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Growth and yield response of Watani Wado job's tears (*Coix lacryma-jobi* L.) to the application frequency of phosphate fertilizer and paclobutrazol in different growing seasons

Abstract. Job's tears (*Coix lacryma-jobi* L.) is a carbohydrate source functional food crop that can be developed as a substitute for rice. This study aims to determine the best application frequency of phosphate (P) fertilizer and paclobutrazol for supporting the growth and yield of job's tears in both rainy and dry seasons. The research was conducted from November 2021 - November 2022 at the Ciparanje research station and Laboratory Centre Universitas Padjadjaran, Jatinangor, Sumedang. The experiment used a randomized block design (RBD) consisting of P fertilizer application frequency (once, twice, and thrice) and paclobutrazol application frequency (once, twice, and thrice) and three replications.. The best season was determined using the T-test. The results showed that there was no interaction between growth components and job's tears yield in both rainy and dry season planting. P fertilizer application had a significant effect on lateral branch per tiller in the rainy season and root-shoot ratio in the dry season. Paclobutrazol application had a significant effect on the number of tillers per plant and number of seeds per plant in the rainy season, and the lateral branch per tiller in the dry season. Planting in the rainy season had the best growth and yield components compared to the dry season.

Keywords: Dry season · Job's Tears · P Fertilizer · Paclobutrazol · Rainy season

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Introduction

Job's tears (*Coix lacryma-jobi* L.) is a crop that can be developed for the substitution of rice from paddy as a food source of carbohydrates (Nurmala et al., 2018). Besides being a substitute for food crops, a variety of processed foods, and industries in several Asian countries, job's tears have other advantages compared to other cereals, including the content of a compound of highly flavonoid and glycosides which useful for health (Nurmala, 2011). Job's tears is also a source component bio-actives that have activity as an antioxidant, anticancer, hypolipidemic, and anti-inflammatory (Xi et al., 2016). Therefore, the seeds of job's tears can be used as material food to cope with diabetes, kidney, liver, and lung cancer.

One of the extensively cultivated varieties of Job's tears in Indonesia is mayuen. The mayuen variety has a soft seed shell and is commonly used as cereals (Handayani et al., 2019). One of the local cultivars of the mayuen variety is Watani Wado, which is developed in Sumedang. This cultivar has a significant advantage since it has a high tolerance to drought. Drought can often affect the plant's ability to perform photosynthesis, leading to grain-filling problems. Therefore, this cultivar is highly suitable for dry seasons (Wicaksono et al., 2022). The yield of a job's tears reported fluctuates depending on the season and technique of cultivation. As reported by Ruminta et al., (2018), the rainy season gave a higher yield compared to the dry season.

Job's tears are an indeterminate plant (Nurmala, 2011). This plant has high vegetative growth but low generative ones, so it affects the harvest index (Septian et al., 2023). Job's tears required intensive cultivation techniques to maximize growth and increase reproductive development. One way to increase the yield of job's tears is by fertilizing and administering plant growth retardant.

According to Fahmi et al. (2009), P fertilizer plays a role in improving the quality and yield of job's tears plants. Hütsch et al., (2023) reported that paclobutrazol can inhibit plant vegetative growth and maximize the rate of assimilation so that it can increase the harvest index. The expected effect of these two treatments is an interaction. The use of paclobutrazol can inhibit vegetative growth, so that P fertilizer can be directly absorbed in the generative phase and the need for P fertilizer is lower. As reported by Zulfaniah et al. (2020), giving P fertilizer accompanied by paclobutrazol at the right time and dose can optimize soybean crop yields. This study aims to determine the best application frequency of phosphate (P) fertilizer and paclobutrazol for supporting the growth and yield of job's tears in both rainy and dry seasons.

Materials and Methods

This research was conducted from November 2021 at the Experimental Field Faculty of Agriculture and Laboratory Centre of Universitas Padjadjaran, Jatinangor, Sumedang Regency, West Java. The altitude of the research location was 750 m above sea level, with the climate type C3 according to Oldman's classification. Analysis of nutrient content carried out in the Laboratory Centre of Universitas Padjadjaran.

