The effect of different stem immersion duration on goat urine solution on success rate of elephant grass cuttings (*pennisetum purpureum*)

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Abstract. This research was aimed to determine the success rate of elephant grass cuttings (*Pennisetum purpureum*) with various durations on immersion stem cuttings in goat urine solution. The method used was field experimental using Completely Randomized Design with 5 treatments and 3 replications. The treatment used was P0 (without immersion), immersion on goat urine solution P1 (10 min), P2 (20 min), P3 (30 min), P4 (40 min). The variables observed in this research are the percentage of success rate, the quantity of root, the number of leaves, plant height and production quantity. The results showed that on elephant grass cuttings (*Pennisetum purpureum*) with various immersion times in goat urine gave highly significant effect (P<0.01) on the percentage of success rate and had a great influence (P<0.01) against the average quantity of roots. While on the results of observations on the number of leaves and plant height gave no significant effect (P>0.05) on the results of cuttings. Percentage of highest success rate on the treatment of P3 and P4 (97.78%), highest root quantity at P3 (38.33 cm). This research concluded that the treatment of immersion elephant grass stem for 30 minutes in goat urine solution can increase the success rate reaches 97.78%.

1. Introduction

Elephant grass (*Pennisetum purpureum*) is one of the grasses that are widely cultivated in Indonesia as ruminant feed because it has a high nutrient content such as dry matter 20.29%, crude protein 6.26%, fat 2.06%, fiber rough 32.60%, ash 9.12%, calcium 0.46%, and phosphorus 0.37%. Elephant grass including annual plants form clumps consisting of 20-50 stems with a diameter of approximately 2.3 cm. Grows upright and dense, the trunk is covered with hairy shields and deep roots. The stem height reaches 2-3 m, leaf width is 1.25-2.50 cm and length are 60-90 cm. This cultivar has the characteristics of the ratio of stem: leaves = 1:2, the number of tillers is very large, in 2 harvest times can reach 40-70 tillers per clump [1]. The cultivation of elephant grass carried out by farmers is still relatively traditional, so productivity is less optimal.

Crop productivity is affected by two factors, namely internal factors and external factors. Internal factors include genetics and hormones, while external factors include climate, nutrient content, water availability, and disease. Utilization of urine is one alternative in the fulfilment of nutrients and the addition of hormones as a growth driver.

Immersion of the stem in a solution of growth regulators aims to increase the hormone auxin levels that play a role in stimulating rooting. The effectiveness of growth regulators is related to concentration and soaking time. Concentration is the number of substances dissolved in a solution. The duration of
soaking determines the length of contact of the material with the solution, thus determining the amount of solution absorbed. According to Ardian and Murniati, elephant grass stem cuttings as one of the vegetative propagation plants, cuttings become an alternative that many people choose because the way is simple, does not require complicated techniques that can be done by anyone [2]. Cuttings often fail with no root growth. One effort to overcome failure in root growth in cuttings is to provide growth regulators (ZPT) [3].

Goat urine concentration is 20% good to get the growth of Jatropha plant cuttings. Soaking in goat urine can affect the percentage of cuttings that can be rooted. Based on the description above, it is necessary to do research on the power test of elephant grass cuttings with various duration of immersion in goat urine solution to stimulate the roots of elephant grass stems, the lower the concentration of hormones given, the longer the immersion will be. Whereas the more concentration of hormones given the longer the hormone immersion [4]. The results of Sarah et al soaking in goat urine concentration 100 ml / l affect the number of roots and leaves aged 15 HST on the growth of pepper cuttings (Piper nigrum L) [5]. The results of this study can be used as a method for treatment of stems before being planted on the land and can be applied by the community.

2. Materials and methods
The material used was elephant grass (Pennisetum purpureum) as much as 225 stems and 2 liters of goat urine. The method used in this study was a field experiment based on a Completely Randomized Design (CRD) consisting of 5 treatments and 3 replications. The total experiment was 15 units of experiment 1 unit of an experiment consisting of 15 rods in all 225 rods. The treatment consisted of control treatments without immersion and experimental treatment with various durations with a distance of each treatment 10 minutes soaking the cuttings of goat urine solution with a concentration of 20%, namely P1 (10 minutes), P2 (20 minutes), P3 (30 minutes) and P4 (40 minutes). The use of this concentration is adjusted to previous studies conducted by Setiawan (2017) the use of 20% goat urine mixture significantly affected the success rate of odot grass cuttings (Pennisetum purpureum cv meot).

Variables observed in this study include the percentage of success rate, average number of roots, number of leaves, plant height, fresh forage production. The data obtained were analyzed using the variance analysis method with the help of the SPSS for Windows application. If the results of the analysis show a difference in the treatment then proceed with the Duncan test.

