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Effect of Rabbit Urine Liquid Organic Fertilizer and Coconut Water on the Vegetative Growth of Red Canna (Canna edulis Kerr.)

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Abstract: This study evaluated the effects of rabbit urine liquid organic fertilizer (LOF) and coconut water on the vegetative growth of red canna (Canna edulis Kerr.). The experiment was conducted from February 2024 to June 2025 in Tohudan Village, Colomadu District, Karanganyar Regency, Central Java, Indonesia. A completely randomized design (CRD) with a 3 × 4 factorial arrangement was applied, consisting of three coconut water concentrations (0%, 50%, and 100%) and four rabbit urine concentrations (0, 10, 15, and 20 mL L^{-1}), with four replications. Growth parameters observed included plant height, number of leaves, leaf length, leaf width, stem diameter, root length, and fresh weight. Data were analyzed using analysis of variance (ANOVA), followed by the honestly significant difference (HSD) test at the 5% significance level. The results showed that rabbit urine significantly affected leaf length and leaf width, while coconut water significantly influenced leaf length and root length. The highest vegetative growth response was observed at a rabbit urine concentration of 20 mL L^{-1}, particularly for leaf length and width. These findings indicate that rabbit urine and coconut water have potential as sustainable organic inputs for enhancing the vegetative growth of red canna plants.

Keywords: Canna edulis, rabbit urine, coconut water, liquid organic fertilizer

1.0 Introduction

Red canna (*Canna edulis* Kerr.), commonly known as ganyong, is a tropical tuber crop that grows widely in home gardens and forest margins. Originally introduced from South America by Portuguese traders, this species is now distributed across Asia, Australia, and Africa. Red canna is utilized for both food and non-food purposes, particularly as an alternative carbohydrate source. However, its productivity is highly influenced by environmental conditions and nutrient availability (Hasanah & Hasrini, 2018).

The excessive use of chemical fertilizers has contributed to soil degradation, including reduced soil porosity and deterioration of soil structure. Consequently, the adoption of organic fertilizers has gained attention as a sustainable alternative. Rabbit urine liquid organic fertilizer has been reported to improve soil structure, enhance nutrient availability, and promote vegetative growth while reducing production costs (Sri Hartini, 2019). Rabbit urine contains essential macronutrients such as nitrogen, phosphorus, and potassium, as well as growth-promoting substances that support root, leaf, and shoot development during the vegetative phase (Aeni Nur, 2023).

Coconut water, a by-product often underutilized, contains natural plant growth regulators such as auxins and cytokinins, as well as minerals that can stimulate plant growth. When used as a liquid organic fertilizer, coconut water can improve soil properties and enhance plant physiological processes (Johenes et al., 2022). Therefore, combining rabbit urine and coconut water may provide synergistic effects on plant growth. This study aimed to evaluate the effects of rabbit urine LOF and coconut water, individually and in combination, on the vegetative growth of red canna plants.

2.0 Materials and methods

The experiment was conducted from February to March 2025 at the Tohudan Food and Horticultural Seed Garden, Colomadu District, Central Java, Indonesia. The materials used included red canna tubers, rabbit urine, coconut water, soil, water, and polybags measuring 50 × 50 cm. Equipment consisted of a sprayer, bucket, hoe, measuring tape, and measuring cylinder.