The tools that were used for this research included a meter gauge, analytical scale with 0.01-gram accuracy, writing tools, oven, Kjeldahl flask, boiling flask, Soxhlet's tools, and exicator. and a camera. The materials that were used included the seeds of job's tears var. mayuen, NPK 16-16-16 fertilizer, SP-36 fertilizer (36% P), plant growth regulator of paclobutrazol, and Profenos insecticide.

This research was carried out using the method randomized block design two factorial on two season planting consisting of 9 treatments. The first factor is the frequency of P fertilizer application (p1=once of 240 g, p2=twice of 120 g, and p3=thrice of 80 g) with the number of the same dose of 200 kg/ha on 12, 14, and 16 weeks after planting (WAP). The second factor is the frequency of paclobutrazol application (z1=once, z2=twice, and z3=thrice) with a dose of 2000 ppm on 13, 15, and 17 WAP. All treatments were repeated three times, so there were 27 plots. Concerning analysis of characteristic chemistry, there was a method of augmented design (without design trial).

The plots were 4.5 m width and 5 m length. Plant spacing was 60 cm x 40cm. Experimental plots were fertilized with manure at a dose of 2 tons/ha a week before planting. Well-sprouted and healthy job's tears were planted in a hole with 3 cm depth and covered

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by soil. The application of NPK according to treatment was given gradually over two times at 4 and 6 WAP by side dressing. P fertilizer treatment was given gradually over three times at 12, 14, and 16 WAP. Paclobutrazol treatment was applied to the plant gradually over three times at 13 (early flowering stage), 15, and 17 WAP. Plant cultivation included watering, weeding, pest, and disease control. Job's tears are harvested 165 days after planting (DAP), or when the seed reaches physiological maturity. Dry and yellowish leaves on the plant physically suggested that seeds were ready to be harvested.

Parameters observed in this experiment are plant height, number of tillers per plant, leaf area index, root shoot ratio, lateral branch per tiller, 100 grain weight, and harvest index. Plant height was measured from the level of ground surface to the tip of main stem using roll mater at 80% flowering before harvest. The number of tillers per plant was recorded by counting the tillers at 13, 15, and 17 WAP (reproductive stage). Leaf area was calculated using the regression equation method for job's tears y = 0.227 + 0.683 (width x length), (R2 = 94,5%) at vegetative stage. Root shoot ratio obtained by comparing the dry weight of shoot with the dry weight root plant after harvest. 100 grain weight was measured after harvest using an analytical scale. The harvest index is calculated using the Sitompul and Guritno (1995) formula, which is the crop yield (seeds) divided by the total dry weight of the plant.

Data collected were subjected to analysis of variance (ANOVA) procedures for randomized block design factorial and where treatment means were significant, they were separated using Duncan's test at 5% level of probability using SmartstatXL statistical software.

Result and Discussion

Plant height. The result of statistical data analysis in Table 1 showed that there was no interaction between the application frequency of P fertilizer and paclobutrazol on plant height at 13 WAP, 15 WAP, and 17 WAP. Single effect application frequency of P fertilizer and paclobutrazol did not affect the plant height of job's tears in both rainy and drought season.

There was no significant difference in plant height after the application frequency of P fertilizer and paclobutrazol. This phenomenon appears to be attributed to genetic factors. Plant growth is influenced by two main factors: genetic and environmental factors (Mahdiannoor & Istiqomah, 2015). The specified environmental factors, namely paclobutrazol and phosphorus fertilizer, did not exhibit a discernible influence on plant height in each treatment. Consequently, genetic factors are deemed more dominant in shaping plant height.

