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POTENTIAL GROWTH OF Gynura procumbens CUTTINGS IN NURSERY AFTER DELIVERY PROCESS IN DIFFERENT PACKAGING

DAYA TUMBUH STEK *Gynura procumbens* SELAMA PEMBIBITAN SETELAH PROSES PENGIRIMAN DALAM KEMASAN YANG BERBEDA

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ABSTRACT

The research aimed to evaluate the durability and potential growth of Gynura procumbens cutting after the delivery process in different packaging types. The study was conducted using a factorial completely randomized design (3x3). The first factor was cutting delivery which consisted of no delivery (D0), 104 km delivery length/in two days (D1), and 988 km length/in three days (D2). The second factor was the packaging which consisted of no packaging (P0), dry paper (P1), moistened paper (P2), and bubble wrap plastic(P3). The result showed that the physical condition of G. procumbens cuttings differed after the delivery and packaging, but there were no significant differences in statistics. G. procumbens growth rate was 95% to 100% without being affected by the delivery process or packaging types. The delivery process affects plant height and the number of leaves in 14 days after planting. G. procumbens cuttings have good durability during the delivery process with different packaging types and the vegetative growth rate was not affected.

KATA KUNCI:

Pemotongan, pengemasan, pengiriman, pertumbuhan vegetatif

ABSTRAK

Tujuan penelitian ini adalah untuk mengevaluasi daya tahan dan kemampuan tumbuh stek *Gynura procumbens* setelah proses pengiriman dengan kemasan yang berbeda. Penelitian ini menggunakan Rancangan Acak Lengkap Faktorial 3x3. Faktor pertama adalah proses pengiriman yang terdiri dari tanpa pengiriman (D0), pengiriman pada jarak 104 km/dalam 2 hari, dan pengiriman sejauh 988 km/dalam 3 hari (D2). Faktor kemasan terdiri dari tanpa kemasan (P0), kertas kering (P1), kertas lembab (P2), dan plastik *bubble wrap* (P3). Hasil menunjukkan bahwa terjadi perubahan pada kondisi fisik stek *G. procumbens* namun tidak berbeda nyata secara statistik. Tingkat pertumbuhan *G. procumbens* tidak dipengaruhi proses pengiriman maupun kemasan yang berbeda, mencapai 95% hingga 100%. Proses pengiriman stek berpengaruh pada tinggi tanaman dan jumlah daun pada pengamatan hari ke-14 setelah tanam. Stek *G. procumbens* memiliki daya tahan dan tingkat pertumbuhan vegetatif yang baik setelah pengiriman dengan jenis kemasan yang berbeda.

1. INTRODUCTION

Gynura procumbens known as Sambung Nyawa in Indonesia, has garnered significant attention due to its nutritional and medicinal benefits (Tan *et al*., 2016). This perennial herb, native to Southeast Asia, is characterized by its fleshy, purplish stems and ovate-elliptic leaves, which are often consumed fresh in salads or as a cooked vegetable (Yusoff *et al*., 2019). Beyond its food uses and medicinal effects, *G. procumbens* is recognized for its potential as animal forage (Kumalasari *et al*., 2024). *G. procumbens* feeding has several benefits to animal performance and health status (Yusfani *et al*., 2024). The ability of this plant to thrive in various environmental conditions makes it an attractive candidate for cultivation on farms.

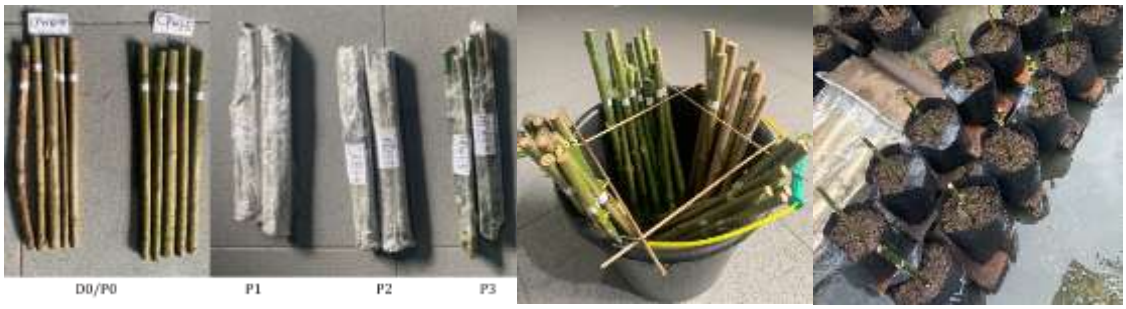
The dissemination of *G. procumbens* seed in Indonesia needs to be handled carefully because the plant seed is in the form of vegetative i.e. cutting stem (Mulyati *et al*., 2023). The delivery process and packaging play crucial roles in the successful establishment of cuttings in a nursery setting (Struve, 2009). Factors such as moisture retention (Rusnak & Braun, 2017), protection from physical damage (Owolabi *et al.,* 2024), and exposure to light (Tombesi *et al.,* 2015) can significantly influence the survival and growth rates of cuttings after they have been transported (Qaderi *et al*., 2019). Different packaging methods can either enhance or inhibit the cuttings' ability to root (Li *et al.*, 2022) and establish themselves in the nursery environment. For instance, the use of breathable materials may promote better air circulation and moisture retention compared to plastic wraps that can trap humidity and lead to rot (Caleb *et al*., 2016).