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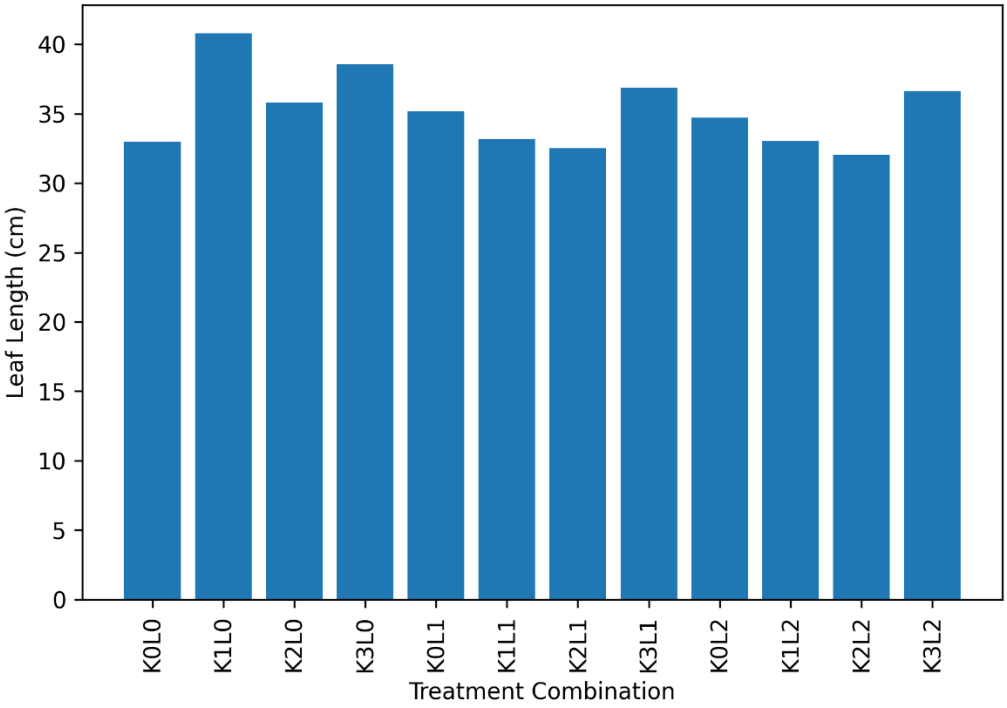
The study employed a completely randomized design (CRD) with two factors. The first factor was coconut water soaking applied for 4 hours at three concentration levels: L0 (0%), L1 (50%), and L2 (100%). The second factor was rabbit urine application at four concentration levels: K0 (0 mL L^{-1}), K1 (10 mL L^{-1}), K2 (15 mL L^{-1}), and K3 (20 mL L^{-1}). Rabbit urine was applied seven times during the observation period. Observed parameters included leaf length, leaf width, and root length. Data were analyzed using analysis of variance (ANOVA). When significant differences were detected, mean separation was performed using the honestly significant difference (HSD) test at the 5% significance level.

3.0 Results and Discussion

3.1 Leaf Length

Leaf length was measured from the base to the tip of the leaf using a ruler at 70 days after planting (DAP). Analysis of variance indicated that both rabbit urine and coconut water treatments significantly affected leaf length (Figure 1; Table 1.1).



K0 = 0 ml/L
K1 =10 ml /L
K2 =15 ml/ L
K3 =20 ml /L

L0 = 0 %
L1 = 50 % (500 ml coconut water + 500 ml water)
L2 = 100 % (1000 ml coconut water)

Fig. 1: Effect of Rabbit Urine and Coconut Water on Leaf Length of Red Canna at 70 DAP

Table 1: Effect of Coconut Water and Rabbit Urine on the Leaf Length of Red Ganyong Plants (Canna edulis Kerr.)

Treatment	Rabbit 0 ml/L	Rabbit 10 ml/L	Rabbit 15 ml/L	Rabbit 20 ml/L	Average (Coconut Water)
Coconut Water 0 %	33,00	40,80	35,83	38,58	37,05 b
Coconut Water 50 %	35,20	33,20	32,50	36,88	34,45 a
Coconut Water 100 %	34,70	33,03	32,03	36,63	34,10 a
Average (Rabbit)	34,30 a	35,68 ab	33,79 a	37,46 b	

Explanation: Numbers followed by the same letter in rows and columns indicate no significant difference at the 5% level in the BNJ test.