Table 1. Single effect of different frequency of P fertilizer and paclobutrazol on plant height in rainy and dry seasons

Treatment	**Plant height** (cm)		
	Rainy Season*		
	13 WAP	15 WAP	17 WAP
p1	209.46 a	258.70 a	273.17 a
p2	203.06 a	249.44 a	269.54 a
p3	201.58 a	247.14 a	270.39 a
z1	206.99 a	255.94 a	275.63 a
z2	202.09 a	244.61 a	268.03 a
z3	200.68 a	254.73 a	269.43 a
Treatment	Dry Season		
	13 WAP	15 WAP	17 WAP
p1	202.51 a	205.42 a	209.58 a
p2	200.82 a	203.80 a	209.53 a
p3	204.27 a	206.27 a	214.96 a
z1	204.8 a	206.18 a	213.27 a
z2	204.49 a	206.42 a	212.49 a
z3	201.31 a	202.89 a	208.31 a

Description: The average value followed by the same letter is not significantly different based on Duncan's Multiple Range Test at 5% level. *=showing significant differences among seasons based on a T-test at a 5% level of significance. P fertilizer application frequency (p1=once, p2=twice, and p3=thrice). Paclobutrazol application frequency (z1=once, z2=twice, and z3=thrice).

Number of tillers per plant. The interaction between application frequency of P fertilizer and paclobutrazol had not a significant effect on numbers of tillers per plant (Table 2). Single effect of application frequency of P fertilizer and paclobutrazol also did not affect the number of tillers per plant, except for the treatment of paclobutrazol application frequency in rainy season.

Our hypothesis suggests that at the commencement of the growth phase, there was an ample supply of water, a balanced hormonal state, and sufficient nutrients, leading to a relatively uniform number of tillers per plant. Tiller formation is influenced by the content of

N, P, K, and Fe. Low levels of these nutrients result in reduced tiller production. Unlike P, N has a significant impact on the number of tillers, with its availability being the determining factor. Fulfilling the N content in the soil is crucial for achieving optimal tiller production (Ruminta et al., 2017). The application of paclobutrazol may be less targeted in each treatment due to the heat of the sun, causing the sprayed paclobutrazol to evaporate. According to Simanjuntak et al., (2013), improper timing and application methods resulted in paclobutrazol being less effective, thereby not affecting plant growth.

Table 2. Single effect of different frequency of P fertilizer and paclobutrazol on the number of tillers per plant in the rainy and dry seasons

Treatment	Number of tillers per plant		
	Rainy Season *		
	13 WAP	15 WAP	17 WAP
p1	6.89 a	8.02 a	8.24 a
p2	7.8 a	7.84 a	8.29 a
p3	7.11 a	7.18 a	7.4 a
z1	6.58 a	7.16 a	7.38 b
z2	6.89 a	7.33 a	7.42 b
z3	6.83 a	8.56 a	9.13 a
Treatment	Dry Season		
	13 WAP	15 WAP	17 WAP
p1	5.71 a	5.82 a	5.6 a
p2	5.09 a	5.8 a	5.31 a
p3	5.38 a	5.09 a	5.16 a
z1	5.4 a	5.58 a	5.11 a
z2	5.31 a	5.56 a	5.4 a
z3	5.47 a	5.58 a	5.56 a

Description: The average value followed by the same letter is not significantly different based on Duncan's Multiple Range Test at 5% level.*=showing significant differences among seasons based on a T-test at a 5% level of significance. P fertilizer application frequency (p1=once, p2=twice, and p3=thrice). Paclobutrazol application frequency (z1=once, z2=twice, and z3=thrice).

aLeaf Area Index. Leaf area index (LAI) is an important indicator reflecting the growth status of plant. Based on the result of the statistical data analysis in Table 3, showed that there was no interaction between the application frequency of P fertilizer and paclobutrazol on leaf area index. Single effect of application frequency of P fertilizer and paclobutrazol did not affect the leaf area index of job's tears. There was no significant difference in leaf area index after the application frequency of P and paclobutrazol, suggesting that the nutrient needs of the leaves were met while the concentration of paclobutrazol used was not appropriate.

Leaves as photosynthetic organs show that they are affected by P fertilization. The adequate of P will increase nitrogenase activity, and leaf photosynthesis, which increases the growth of plant leaf area and plants can produce more dry matter (Cha et al., 2023). Paclobutrazol significantly reduced plant height and leaf area but increased the leaf area index. Reduced photosynthetic rates were recorded with the treated plants as compared to the control plants ((Roseli et al., 2012). The optimal range of leaf area index values for crop plants is 3-5 (Ruminta et al., 2019). In the rainy season planting, the average leaf area index in each treatment was above 3. Therefore, the leaf area index in this experiment was quite good.