Research into the growth potential of *G. procumbens* cuttings as forage has already been studied, thus following various delivery processes is vital for improving plant utilization on farms (Gallucci *et al*., 2025). The different packaging impacts on the physiological responses of cutting growth can refine their methods to maximize yield and quality (Shafique *et al.*, 2021). Additionally, insights gained from such studies can contribute to sustainable agricultural practices by reducing waste and lowering delivery cost. The research aimed to evaluate the durability and potential vegetative growth of *G. procumbens* cuttings after the delivery process in different packaging types.

2. MATERIALS AND METHOD

The research was conducted at IPB University, Bogor City, West Java Province; the University of Sultan Ageng Tirtayasa, Serang City, Banten Province; and the State Polytechnic of Jember, Jember City, East Java Province. The research was collaborative activities that each university has a role, i.e. researchers from IPB University were 1) prepare research materials, 2) deliver to other city, 3) manage and cultivate cuttings without delivery nor packaging, 4) observe plant parameter; University of Sultan Ageng Tirtayasa and the State Polytechnic of Jember were 1) accept research materials, 2) prepare and cultivate cuttings at field laboratory, 3) observe plant parameter.

The research was conducted using a factorial completely randomized design (3x4). The first factor was the length of cutting delivery, while the second factor was the packaging. The cutting delivery consisted of no delivery (D0), 104 km delivery length/in two days (D1), and 988 km length/in three days (D2). The packaging consisted of no packaging (P0), dry paper (P1), moistened paper (P2), and plastic bubble wrap (P3) (Figure 1). The cuttings were collected from an adult plant (3 years old) with a stem age of 6 months after pruning. A total of 120 cutting stems of *G. procumbens* with a length of 30 cm were used in this research. The stem cuttings that had been soaked for one week and weighed were then immediately packaged based on the treatments in ten replicates. All the packages were put in a styrofoam box, sealed, and delivered through the shipping company to the partners according to the delivery treatments. The control samples did not receive any packaging treatment nor undergo delivery procedures.



a. b. c.

Figure 1. a. Packaging treatment, b. Adaptation process, c. Cutting cultivation

At the destination, the packages were weighed, and the physical condition of the cutting, especially the cutting scent and mucus, was observed. The cuttings were soaked in fresh water for three hours to reduce oxidative stress and adapt to the new environment. *G. procumbens* potential growth was observed through the cutting cultivation on the nursery stage. Cultivation media were a combination of soil and organic fertilizer with a ratio of 1:1 in polybags of size 25 x 25 cm. A cutting was planted into media with a 5 cm soil depth, and the growth parameters were observed in 7 and 14 days. The growth parameters were growth rate in 14 days, the number of shoots, shoot growth percentage, plant height, and the number of leaves. Plant height was measured from soil surface to the leaf tips. Data were analysed using ANOVA Two-way with Rx64 4.1.0. The significance of different were then analysed further using Multiple Comparisons of Means: Tukey Contrasts to determine the best treatments.

3. RESULT AND DISCUSSION

3.1. Effect of delivery and packaging on the physical condition of *G. procumbens* cuttings

The result showed that the physical condition of *G. procumbens* cuttings differed after the delivery and packaging, but there were no significant differences in statistics (Table 1). There are no differences in cutting weight, but a different odor and a little mucus were sticking out of the cuttings' skin after the delivery and packaging. This condition was different from cutting without treatments, in that no odor or mucus appeared. The previous research reported that the consumption time for delivery affects cutting weight due to evaporation (Kumalasari *et al*., 2020). The cutting weight in this research has different responses due to the plant characteristics, size of the cutting, and packaging types, which decreases the probability of evaporation. Mahajan *et al*. (2016) reported that fresh plant packaging causes carbon dioxide accumulation in the package that leads to fermenting odor formation.

The results showed that moistened papers (P2) were counterproductive for longer transportation periods. Optimizing extended delivery processes requires modified packaging design to increase the balance of mass retention with efficient moisture dissipation (Kusuma *et al.,* 2026). These findings align with established postharvest principles stating that transportation (Al Dairi *et al.,* 2022) and physical road vibrations could affect plant tissues (Vellila *et al.,* 2025). Plant tissues' damage could significantly accelerate enzymatic activity, metabolic respiration, and postharvest weight losses (Reid & Rose, 2011). The weight increase on P3 indicates that the impermeable plastic barrier trapped metabolic condensation and cellular exudates over the three days. This condition forces absorption of trapped moisture by the stem tissues (McElrone *et al.*, 2013) while simultaneously accelerating superficial biodeterioration and microbial breakdown (Chang *et al.*, 2025).