3. Results and discussion
Based on the results of elephant grass cuttings (Pennisetum purpureum) with various durations of time soaking the stems in goat urine solution, showed that the treatment of soaking stems in the urine solution of goats had a very significant effect (P < 0.01) on the percentage of success rate and the average number of roots. Whereas in the results of observations on the number of leaves, plant height and yield gave no significant effect (P > 0.05). Research data can be seen in table 1.

| Treatment | The Success Rate (%) | Number of roots (pcs) | Number of leaves (pcs) | Plant height (cm) | Plant Production (Kg) |
|-----------|----------------------|-----------------------|------------------------|------------------|----------------------|
| P0 (control) | 73.3±6.67a | 22.9±2.23a | 46.8±2.38 | 79.5±1.74 | 1.61±0.08 |
| P1 (10") | 84.4±3.85ab | 31.0±0.16b | 45.15±1.54 | 79.29±1.68 | 1.43±0.11 |
| P2 (20") | 88.8±3.85bc | 31.44±2.80b | 42.50±6.35 | 79.83±0.84 | 1.54±0.28 |
| P3 (30") | 97.7±3.85c | 38.33±0.76c | 45.32±1.67 | 78.88±0.52 | 1.56±0.17 |
| P4 (40") | 97.7±3.85c | 37.00±0.14c | 43.91±2.49 | 78.71±0.73 | 1.71±0.13 |

P-value: (P<0.01) (P<0.01) (P>0.05) (P>0.05) (P>0.05)

Note: The different notation in the same column shows the effect of treatments.
3.1. Percentage of success rate

Based on the analysis of variance showed that the various lengths of time soaking the stem in the urine solution of goats gave a very real influence (P < 0.01) on the results of the percentage level of success, based on the results of the calculation of the average percentage of success rate shows that the lowest results reached the average (P0) 73.33%, and the highest yield is P3 (97.78%) and P4 (97.78%). This is because with soaking the stem, elephant grass cuttings will spur the growth of plant organs such as roots [2]. When compared with the previous research of Setiawan, the percentage of success rates shows the same trend as this study [6]. This is in accordance with the opinion of Sarah et al. that the success of the cuttings stage is the most important key at the time of pepper nursery (Piper nigrum L), the success rate of cuttings generally reaches 80% [5]. In this case, IBA (Indole Butyric Acid) at this concentration can optimize roots, so that the absorption of nutrients can be done optimally. Giving IBA as one synthetic types of auxin, proven to be able to increase rooting. Even from results obtained, it is known that IBA is more effective than IAA or synthetic auxin other [7]. The absorbed nutrients will then be used to support plant growth before the food reserves that are owned are exhausted. The control treatment, there is an average number and the lowest root length. Although in the stem cuttings there is auxin endogenous, the concentration of endogenous auxin contained in the plant is unable to accelerate root growth so that the nutrient uptake becomes low. Low nutrient uptake causes a lack of incoming nutrients to replace the depleted reserves so that the plants will die [8].

3.2. Number of roots

Based on the analysis of variance showed that the various lengths of time of soaking the stem in the urine solution of the goats had a very significant effect (P < 0.01) on the results of the number of roots. Based on the calculation of the average number of roots it was seen that the lowest yield reached an average of 22.92 pcs, and the highest yield reached 38.33 pcs. Percent percentage results data can be seen in table 1.

Based on the average treatment of P3 with soaking in goat urine solution for 30 minutes, the results of 38.33 pcs were the best treatment, this is because the goat urine contains hormones that can stimulate the development of roots in stem cuttings. This is in accordance with Sutedjo opinion that goat urine is a natural source of auxin, which contains auxin and cytokines [9]. Plant tissues consumed by goats contain auxin and cytokines. According to Nasution, limited animal urine can replace the phytohormone function needed to stimulate the burning of coffee cuttings [10]. Root development occurs because of the downward movement of auxin (substances that interact with auxin resulting in rooting), this substance will then stimulate the formation of root cuttings [11].

3.3. Number of leaves

Based on the analysis of variance showed that the various lengths of time soaking the stem in the urine solution of the goats had no significant effect (P > 0.05) on the results of the number of leaves. Based on the calculation of the average number of leaves it was seen that the lowest yield reached the average 42.50 (section), and the highest yield reached an average of 46.87, as seen in table 1.

No-different result shows that the treatment of soaking stem cuttings in goat urine solution has no effect on the number of leaves, this is due to the treatment of soaking stem cuttings in goat urine solution which aims to increase the concentration of hormones in the cuttings only focus on the development of roots. This is in line with the opinion of Irwanto, that root development occurs due to downward diffusion of hormones and food reserves to support root development, this substance will then stimulate the formation and development of cuttings roots [11].

Giving higher concentrations of hormones is not necessarily able to increase plant growth, but can also cause poisoning in plants. This is consistent with Kusuma statement which states that in applying hormones it is necessary to pay attention to dose determination because if the dose is too high instead of spurring plant growth, it inhibits plant growth and causes poisoning in all plant tissues [12].