Table 3. Single effect of different frequency of P fertilizer and paclobutrazol on leaf area index, root-shoot ratio, and number of shoots per tiller in job's tears planting in rainy and dry seasons

Treatment	Rainy		
	Leaf Area Index*	Root -shoot Ratio	Lateral Branch per Tiller*
p1	3.56 a	3.72 a	7.93 a
p2	3.69 a	3.8 a	8.07 a
p3	3.71 a	3.8 a	7.12 b
z1	3.64 a	3.86 a	7.81 a
z2	3.73 a	3.82 a	7.62 a
z3	3.58 a	3.63 a	7.68 a
Treatment	Dry Season		
	Leaf Area Index	Root -shoot Ratio	Lateral Branch per Tiller
p1	2.96 a	3.39 b	6.53 a
p2	2.91 a	3.86 a	6.6 a
p3	3.17 a	3.56 ab	6.46 a
z1	2.99 a	3.47 a	6.86 a
z2	2.99 a	3.68 a	6.53 ab
z3	3.05 a	3.66 a	6.2 b

Description: The average value followed by the same letter is not significantly different based on Duncan's Multiple Range Test at 5% level. *=showing significant differences among seasons based on a T-test at a 5% level of significance. P fertilizer application frequency (p1=once, p2=twice, and p3=thrice). Paclobutrazol application frequency (z1=once, z2=twice, and z3=thrice).

Root-shoot Ratio. Table 3 showed that there was no interaction between the application frequency of P fertilizer and paclobutrazol on root-shoot ratio. Single effect of application frequency of P fertilizer and paclobutrazol also

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did not affect root-shoot ratio of job's tears. In the single treatment of P fertilizer application frequency, there was an effect on the root-shoot ratio in the dry season. Irwan et al. (2017), state that the recommended root-shoot ratio for cereal crops is 3. In this research, the root-shoot ratio that is higher than 3 is thought to be due to P fertilizer application and genetic response.

According to Lusiana (2020), a high uptake of P will increase the root-shoot ratio since P plays a crucial role in the formation of plant tissues such as nucleic acids and phospholipids. The positive impact on the above-ground portion of the plant, including leaf area and photosynthetic capacity per unit of leaf area, is influenced by the optimal availability of N and P (Luo et al., 2016). In addition to P fertilizer, paclobutrazol had no impact on root-shoot ratio. We assumed that genetic factors influence the result.

Root-shoot ratio in different growing seasons did not show different results. It is possible that the water factor does not affect the root-shoot ratio, because job's tears a plant that have high tolerance to environmental conditions. Therefore, the root-shoot ratio of job's tears can remain relatively stable or insignificant in variations in the growing season (Xi et al., 2016). Root-shoot ratio is also influenced by several factors such as plant variety, soil conditions, moisture, temperature, and other growth factors.

Lateral branch per tiller. The lateral branch per tiller did not exhibit any interaction after treatment. This can be attributed to the influence of plant genetic factors and environmental conditions. No significant differences were observed among single factors, except for the frequency of P fertilizer application in the rainy season and paclobutrazol application in the dry season. Environmental factors such as temperature, humidity, and soil conditions may influence the interaction between P fertilizer and paclobutrazol. If these conditions are not optimal for the absorption and influence of these substances on plants, the interaction may not be effective (Kamran et al., 2018).

The frequency of P fertilizer application during the rainy season had a significant impact on the lateral branches per tiller. The number was higher when P fertilizer was applied twice compared to other treatments. However, in the dry season, the frequency of P fertilizer application did not have a significant effect. This could be attributed to water scarcity, which inhibits the growth and formation of shoots in job's tears plants. Water scarcity can disrupt cellular functions and negatively affect growth. During the rainy season, a single treatment of paclobutrazol did not significantly impact the lateral branches per tiller, but it had a significant effect during the dry season. The most effective method was to use paclobutrazol once, resulting in 6.86 lateral branch per tiller. In the rainy season, plants experience favorable environmental conditions, such as warmer temperatures, high humidity, and sufficient rainfall, which often lead to active growth and high levels of natural hormone production. Therefore, the use of paclobutrazol, which inhibits plant growth, may not have a significant effect in such conditions (Desta & Amare, 2021).

