

EFFECTS OF TYPES OF MEDIA AND NPK FERTILIZER ON THE ROOTING CAPACITY OF CHRYSANTHEMUM CUTTINGS

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ABSTRACT

Physiological status of chrysanthemum cuttings during rooting process highly influences plant growth and flower production. Amongst other aspects, rooting capacity of the cuttings is the most important. Rooting capacity is influenced by environmental conditions such as growing medium and nutrition. The study was aimed to analyze the effects of different types of media, fertilizer concentration, and frequency of fertilizer application on the rooting capacity of chrysanthemum cuttings. The experiment was conducted at the Segunung Experimental Station of the Indonesian Ornamental Crops Research Institute from February to May 2005. The treatments consisted of four different rooting media, i.e. carbonized rice husk, coco peat, perlite, and mixture of perlite and vermiculite (1:1 v/v); two concentrations of NPK (25:7:7) fertilizers, i.e. 1.75 and 2.5 g l⁻¹; and four frequencies of fertilizer application, i.e. every 1 day, 2 days, 3 days, and 4 days. The experiment was designed in a completely randomized block with four replications. Parameters observed were rooting capacity and cutting performances such as cutting height, cutting diameter, number of leaves, number of visible roots, and root length at 16 days after planting. The results showed that chrysanthemum cuttings rooted in carbonized rice husk had better performance than those rooted in coco peat, vermiculite, and mixture of perlite + vermiculite. Higher concentration of fertilizer solution up to 2.5 g l⁻¹ also gave significant effect on the root formation and further root growth of cuttings. However, the rooting capacity of cuttings was not affected by the frequency of fertilizer application. This study implied that carbonized rice husk growing medium supplemented with NPK (2.5 g l⁻¹) every 4 days during rooting period is the choice for traditional chrysanthemum growers to increase the performance and quality of the cut flowers.

[**Keywords:** *Dendranthema grandiflora*, cutting growing media, fertilizer application, rooting]

INTRODUCTION

Chrysanthemum (*Dendranthema grandiflora* Twelve) is one of the major cut flowers in the world. Quantity of the chrysanthemum cut flower ranked on the first of all cut flowers marketed every year from Indonesia which contributed US\$ 1 million to the national income

in 2003, and the number increases up to US\$ 1.8 million in 2005 (Indonesian Statistics Bureau 2005). However, Southeast Asian countries including Indonesia, supplied less than 10% of the world market share (Chomchalow 2005).

The fast and dynamic trend changes in the floriculture market have made quality and performance as the determining factors in grading and pricing. This is in addition to the consumer preferences on color, size, and flower types. However, chrysanthemum cut flowers produced by traditional growers in Indonesia have poor physical performance and quality due to lack of good planting material and cultivation method, therefore their prices become uncompetitive and less profitable.

Good planting material is responsive to the application of nutrient therefore it will produce better plant growth and development, and quality of the flowers produced (Grunewaldt 1988). Aside from the systemic disease problem, the quality of cuttings is highly influenced by physiological status of the cuttings such as rooting capacity. The rooting capacity is not only determined by the genotype, but also by environmental conditions (Horridge and Chockshull 1989). Favorable environment conditions which facilitate good rooting process of the cuttings are physical environments and edaphic factors that may act solely or simultaneously to the cuttings in root initiation and further root growth. Nugroho *et al.* (2004) indicated that higher dry weight, more compact and faster rooting capacity of chrysanthemum was affected by fertilizer application during rooting process. However, the appropriate concentration and frequency of fertilizer application during the rooting process still need to be evaluated. The study was conducted to find out the effect of different rooting media, concentration and frequency of fertilizer application during rooting process on the rooting capacity of chrysanthemum cuttings.

MATERIALS AND METHODS

The experiment was conducted at the Segunung Experimental Station of the Indonesian Ornamental Crops Research Institute from February to May 2005, located at 1100 m above sea level (asl). Unrooted chrysanthemum cuttings (6-7 cm long) of cv. Town Talk from the Saung Mirwan Nursery Co. Ltd. were planted and arranged in 30 cm x 40 cm plastic boxes with the density of 60 cuttings per box. In the first three days, the boxes were covered with paper to avoid excessive transpiration. During the rooting process, long day condition was provided with 75 watt incandescent lamps cyclic lighting (20 minutes off followed by 10 minutes on) from 22.00 pm to 03.00 am. The lamp points were arranged 1 m above the planting boxes.

The experiment was designed in a randomized complete block with four replications. The treatments evaluated were type of rooting media, fertilizer concentration, and frequency of fertilizer application. After 16 days of rooting period, the rooting media were removed and the rooting capacity and performances of the cuttings were recorded. Parameters evaluated were cutting height, cutting diameter, number of leaves, number of visible root, and root length.

Type of Rooting Media

Rooting capacity of cuttings was observed under four different rooting media, i.e. carbonized rice husk, coco peat, perlite, and a mixture of perlite and vermiculite (1:1 v/v). The media were pasteurized at 80°C for 4 hours. After 24-hour cooling, 2.5 kg media was placed into a planting box. To facilitate the humidity for the cuttings, 500 ml distilled water was sprayed to each planting box before the cuttings were planted.

Fertilizer Concentration

Three days after the cuttings were planted, the paper covers were removed. NPK fertilizers (a compound of

25:7:7) were mixed with distilled water. Two fertilizer concentrations tested was 1.75 and 2.5 g l⁻¹.

Frequency of Fertilizer Application

NPK solution was applied at four different application frequencies, i.e. every 1 day, 2 days, 3 days, and 4 days. Half litre of the fertilizer solutions was applied by pouring to the rooting media in each box.

