

EFFECTS OF SLOW - RELEASE UREA FERTILIZER PRODUCED BY AQUEOUS SUSPENSION TECHNIQUE METHODS ON GROWTH AND DEVELOPMENT OF CHRYSANTHEMUM IN DONG HY, THAI NGUYEN

Đến tòa soạn 09-08-2022

Tran Quoc Toan^{*1}, Ha Xuan Linh², Dam Ha Luong Thanh²

1. TNU - Thai Nguyen University of Education

2. TNU-International School

Email: toantq@tnue.edu.vn

TÓM TẮT

ẢNH HƯỞNG CỦA PHÂN URE NHẢ CHẬM CHẾ TẠO THEO PHƯƠNG PHÁP HUYỀN PHÙ ĐẾN SINH TRƯỞNG VÀ PHÁT TRIỂN CỦA CÂY HOA CÚC VÀNG (*Chrysanthemum sp*) Ở ĐỒNG HỖ, THÁI NGUYÊN

Nghiên cứu này được thực hiện trong vụ Đông Xuân năm 2021-2022 nhằm đánh giá ảnh hưởng của phân ure nhả chậm chế tạo theo phương pháp huyền phù đến sinh trưởng và phát triển của cây hoa cúc (*Chrysanthemum sp*) ở Đồng Hỷ, Thái Nguyên. Ba công thức phân bón nhả chậm là 25 g N /bầu thí nghiệm, 17.5 g N /bầu thí nghiệm, và 12.5 g N /bầu thí nghiệm được sử dụng để so sánh với công thức đối chứng sử dụng ure thông thường (25 g N /chậu thí nghiệm). Kết quả cho thấy, phân ure nhả chậm phù hợp với sinh trưởng và phát triển của cây hoa cúc. Kết quả cho thấy khi sử dụng phân ure nhả chậm với liều lượng 17.5g N /bầu thí nghiệm là công thức tốt nhất, giúp cây sinh trưởng phát triển tốt nhất, giảm 30% N so với công thức đối chứng.

Keywords: *Chrysanthemum sp*, slow-release fertilizer, urea, growth, development

1. INTRODUCTION

Nitrogen is the most important nutrient for plants, most used in agricultural production. Among nitrogen fertilizers, urea is the most used to provide nitrogen for plants. Due to the effects of climate change, leaching, erosion and improper use have reduced the effectiveness of fertilizers when applied, causing environmental pollution. Therefore, the use of slow-release fertilizers is an effective solution to improve the efficiency of fertilizer use, reduce nutrient loss and the risk of environmental pollution, and save labor and production costs [1]. The potential for using slow-release fertilizers in agricultural

production is great, however, the research on slow-release fertilizers in Vietnam is still very new, the application of slow-release fertilizers in agricultural production is still very limited, using mainly is imported fertilizers with high costs [2-5]. This study was conducted to evaluate the effect of a slow-release urea fertilizer prepared by the suspension method [6] on the growth and development of the *Chrysanthemum*.

Chrysanthemum (Chrysanthemum sp.) has strong vitality, is diverse in colors, beautiful and long-lasting flowers. It is grown all over the world as well as in Vietnam. In addition to their oldest ornamental value,

Chrysanthemums are also used as beverages, pharmaceuticals,... In the process of growth and development, Chrysanthemum plants need a lot of nitrogen. Lack of nitrogen, the plant is barren, the leaves are yellow, the flowers are unsightly and small [7-10].

2. METHODOLOGY

2.1. Materials

Slow-release urea fertilizer (SU) is produced at the Thai Nguyen University of Education - Thai Nguyen University by the suspension method from urea and bentonite. Fertilizer is in powder form, with an N content of 41.65%, and a nutrient release time of 28 days in the soil [6].

Control Ha Bac urea fertilizer (Ha Bac-Vietnam), granular with an N content of 46.3% and Biure content of 1.0%.

The CN01 Chrysanthemum variety is propagated by cuttings, ensuring planting quality standards.

2.2. Methods

Location and time: The experiment was conducted in Tam Thai hamlet, Hoa Thuong commune, Dong Hy district, Thai Nguyen province from November 5, 2021 to February 5, 2022.

Experimental design: The experiment was arranged in a completely randomized design with 04 treatments and 03 repetitions. Formulas include:

Formula 1 (CT1-control): normal urea fertilizer, 25g N/potential

Formula 2 (CT2): SU, 25g N/pot

Formula 3 (CT3): SU, 17.5g N/pot (70% compared to CT2)

Formula 4 (CT4): SU, 12.5g N/pot (50% compared to CT2)

The ground substance includes 16g P₂O₅/pot, 20g K₂O/pot and 30g microbial organic fertilizer/pot/crop.