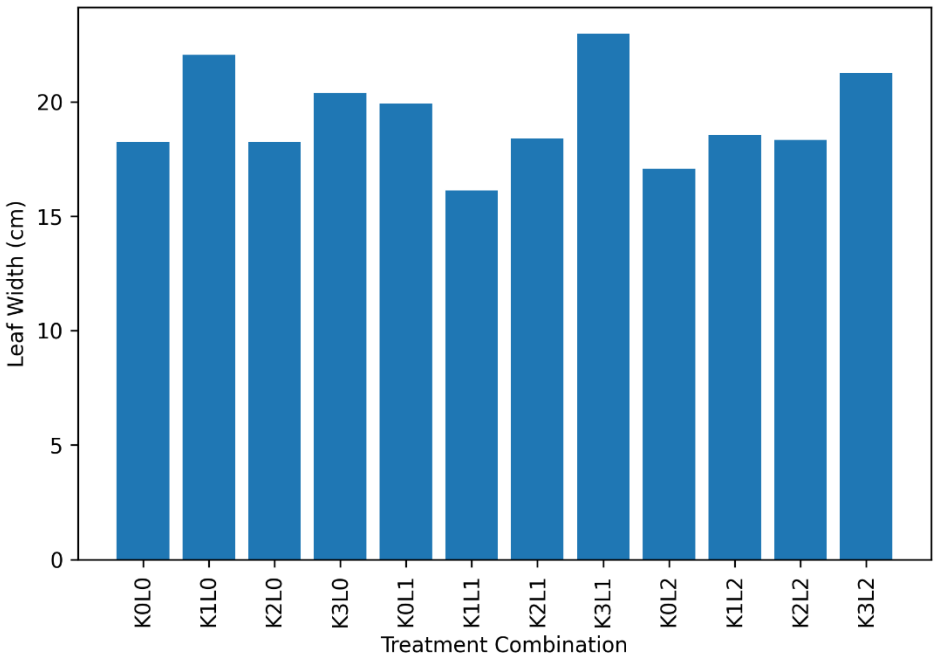
The highest leaf length (40.80 cm) was recorded in the treatment combination of 10 mL L^{-1} rabbit urine without coconut water soaking (K1L0). This suggests that optimal nutrient availability from rabbit urine under favorable soil conditions

enhanced leaf elongation. Rabbit urine contains nitrogen, phosphorus, and potassium, which play essential roles in leaf development. Nitrogen, in particular, promotes cell division and expansion, thereby increasing leaf size (Sri Hartini, 2019).

However, excessive nitrogen application may reduce nutrient balance and increase susceptibility to pests and diseases (Pahlevi et al., 2016). This explains why higher concentrations did not consistently produce superior results. Proper nutrient dosage is therefore critical to achieving optimal vegetative growth.

3.2 Leaf Width

Leaf width was measured at 70 DAP. ANOVA results showed that rabbit urine significantly influenced leaf width, while coconut water had no significant main effect (Figure 2; Table 1.2). The highest leaf width (22.98 cm) was observed in the treatment combination of 20 mL L^{-1} rabbit urine with 50% coconut water soaking (K3L1). This response may be attributed to magnesium content in rabbit urine, which is a key component of chlorophyll and plays a vital role in photosynthesis. Adequate magnesium availability enhances leaf expansion and biomass accumulation (Rustiana et al., 2021). Conversely, the lowest leaf width was recorded at 10 mL L^{-1} rabbit urine with 50% coconut water soaking, suggesting that nutrient imbalance or suboptimal absorption may have limited leaf development.



K0 = 0 ml/L
K1 =10 ml /L
K2 =15 ml/ L
K3 =20 ml /L

L0 = 0 %
L1 = 50 % (500 ml coconut water + 500 ml water)
L2 = 100 % (1000 ml coconut water)

Fig. 2: Effect of Rabbit Urine and Coconut Water on Leaf Width of Red Canna at 70 DAP

