays*) with a hydroponic system.

2. Methods
The research method used was a field experiment using a completely randomized design (CRD) with 5 treatments and 5 replications. If it shows a real effect, it will continue with the LSD test. The treatments carried out are: T0 = Watering with control water, T1 = Watering with a 5% concentration of sheep urine solution, T2 = Watering with a 10% concentration of sheep urine solution, T3 = Watering with a 15% concentration of sheep urine solution, T4 = Watering with a 20% concentration of sheep urine solution.

The variables observed in this study were the percentage of germination, percentage of normal sprouts, number of leaves, plant height, production of fresh forage, and production of dry matter. The data obtained were analyzed using analysis of variance, if there were differences, a further test was carried out using the LSD test.

3. Results and discussion
Based on the results of research on the concentration of sheep urine solution as a watering medium and organic fertilizer, it was shown that there was a very significant effect (P < 0.01) on the percentage of germination, the percentage of normal sprouts, number of leaves, plant height, fresh production, and dry matter production. The average results of the study are presented in Table 1.

| Treatment | Germination Percentage (%) | Normal Germination Percentage (%) | Number of leaves | Plant height (cm) | Fresh production (g) | Dry Matter Production (g) |
|-----------|----------------------------|----------------------------------|-----------------|------------------|----------------------|-------------------------|
| T0        | 64.5±8.22^a                | 81.2±6.73^b                     | 3.0±0.00^b      | 31.64±2.30^b     | 467.4±54.17^b        | 418.51±48.51^c          |
| T1        | 91.60±7.40^b               | 86.78±6.06^b                    | 3.0±0.01^b      | 29.84±4.82^b     | 646.6±67.37^d        | 568.41±72.50^c          |
| T2        | 85.20±9.55^b               | 76.07±4.16^a                    | 2.8±0.45^a      | 27.44±3.34^b     | 577.6±46.88^c        | 548.62±26.77^c          |
| T3        | 73.92±8.88^a               | 75.80±3.06^a                    | 2.4±0.55^a      | 18.44±4.62^a     | 548.8±47.10^c        | 451.74±74.30^b          |
| T4        | 69.58±7.75^a               | 73.65±4.46^a                    | 2.2±0.45^a      | 16.64±3.97^a     | 363.4±52.18^a        | 332.8±17.26^a           |

3.1. Germination percentage (%)
Based on the results of analysis of variance, it showed that the effect of different concentrations of sheep urine solutions as watering media and organic fertilizer on the productivity of corn fodder had a very significant effect (P < 0.01) on the percentage of germination. The highest germination percentage was found at (P1) at a concentration of 5% with an average value of 91.60% and very significantly different from (P2) at a concentration of 10% with an average value of 85.20%, and the lowest percentage of germination at (P0) with 100 % water without sheep urine with an average value of 64.56%. This is because the treatment (P1) has media moisture and the nutrients needed by the plant are fulfilled, the planting medium that is too much water (poor drainage) and too moist can cause the plant to not absorb nutrients properly, inhibition of growth and root development can inhibit absorption of nutrients [6].
The germination success rate can be increased by various treatments before planting, the treatment that is often used is immersion to stimulate root growth with various immersion times that vary according to the dose and type of plant [7]. The minimum germination percentage requirement for plant cultivation is 80% [4].

3.2. Percentage of normal sprouts
Based on the results of analysis of variance, it showed that the effect of different concentrations of sheep urine solution as watering media and organic fertilizer on the productivity of corn fodder had a very significant effect (P < 0.01) on the percentage of normal sprouts. The highest percentage of normal sprouts was found at (P1) with a concentration of 5% with an average value of 86.78% which was quite different from (P2) 10% concentration with an average value of 76.07%, and the lowest percentage of germination at (P4) with 20% with an average value of 73.65%. Treatment (P1) is better because at (P1) more water needs and seed growth, because the percentage of germination in treatment (P1) is also good. The standard of normal sprouts is 70% and states that if the water needs in watering are not appropriate then the seed growth will be destructive or inhibit growth [8].

3.3. Number of leaves
Based on the analysis of variance, it showed that the concentration of different sheep urine solutions as watering media and organic fertilizers on the productivity of corn fodder had a very significant effect (P < 0.01) on the number of leaves. The highest number of leaves was found in treatment (P1) with an average number of leaves of 3.0, and the lowest number of leaves was in treatment (P4) with a concentration of 20% of sheep urine solution with an average of 2.2 strands. Differences in treatment and different concentrations at (P1-P4) had an effect on the number of leaves. The addition of sheep urine has an effect on the number of leaves, the highest number of leaves is found in concentration with the addition of sheep urine by 5%, this is seen from the average number of leaves in plants, because plants have a limit of nutrient absorption for their life. When giving a dose of liquid organic fertilizer from urine as much as 32 ml / polybag, the number of leaves does not increase because after the dose of liquid organic fertilizer from urine is increased, the plant will experience nutrient saturation so that the plant is unable to absorb nutrients optimally which results in a decrease in the number of leaves produced.