The results of different leaf numbers in each experimental unit were due to the temperature in the study area which was quite cold, so that root growth was more spurred than leaf growth, this was also
stated by Wahyuningtyas that the optimal room temperature for cutting roots ranged between 21°C up to 27°C in the morning and afternoon and 15°C at night. Too high temperatures can encourage shoot development beyond the development of roots and increase the rate of transpiration. With the trend from a fluctuating graph, it shows that to trigger the growth of new shoots, stems, and forage production, fertilizer is needed, this is in accordance with Tampubolon opinion that plants need nutrients or nutrients during their growth so they can grow and develop properly [13]. Giving or adding nutrients to plants can be done through fertilization. Liquid organic fertilizer from goat urine fermentation contains elements of N, P, and K, where elements of N, P, and K are macronutrients for plants, apart from the presence of elements N, P, and K, liquid organic fertilizer from goat urine fermentation as well contains natural hormones group IAA (indole acetic acid), gibberellin and cytokines. Budi states that nitrogen plays a role in the process of growth, synthesis of amino acids, and proteins. Nitrogen as a form of chlorophyll structure, nitrogen will affect the green color of the leaves, this is consistent with Putra et al. opinion about the number of leaves can affect forage production, increase in leaf area and increase the height of this plant followed by an increase in total forage dry weight [14]. These results indicate that there is an increase in photosynthesis process with increasingly wide leaves so that the resulting dry weight is higher.

3.4. Plant height
Based on the analysis of variance showed that the various lengths of time soaking the stem in the urine solution of goats gave no significant effect (P > 0.05) on the average yield of the plant, based on the calculation of the average plant height, in the treatment of urine immersion P4 40 minutes showed that the lowest yield reached an average of 78.71 cm. In treating P2 the urine immersion was 20 minutes, the highest yield reached an average of 79.83 cm. Data on the percentage of plant height can be seen in table 1.

No-different result shows that the treatment of soaking stem cuttings in goat urine solution has no effect on plant height, this is presumably due to the treatment of soaking stem cuttings in goat urine solution which aims to increase hormone concentration in the stem cuttings until it triggers cuttings. This is in accordance with the opinion of Hidayat the production and quality of plants is a function of soil, climate, species, and management [15]. The chemical, physical and biological properties of the soil greatly affect the growth, yield, and quality of plants and this shows that plant height is more influenced by genetics and soil moisture. Hidayat et al. stated that the content of N, P, K and micronutrients elements in the formation of plant stems and leaves [15] and according to Aryanto and Polakitan said that the percentage of growth depends on the availability of nutrients in the soil [16]. A large number of available food reserves in the cuttings can be used by cuttings as an energy source for root formation so that the shoots can grow optimally where the stem diameter is cut. Directly proportional to the amount of food available. The absence of roots on the cuttings at the beginning of the planting forces the cuttings to utilize the reserve source from the stem. This is in accordance with Panjaitan literature which states that in large diameter stems the availability of food reserves is more than the smaller diameter [17]. This is supported by the literature of Hartmann et al. which states that generally getting away from the shoot, the stem diameter increases and the diameter difference directly affects the ability of cuttings to form roots and shoots because of differences in types and variability of carbohydrates and other stored materials [18].

3.5. Plant production
Based on the analysis of variance showed that the various lengths of time soaking the stem in the urine solution of the goat had a non-significant effect (P > 0.05) on the average plant production. Based on the calculation of the average height of the plant it was seen that the highest yield reached the average averaged 1.71 kg in the treatment of 40 minutes of P4 soaking urine, and the lowest yield reached an average of 1.43 kg in 10 minutes urine immersion treatment. Data on the percentage of production results can be seen in Table 1.
No-different result shows that the treatment of soaking stem cuttings in goat urine solution has no effect on production results, this is presumably due to the treatment of soaking stem cuttings in goat urine solution which aims to increase the concentration of hormones on the cutting stem not to trigger the growth and development of shoots or leaf.

The results of the relatively similar crop production in each unit of the experiment are also thought to be due to the temperature in the study area which is quite cold, so that root growth is more motivated than the growth and development of shoots and leaves. Rooting cuttings range from 21°C to 27°C in the morning and afternoon and 15°C at night. Too high temperatures can encourage shoot development beyond the development of roots and increase the rate of transpiration. The control treatment produces the lowest average value and root length. This is because without giving IBA (Indole Butyric Acid), endogenous auxin is not enough to accelerate root formation in stem cuttings. The number of roots that grow, root length, and the presence of fine roots influence the extent of absorption. The broader the area of absorption, the more water and property elements absorbed by Hasanah and Setiari [8], so that it will affect the production of these forage crops on an ongoing basis with Putra et al. opinion about the number of leaves can affect forage production [14]. the level of this plant is followed by an increase in the total dry weight of the forage. These results indicate that there is an increase in photosynthesis by increasing the width of the leaves, resulting in higher dry weight.

When harvesting is taken to be weighed, the stem and leaves are weighed. Determining the right harvest time to get optimum production and quality is generally guided by the age of the plant. According to Prasetyo, elephant grass is harvested as well [19].

4. Conclusion

Based on the results of the study it can be concluded that the treatment of stem immersion for 30 minutes in a 20% goat urine solution provides the best success rate based on time efficiency and the number of roots.

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