3.2. Effect of delivery and packaging on the *G. procumbens* cuttings' growth

The Tukey test showed that G. procumbens growth rate was in the range of 95% to 100% and was not affected by the delivery process or packaging types (Table 2). The delivery process has an effect on the number of shoots, plant height, and the number of leaves in 14 days after planting. The highest number of shoots was found on cuttings without delivery and no packaging (1.48) with the range of shoots between 0 to 4. The shoots were start to growth on the first week was about 37.00%, and increased up to 76.67% on the second week. However, the shoot growth to be a branch only 45.00% to 85.00% in 14 days after planting. The delivery process reduced the plant height at the shorter destination but increased it at the farther one due to etiolation responses alter normal morphology on moisture-retentive paper wraps (Jedynak *et al.,* 2022).

Plant height and the number of leaves were indicated that plant growth was affected by the delivery and packaging. The plant height had different responses after packaging due tocutting stem respiration rate, ethylene production, and growth hormone release that increased the plant height (Poonsri, 2021). The number of leaves also decreased after the packaging and delivery process disturbed the axillary bud break (Rusdy & Qalbih, 2023). The different packaging types have different effects on the number of leaves, with the moisture paper having less effect due to it maintaining local relative humidity around the root-shoot buds (Thorne & Frank, 2009).

Table 1. The effect of delivery and packaging on the physical condition of stem cutting

Treatments	Weight	Odor	Mucus
Delivery			
D0	48.98	-	-
D1	43.69	-	+
D2	46.30	+	++
SEM	2.36		
Packaging			
P0	48.98	-	-
P1	45.41	+	+
P2	42.70	+	+
P3	46.89	+	+
SEM	2.59		
Delivery x Packaging			
D0P0	48.98	-	-
D0P1	48.98	-	-
D0P2	48.98	-	-
D0P3	48.98	-	-
D1P0	48.98	-	-
D1P1	44.73	-	+
D1P2	42.73	+	+
D1P3	43.62	+	+
D2P0	46 .30	-	-
D2P1	46.09	+	+
D2P2	42.67	+	+
D2P3	50.15	+	+
SEM	0.71		

Note: D0=no delivery; D1=104 km delivery length/in two days; D2=988 km length/in three days; P0=no packaging, P1=dry paper, P2=moistened paper, P3=plastic bubble wrap; - = no odor/no mucus; + = indicated odor/mucus appearance intensity.

Table 2. The effect of delivery and packaging on the stem cutting growth

Treatments	Growth rate	Number of shoots	%Shoots growth	Plant height (cm)	Number of leaves
Delivery					
D0	100	1.48a	75.00	26.49b	19.51a
D1	96.67	0.91b	76.67	25.81c	13.63b
D2	98.33	0.85	73.80	30.44a	15.23ab
SEM	2.36	0.003		2.35	2.35
Packaging					
P0	100	1.48a	75.00	26.49b	19.51a
P1	97.5	0.83bc	75.00	28.35a	14.82ab
P2	100	1.35ab	85.00	28.32a	16.91a
P3	95	0.57c	45.00	27.70a	11.56b
SEM	2.59	0.0005		0.15	0.70
Delivery x Packaging					
D0P0	100	1.28		26.49	19.51
D0P1	100	1.28		26.49	19.51
D0P2	100	1.48		26.49	19.51
D0P3	100	1.48		26.49	19.51
D1P0	100	1.10		25.81	13.63
D1P1	95	1.03		26.13	12.27
D1P2	100	1.31		26.15	18.17
D1P3	95	0.98		25.15	10.45
D2P0	100	1.01		30.43	15.22
D2P1	100	0.85		30.57	17.37
D2P2	100	1.10		30.49	15.65
D2P3	95	0.83		30.25	12.67
SEM	0.41	0.13		1.18	2.12

Note: D0=no delivery; D1=104 km delivery length/in two days; D2=988 km length/in three days; P0=no packaging, P1=dry paper, P2=moistened paper, P3=plastic bubble wrap; numbers followed by the same alphabet were significantly different at 5%.

The result was in line with Nirmala *et al*. (2023) that reported packaging materials have effects on plants. The different effects occur due to the different parts of plants used in both kinds of research. Plant material in the package contained enzymes that might be active during the delivery, affecting plant growth (Tatipata, 2010). Fernandez *et al.* (2020) reported that packaging types could affect the plant due to the different packaging materials having different air permeance. The air exchange affects biochemical and physiological changes in cutting that might alter the cutting metabolism in the growth stage (Thakur, 2020). The moisture paper package has the best effect on the plant growth rate, number of shoots, height, and number of leaves because the water content could help maintain the temperature and humidity during the delivery (Rubim *et al*., 2019).

4. CONCLUSION

G. procumbens cuttings have good durability during the delivery process with different packaging types. The cutting growth rate was not affected by delivery or packaging types. *G. procumbens* growth in 14 days after planting has various responses after delivery i.e. the packaging increases the plant height while the number of leaves decreases after the delivery and packaging process.

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