The application of high concentration fertilizers to a certain extent will cause increased yields, and at concentrations that exceed a certain limit will cause the yield to decrease and also the plants will grow well if the nutrients provided are in a balanced amount and in accordance with the needs of the plant [9]. At (P0) it has the same number of leaves on (P1) but the stem diameter (P0) is small even though the number of leaves is the same as (P1) this is due to the treatment using water alone, the number of leaves and stem height is quite high, otherwise This is the case with (P1) using a concentration of 5% urine and 95% water, the number of leaves on average is the same as (P0) but the stem diameter and other aspects are also good. This is because the concentration of sheep urine solution with a higher dose has a bad effect, such as the delay in the development of leaf release in plants on the height of the stem internodes in maize where the leaves are released, so that if the plant has a long stem size, the number of leaves of the plant is also more. much will be related to the process of plant assimilation [8].

3.4. Plant height
Based on the analysis of variance, it showed that the concentration of different sheep urine solutions as watering media and organic fertilizers on the productivity of corn fodder had a very significant effect (P < 0.01) on plant height. The highest average plant height was found in the treatment without using sheep urine solution at (P0) with a value of 31.6 cm and very significantly different from the lowest average value on plant height using the concentration of 20% sheep urine solution at (P4) with a value of 16.6 cm. Low plant height growth is caused by plants experiencing environmental stress (high nutrient temperature), so the plants do not grow optimally. Treatment (P0) has a higher stem height because at (P0) it does not use a sheep urine mixture so that water alone without the addition of sheep urine is a
factor why at (P0) the stems are higher than treatment using additional sheep urine. Therefore, nutrients are useful for stimulating plant growth, increasing node growth, resulting in an increase in plant height. Plants will grow well if they are encouraged by the application of nitrogen fertilizers to support their growth and development [9].

3.5. Fresh forage production
Based on the analysis of variance, it showed that the concentration of different sheep urine solutions as watering media and organic fertilizer on the productivity of corn fodder had a very significant effect (P <0.01) on fresh production. The highest average fresh plant production was found in the treatment using the concentration of 5% sheep urine solution (P1) with a value of 646.37g which was very significantly different in the treatment with a urine solution concentration of 20% in treatment (P4) with the lowest yield at an average of 363.4 g. Treatment (P1) has the highest value, it can be seen from the results of a high percentage of germination, the greater the percentage of germination, the higher the yield, the quality of the seeds in germination greatly affects production, the better the quality of the seeds, the better the results will be obtained.

The higher the sprouts / shoots on the plant, the higher the growth and effect on plant production, so that it can accelerate the cutting age (harvest) [10]. This result is also balanced with the percentage of normal sprouts that grow in treatment (P1) with a concentration of 5% giving a high value so that the production yield is also high. Higher plant viability will be able to produce greater sprouts dry weight [11]. Measuring the dry weight of sprouts is a more quantitative and objective measure. Plant growth and yield activities are influenced by the number of leaves as a place for photosynthetic activities to produce energy that will be needed for the plant growth process. In addition, the number of leaves is also related to plant height, because the higher the plant, the more leaves are formed [12]. Production Standard Fodder for corn produced from corn kernels as much as 713 grams can produce about 2 times as much fresh forage at the harvest age of 13 days [13]. Fodder from 1 kg of corn kernels planted with a hydroponic system can produce 6-10 kg of fresh forage for about 2 weeks [14].

3.6. Dry material production
Based on the analysis of variance, it showed that the concentration of different sheep urine solutions as watering media and organic fertilizer on the productivity of corn fodder had a very significant effect (P <0.01) on dry matter production. The highest average dry matter production was found in treatment with a concentration of 5% at (P1) with a value of 568.41g and very significantly different from the lowest average dry matter production found in treatment (P4) with a concentration of 20% sheep urine with a value of 332.88g. An increase in forage fresh production is accompanied by an increase in dry production [3]. Cutting age affects fresh production and dry production of a forage [15].

4. Conclusion
Based on the results of the research that has been done, it can be concluded that the concentration of adding 5% sheep urine as a watering medium and organic fertilizers can increase the productivity of corn fodder. The results of this study can be applied to the cultivation of fodder crops and agricultural crops. The use of organic fertilizers is recommended to be applied, because it does not cause residues in food or feed products.

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