The direction of fertilizing:

+ The control urea fertilizer, phosphate and potassium are divided into four times:

First time: 8g N, 2g P₂O₅, 2g K₂O. Fertilizing 10 days after planting.

Second time: 8g N, 2g P₂O₅, 4g K₂O. Fertilizing 30 days after planting.

Third time: 5g N, 2g P₂O₅, 7g K₂O. Fertilizing 50 days after planting.

Fourth time: 4g N, 2g P₂O₅, 7g K₂O. Fertilizing 70 days after planting.

+ Slow-release urea fertilizer is applied once/crop season. Fertilizing 10 days after planting, around the ground of the tree. Phosphate, potassium, and organic fertilizers are applied according to the process of caring for Chrysanthemum plants [8].

Experimental pot size: height 30 cm, a radius of pot mouth is 20 cm, radius of the bottom of pot is 15cm. Each pot is spaced 10cm apart.

Planting density of 7 plants/pot. Plant 5-6 cm from the plant, evenly distributed around the pot.

Methods of analysis and monitoring were carried out according to the "Handbook of soil - water - fertilizer and crop analysis" of the Institute of Soil and Agrochemistry.

The data was aggregated and statistically processed using Excel and SAS 9.1 software.

2.3. Monitoring targets

The monitoring criteria for Chrysanthemum plants include: growth and development indicators such as plant height (cm), number of leaves/plant (leaves/plant), stem diameter (cm); time from planting to buds (days); yield and quality as effective flowering rate (%), flower length (cm), flower diameter (cm), flower durability (day), flower color.

3. RESULTS AND DISCUSSION

3.1. Effect of slow-release urea fertilizer on the height of Chrysanthemum

Table 1 shows that, from 2-8 weeks after planting, the slow-release fertilizer treatments gave higher plant height than the control

formula (CT1), except for CT4 fertilizing with low N content (50% compared with CT2). This proves that CT2, and CT3 have provided nutrients for Chrysanthemum plants in an effective and suitable way, helping the plant to grow well. Where CT2 is for the highest tree height at 95% statistical significance. The results of this study are similar to those of the authors [2].

Table 1. Effect of slow-release urea fertilizer on the height of Chrysanthemum

Treatment	Plant height (cm)			
	2TST	4TST	6TST	8TST
CT1 (Control)	9.54 ^{ab}	17.16 ^{ab}	42.55 ^b	50.68 ^{ab}
CT2	11.18 ^a	19.63 ^a	47.24 ^a	53.82 ^a
CT3	10.42 ^{ab}	18.10 ^{ab}	45.28 ^a	52.15 ^a
CT4	8.82 ^b	15.12 ^b	38.10 ^c	45.21 ^b
LSD _{0,05}	2.21	4.33	2.61	6.23
CV	11.73	13.13	3.20	6.56

Legend: TST: number of weeks after planting. LSD_{0.05} is the smallest statistically significant difference. CV% is the coefficient of variation. The letters a, b, and c are significant at the 95% level.

3.2. Effect of slow-release urea fertilizer on Chrysanthemum stem diameter

Table 2 showed that the slow-release fertilizer treatments for the stem diameter were not different from the control formula (CT1) after 2 weeks of planting, after 4-8 weeks after planting, the formulas CT2, and CT3 gave stem diameter higher than CT1 at 95% statistical significance. At 8 weeks after planting, the diameter of plant was the largest in CT3 (0.55 cm) and the lowest in CT4 (0.48 cm). This is explained by the fact that CT4 fertilizes with low N content, so the plant grows more slowly.

This result is consistent with the published studies of the authors [2], [5].

Table 2. Effect of slow-release urea fertilizer on stem diameter of Chrysanthemums

Treatment	Stem diameter (cm)			
	2TST	4TST	6TST	8TST
CT1 (Control)	0.39 ^a	0.41 ^{bc}	0.48 ^{ab}	0.50 ^{ab}
CT2	0.41 ^a	0.47 ^{ab}	0.51 ^{ab}	0.53 ^{ab}
CT3	0.42 ^a	0.49 ^a	0.52 ^a	0.55 ^a
CT4	0.38 ^a	0.40 ^c	0.46 ^b	0.48 ^b
LSD _{0,05}	0.08	0.06	0.05	0.07
CV	11.04	7.75	5.83	7.13

Legend: TST: number of weeks after planting. LSD_{0.05} is the smallest statistically significant difference. CV% is the coefficient of variation. The letters a, b, and c are significant at the 95% level.