RESULTS AND DISCUSSION

Analysis of variances of all factors studied such as type of rooting media, fertilizer concentration, and frequency of fertilizer application revealed that no interaction among the factors in all parameters observed. Therefore, the effect of each individual factor was then presented below.

Effect of Different Media on the Rooting Capacity

Rooting media affected the rooting capacity and performance of the cuttings at 16 days after planting. Chrysanthemum cuttings planted in the carbonized rice husk produced better rooting capacity compared with those grown on vermiculite and vermiculite + perlite mixture as indicated by higher number of visible root (26.6 roots per cutting) and root length (7.065 cm) (Table 1).

The higher number of visible roots and longer roots of the cuttings grown on carbonized rice husk may be attributed with its better water holding capacity and drainage. Under such favorable condition, the plant was provided sufficient air and oxygen for cell respiration during the rooting process (Frenck and Kim 1995). The moisture in smaller pores served not only for metabolic activities but also provided sufficient humidity to avoid excessive transpiration (Karlsen 1997) and destructive temperature fluctuation that may happen in the rhizosphere (Klapwijk 1987).

Table 1. Rooting capacity and performances of the chrysanthemum cuttings grown on four different rooting media, 16 days after planting.

Rooting media	Cutting height (cm)	Cutting diameter (mm)	Number of leaves	Number of visible root	Root length (cm)
Carbonized rice husk	13.575a	2.768a	6.837a	26.650a	7.065a
Coco peat	13.389a	2.713a	6.667a	23.663ab	6.035b
Vermiculite	12.876a	2.724a	6.550a	20.517b	5.587b
Perlite + vermiculite	13.389a	2.606a	6.358a	21.467b	6.215ab

Values followed by different letters in the same column differ significantly at LSD 5%.

Aside from water holding capacity and drainage, the better root initiation and formation seemed to have relation with darker environment provided by carbonized rice husk. Compared to other treatment media, black color of carbonized rice husk may contribute to darker rhizosphere environment. In this situation, the root promoter (e.g. auxin) may be translocated and accumulated at the basal part of cuttings where root initials appear and these induce faster cell division and differentiation for root formation (Moe 1988).

Effect of Fertilizer and Frequency of Application on the Rooting Capacity

Fertilizer application significantly affected root quality of the cuttings as shown after 18 days of rooting process. Increase in NPK fertilizer concentration from 1.75 to 2.5 g l⁻¹ significantly produced higher number of visible roots and root length (Table 2). Other parameters observed, i.e. cutting height, cutting diameter, number of leaves and shoot fresh weight, did not significantly different. This means that for practical reason, chrysanthemum cuttings required 2.5 g NPK l⁻¹ for better growth.

During the rooting process, photosynthates produced in the leaves were mobilized to serve activities for root development (Davis and Potter 1981). In this stage, nutrient availability in root zones was very important for cutting growth (Buwalda *et al.* 1994). Better cutting performances treated with higher concentration of NPK fertilizer (2.5 g l⁻¹) may be attributed

with its root quality, i.e. longer root and more number of visible roots which capable to utilize more available NPK from the root zones. In the contrary, the frequency of fertilizer application did not significantly increase the cutting performance in all parameters observed (Table 3), which means that application of NPK every 4 days of 2.5 g l⁻¹ is sufficient to provide cutting quality during the rooting period of 16 days.

The application of fertilizer solution into the rooting media must be at the right time where cuttings have been rooted. This indicates the importance of understanding on changes of physiological orientation during root initiation and formation (Steiner 1980). The roots appear usually after 10 days (Borowski *et al.* 1981) and therefore, nutrient absorption will be more effective at this time.

This study implied that carbonized rice husk is the choice for traditional chrysanthemum growers to increase the performance and quality of the cut flowers. The materials are abundance and chief which can be afforded by the growers. However, for better result the cuttings need to be fertilized with NPK (2.5 g l⁻¹) every 4 days during rooting period.

CONCLUSION

Carbonized rice husk was the best type of rooting medium for chrysanthemum cutting which produced better rooting capacity as indicated by higher number of visible root (26.6 roots per cutting) and root length

Table 2. Quality performances of chrysanthemum cuttings treated with different concentrations of NPK compound (25:7:7) during rooting process.

NPK concentration (g l ⁻¹)	Cutting height (cm)	Cutting diameter (mm)	Number of leaves	Shoot fresh weight (g)	Number of visible root	Root length (cm)
1.75	13.156a	2.672a	6.667a	2.723a	21.601a	5.812a
2.5	13.573a	2.734a	6.837a	2.946b	29.817b	6.739b

Values followed by different letters in the same column differ significantly at T-test 5%.

Table 3. Quality performances of chrysanthemum cuttings supplemented with NPK fertilizer in different application frequencies during rooting process.

Fertilizer application frequency	Cutting height (cm)	Cutting diameter (mm)	Number of leaves	Shoot fresh weight (g)	Number of visible root	Root length (cm)
Every day	13.604a	2.717a	6.733a	2.963a	26.383a	6.243a
Every 2 days	13.535a	2.648a	6.692a	2.847a	24.333a	5.518a
Every 3 days	13.520a	2.738a	6.662a	2.940a	24.375a	5.947a
Every 4 days	13.554a	2.707a	6.325a	2.832a	21.762a	6.627a

Values followed by different letters in the same column differ significantly at LSD 5%.

(7.065 cm). Cuttings supplemented with NPK compound (25:7:7) at a concentration of 2.5 g l⁻¹ showed higher number of roots, shoot fresh weight, and longer roots compared to those supplemented with NPK 1.75 g l⁻¹. The frequency of fertilizer application every one or four days did not affected rooting capacity of chrysanthemum cuttings.

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