Increasing the flowering and fruiting of Citrus reticulata blanco by application of potassium nitrat and agrodyke

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Increasing the Flowering and Fruiting of *Citrus reticulata* Blanco by Application of Potassium Nitrat and Agrodyke

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Abstract. The appropriate treatment is required to enhance the flowering induction of citrus, particularly during the wet season. Potassium nitrate is an effective dormancy breaking agent; thus, its application can enhance the flowering of numerous fruit crops. Agrodyke is well known as an organic fertilizer that contains macro and micronutrients. This research aimed to obtain the most appropriate dose of potassium nitrate and agrodyke to support the flowering and fruiting of citrus. This study used a Completely Randomized Design with two factors arranged factorially. The first factor used the dose of potassium nitrate (0.25, and 50 g/plant), the second factor used the dose of agrodyke (0.20, and 40 g/plant). This study comprised of nine combination treatments which each treatment was repeated four times; thus 36 citrus trees were planted at planter bag. Observed variables consist of flowering and fruiting components. The research shows that the application of 50 g/plant potassium nitrate provided the fastest flowering, the highest number of flowers and fruit, but the lowest fruit drop. Simultaneously, the application of 40 g/plant agrodyke showed the fastest flowering, the highest number of flowers and fruit, but the lowest fruit drop.

INTRODUCTION

Citrus is an essential fruit crop because it is planted in more than 140 countries worldwide. This fruit is known as a good source of vitamin C offering essential functions in enhancing immune systems [1]. A balanced and good immune system of our body is required these days, particularly during the Covid-19 pandemic. Additionally, vitamin C is able to reduce the risk of cancer and cardiovascular diseases [2]. Citrus fruit can be consumed as fresh fruit or as processed food such as juice or smoothies, jam, and candy [3]. Numerous citrus species are planted worldwide; one of them is *Citrus reticulata* Blanco.

Flowering must occur prior to citrus fruit production. Numerous factors influence citrus plants' flowering. However, citrus trees require drought stress numerous times to induce flowering [4]. Frequently, obtaining sufficient drought stress conditions is challenging, particularly during the wet season. To promote or enhance the flowering process, the necessary treatments should be administered. One of them is fertilization, which increases nutrient availability to enable citrus fruit growth and development at their optimal levels [5].

Appropriate fertilization has been shown to increase the availability of nutrients in the soil [6,7]. Potassium nitrate application can improve the number of flowering branches, panicles, and fruit output [8]. Because agrodyke is an organic fertilizer, it can help improve the soil's properties and citrus yield [9]. This research aims to determine the effect of potassium nitrate and agrodyke on *C. reticulata* Blanco flowering and fruiting.

MATERIAL AND METHODS

Citrus reticulata Blanco trees three years old were used in the research (size of 50 l media). It was conducted from April to October 2021 at the Faculty of Agriculture's Experimental Farm in Purwokerto, Central Java. This area is approximately 113 m asl. The planter bag and its citrus plant were placed in homogenous conditions on open land.

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All citrus plants receive the same amount of rain and sunlight. At a local meteorological station, the average daily sunshine was seven hours, the average rainfall was 146 mm/month, and the average air temperature ranged between 22 and 36ºC.

This factorial experiment with a 3x3 factorial design was conducted using a Completely Randomized Design. Two factors were observed, namely potassium nitrate doses and agrodyke doses. Potassium nitrate doses are 0, 25, and 50 g/plant, whereas agrodyke amounts are 0, 20, and 40 g/plant. Each treatment was repeated four times, resulting in 36 citrus trees. All citrus trees were grown using the same technique.

Components of flowering and fruiting were observed. The flowering components are when the first flower appears, the number of flowers, and the flower drop, whereas the fruiting components are the number of fruit, fruiset, and fruit drop. Analysis of variance was used to analyze the data (ANOVA). Duncan's Multiple Range Test was used to separate means following ANOVA at p=0.05.

RESULT AND DISCUSSION

Effect of potassium nitrate application

According to Table 1, potassium nitrate 50 g/plant accelerated the appearance of the first blossom compared to other treatments. This indicates that the water content of the soil is insufficient to create the conditions necessary for citrus plants to flower. The same treatment also produces the most flowers. This result contrasted with that reported by Astiari, who reported that application of potassium nitrate 40 g/plant resulted in the highest yield compared to no potassium nitrate application [9].

Citrus plants treated with 50 g/plant potassium nitrate produced the most fruit (60.2), an increase of 28.6 and 336% over plants treated with 25 and 0 g/plant potassium nitrate, respectively. The application of potassium nitrate 50 g/plant, as shown in Table 2, resulted in the lowest fruit drop (5.3 %), 64 % less than the fruit drop caused by potassium nitrate 25 and 0 g/plant applications. The same result was recorded for potassium nitrate application in the "off-year" of Zebda [10], mango [11,12].

Effect of agrodyke application

As shown in Table 1, the application of 40 g/plant accelerated the blossoming process, the first flower appeared 50.2 days after treatment (dai), as compared to other treatments. Additionally, such treatment resulted in the maximum flower count (86.1), an increase of 45 and 276% over the value obtained with agrodyke doses of 20 and 0 g/plant, respectively.

TABLE 1. Effect of potassium nitrate and agrodyke application on flowering

Potassium nitrate doses (g/plant)	The appearing time for first flower (days after application of treatment)	Number of flower	Flower drop (%)
0	82,6 a	20.6 c	32,8 a
25	66,8 b	68.8 b	34,3 a
50	50.0 c	92.2 a	35,3 a
Agrodyke doses (g/plant)			
0	81.2 a	22.9 c	43,9 a
20	68.8 b	59.2 b	44,7 a
40	50.2 c	86.1 a	46,3 a

Note: The numbers followed by the same letter at the same column and treatment were not significantly different at DMRT p= 0.05

Agrodyke 40 g/plant application resulted in the maximum number of fruit (49.2), an increase of 50 and 290% above the quantity of fruit obtained with agrodyke 20 and 0 g/plant doses, respectively. The same treatment, as shown in Table 2, decreased fruit drop to 6%, the lowest rate of fruit loss among all treatments. Agrodyke 30 g/plant resulted in the maximum citrus yield [13].

TABLE 2. Effect of doses of potassium nitrate and agrodyke on fruiting

Potassium nitrate doses (g/plant)	Number of fruit	Fruitset (%)	Fruit drop (%)
0	13,8 c	67.0 a	14.8 a
25	46,8 b	68.8 a	14.3 a
50	60.2 a	65.3 a	5.3 b
Agrodyke doses (g/plant)			
0	12.6 c	54.9 a	14.9 a
20	32,8 b	55.4 a	14.7 a
40	49.2 a	56,1 a	6,3 b

Note: The numbers followed by the same letter at the same column and treatment were not significantly different at DMRT p= 0.05

CONCLUSION

The research results indicate that administration of 50 g potassium nitrate per plant resulted in the quickest flowering (50.0 days), the most significant number of flowers and fruits, but the lowest fruit drop. The application of 40 g/plant agrodyke resulted in the quickest flowering (50.2 days), the most flowers and fruit, but the lowest fruit drop.

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