3.3. Effect of slow-release urea fertilizer on growth time and size of Chrysanthemum

The growth and development of Chrysanthemum depend on the genetic nature of the variety, the external conditions, and especially the caring conditions. The effect of slow-release urea fertilizer on the growth time and size of the Chrysanthemum is shown in Table 3, in the formulas of slow-release fertilizer with high concentration (CT2, CT3), the time from planting to bud and to flowering was shorter than that of the control formula CT1 at 95% significance level. Where CT3 gives the shortest time from planting to buds (49.46 days) and to flowering (72.51 days). In the formulas of slow-release fertilizer with high content (CT2, CT3), the number of leaves/plant was not different, while the parameters of the tree when there were buds: tree height, trunk diameter were higher than those of the plant. with the control formula CT1 at the 95% confidence level. In which, CT3 for the size criteria of the tree is the highest. This proves that the slow-release urea has provided nutrients for Chrysanthemum plants in an effective way, increasing the

growth rate of the plant. Particularly, CT4 gave a longer planting time to bud and to gas bloom, and the size parameters of the plants were

lower than that of the control formula CT1, because they grew under N-deficient conditions.

Table 3. Effect of slow-release urea fertilizer on growth time and the size of the Chrysanthemum

Treatment	Time from planting to bud (days)	Growth parameter when budding			Time from planting to flowering (days)
		Plant height (cm)	Number of leaves/plant (leaves)	Stem diameter (cm)	
CT1 (Control)	52.21 ^{ab}	53.30 ^{ab}	30.12 ^a	0.49 ^a	77.68 ^{ab}
CT2	50.52 ^{ab}	55.56 ^{ab}	32.52 ^a	0.53 ^{ab}	75.25 ^{ab}
CT3	49.46 ^b	56.28 ^b	31.86 ^a	0.54 ^b	72.51 ^b
CT4	53.35 ^a	51.24 ^a	29.45 ^a	0.48 ^a	78.52 ^a
LSD _{0.05}	3.80	4.51	3.37	3.99	5.39
CV	3.93	4.43	5.77	2.79	3.77

Legend: LSD_{0.05} is the smallest statistically significant difference. CV% is the coefficient of variation. The letters a, b, and c are significant at the 95% level.

3.4. Effect of slow release urea fertilizer on yield and quality of Chrysanthemums

The yield and quality of flowers is an indicator to evaluate the growth and development of Chrysanthemums, it determines the value of

flower production. The nutrients provided by fertilizers all affect flower quality. The yield of the Chrysanthemum depends on the effective flowering rate or the number of effective blooms per unit area.

Table 4. Effect of slow-release urea fertilizer on yield and quality of Chrysanthemums

Treatment	Flower blooming rate (%)	Stem height (cm)	Flower diameter (cm)	Flower durability (days)	Flower color
CT1 (control)	92.14	56.43	9.61	12.22	Bright yellow
CT2	94.82	59.21	11.22	14.48	Bright yellow
CT3	96.51	60.43	11.54	15.26	Bright yellow
CT4	91.63	55.54	9.26	10.52	Bright yellow



Figure 1. *Chrysanthemums a) after 10 days of planting and b) when in flowering*

The results in Table 4 showed that the slow-release fertilizer treatments had higher effective flower blooming rates than the control formula CT1 (except for CT4 applied with low N content). The commercial quality of Chrysanthemum plants is constituted by criteria such as flower stem length, flower diameter, flower color, and flower color fastness. Research results (Table 4) showed that slow-release fertilizer increased the commercial quality of Chrysanthemums. The formulas CT2, CT3 had flower stem length, flower diameter, and flower durability higher than the control formula CT1, in which CT3 gave the highest criteria but this difference was not significant compared with CT2. Chrysanthemums in the formulas were bright yellow, typical of the variety, and uniform; there was no discernible difference to the senses. This result is consistent with the study published by the authors [10].

4. CONCLUSION

Chrysanthemum flower favorably grows and develops in Dong Hy, Thai Nguyen, which gives high yield and good flower quality when applying slow-release urea fertilizer with nitrogen from 17.5-25.0 g N/pot (pot height 30cm, the radius of pot mouth: 20cm, radius of

bottom of pot: 15cm, containing 7 plants). When applying slow-release urea fertilizer with the amount of 17.5g N/pot, the experiment will be the most suitable for the growth and development of the plant, giving the highest growth and flower quality compared to the control formula. The research results show that the slow-release urea fertilizer made by the suspension method is suitable for the growth and development of Chrysanthemum plants, and it is necessary to continue researching and testing on other crops for mass application in agricultural production in Vietnam.

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