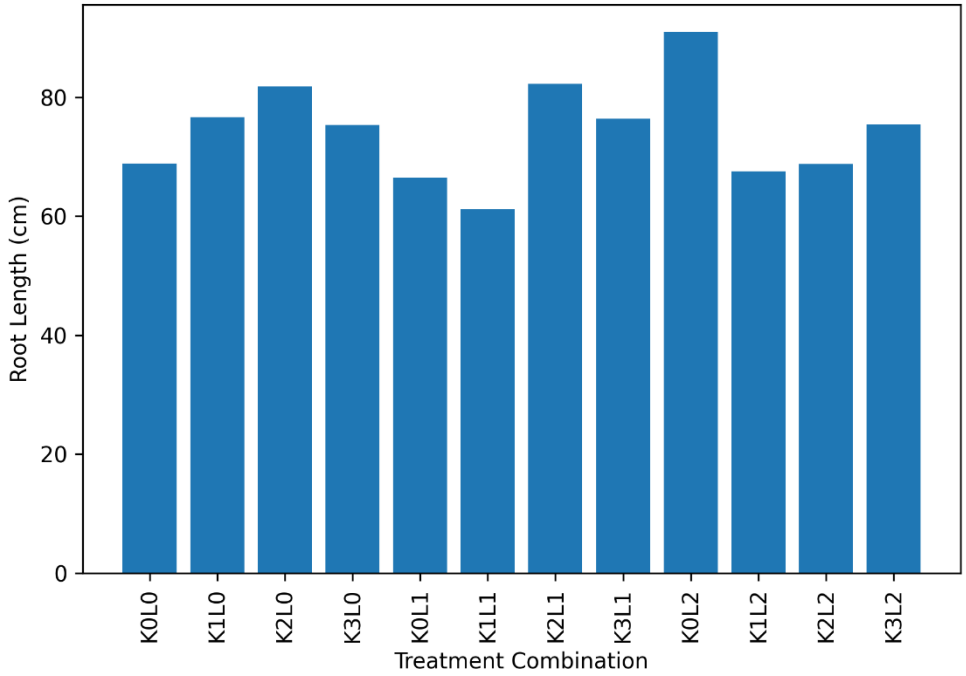
Table 2: Effect of Rabbit Urine on Leaf Width of Red Ganyong Plants (Canna edulis Kerr.)

Treatment	Rabbit 0 ml/L	Rabbit 10 ml/L	Rabbit 15 ml/L	Rabbit 20 ml/L	Average (Coconut Water)
Coconut Water 0 %	18,25	22,05	18,25	20,40	19,74
Coconut Water 50 %	19,93	16,13	18,40	22,98	19,36
Coconut Water 100 %	17,08	18,55	18,33	21,25	18,80
Average (Rabbit)	18,42a	18,91a	18,33a	21,54 b	

Explanation: Numbers followed by the same letter in rows and columns indicate no significant difference at the 5% level in the BNJ test.

3.3 Root Length

Root length was measured at 100 DAP. The results indicated a significant interaction between rabbit urine and coconut water treatments (Figure 3; Table 1.3). The longest roots (91.00 cm) were observed in the combination of 10 mL L^{-1} rabbit urine and 100% coconut water soaking (K1L2). Coconut water contains auxins that stimulate root initiation and elongation. However, excessive concentrations may inhibit growth due to hormonal imbalance (Simangunsong & Lahay, 2017). The shortest root length was recorded at 15 mL L^{-1} rabbit urine combined with 50% coconut water soaking, possibly due to less favorable soil conditions or reduced nutrient uptake efficiency.



K0 = 0 ml/L
K1 =10 ml /L
K2 =15 ml/ L
K3 =20 ml /L

L0 = 0 %
L1 = 50 % (500 ml coconut water + 500 ml water)
L2 = 100 % (1000 ml coconut water)

Fig. 3: Effect of Rabbit Urine and Coconut Water on Root Length of Red Canna at 100 DAP

Table 3: Effect of Coconut Water and Rabbit Urine on the Root Length Growth of Red Ganyong Plants (Canna edulis Kerr.)

Treatment	Coconut Water 0 %	Coconut Water 50 %	Coconut Water 100 %	Average (Rabbit)
Rabbit 0 ml/L	68,88 cdef	66,50 bc	76,40 gh	70,59
Rabbit 10 ml/L	76,63 ghi	61,13 b	91,00 l	76,25
Rabbit 15 ml/L	81,83 ghij	51,50 a	67,58 bcd	66,97
Rabbit 20 ml/L	75,33 efg	82,25 hijk	68,75 cde	75,44
Average (Coconut Water)	75,67 b	65,35 a	75,93 b	

Explanation: Numbers followed by the same letter in rows and columns indicate no significant difference at the 5% level in the BNJ test.

4.0 Conclusion

This study demonstrates that rabbit urine liquid organic fertilizer and coconut water significantly influence the vegetative growth of red canna plants. A rabbit urine concentration of 20 mL L^{-1} was the most effective in enhancing leaf length and leaf width, while coconut water soaking significantly affected root length. The interaction between rabbit urine and coconut water treatments played a crucial role in root development. These findings highlight the potential of rabbit urine and coconut water as sustainable organic inputs for improving red canna growth and reducing reliance on chemical fertilizers.

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Conflict of Interest
The authors declare no conflict of interest.

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