Table 4. Single effect of different frequency of P fertilizer and paclobutrazol on number spike per tillers

Treatment	Number of Spike per Tiller	
	Rainy* Season	Dry Season
p1	27.56 a	27.32 a
p2	31.04 a	25.53 a
p3	28.6 a	25.07 a
z1	28.58 a	27.99 a
z2	29.04 a	24.39 a
z3	29.58 a	25.54 a

Description: The average value followed by the same letter is not significantly different based on Duncan's Multiple Range Test at 5% level. *=showing significant differences among seasons based on a T-test at a 5% level of significance. P fertilizer application frequency (p1=once, p2=twice, and p3=thrice). Paclobutrazol application frequency (z1=once, z2=twice, and z3=thrice).

Number of Spikes per Tiller. Statistical analysis showed that there was no interaction between the application frequency of P fertilizer and paclobutrazol on number of spikes per tillers. The single effect of the application frequency of P fertilizer and paclobutrazol is presented in Table 4. The single application of P fertilizer did not show a significant effect on the number of spikes per tiller per plant during both rainy and dry seasons. Even during the dry season, P fertilizer may not dissolve due to the lack of water. This is due to the low rainfall, which caused the P fertilizer to not dissolve and be absorbed by the plants. Even during the dry season, P fertilizer may not dissolve due to the

lack of water. According to Acquaah (2005) cited in Ruminta et al. (2018), water plays a crucial role in soil as a solvent for further nutrients required for plant growth.

Treatment with paclobutrazol did not affect the number of spikes per tiller, regardless of whether the plants were grown in rainy or dry seasons (Table 4). The plant's ability to produce spikes is determined by the number of spikes and the groundwater status during the vegetative period, as well as the original photosynthate used for vegetative growth, which will later be utilized for generative growth (Watson, 2006). The availability of sufficient water during the vegetative phase affects relative shoot growth, resulting in a similar appearance (Nurmala et al., 2018).

Table 5. Single effect of different frequency of P fertilizer and paclobutrazol on number of seeds per plant

Treatment	Number of Seeds per Plant	
	Rainy* Season	Dry Season
p1	678.6 a	403.59 a
p2	744.94 a	357.09 a
p3	703.94 a	353.54 a
z1	648.86 b	379.85 a
z2	689.78 ab	369.98 a
z3	788.84 a	364.4 a

Description: The average value followed by the same letter is not significantly different based on Duncan's Multiple Range Test at 5% level. *=showing significant differences among seasons based on a T-test at a 5% level of significance. P fertilizer application frequency (p1=once, p2=twice, and p3=thrice). Paclobutrazol application frequency (z1=once, z2=twice, and z3=thrice).

Number of Seeds per Plant. There was no interaction effect between the application frequency of P fertilizer and paclobutrazol on the number of seeds per plant. Single effect application frequency of P fertilizer and paclobutrazol did not affect the number of seeds per plant job's tears on rain season and drought season (Table 5).

The addition of nutrients in this study did not show any significant differences in the character number of seeds per plant. We suspected that the presence of phosphorus is very crucial, and it required in large quantities to support grain formation. Phosphorus is a macro element required by plants for energy transfer, signal transduction, and enzyme activation (Wang et al., 2017). In cereal crops like wheat, a limited supply of phosphorus can decrease grain yields by restricting the number of productive tillers (El Mazlouzi et al., 2020). Climatic factors such as solar radiation, temperature, and rainfall significantly influence the germination and growth of job's tears seeds.

In addition to phosphorus fertilization, paclobutrazol did not exhibit a significant effect on the number of seed per plant, except during the rainy season. In the rainy season planting, the application of paclobutrazol three times resulted in the highest seed count per plant, reaching 788.84. This finding is consistent with the report by Xia et al., (2018), suggesting that the use of paclobutrazol during the rainy season, when vegetative plant growth tends to increase, can regulate growth, and facilitate more efficient allocation of plant resources and energy towards flower and seed formation.

Table 6. Single effect of different frequency of P fertilizer and paclobutrazol on 100 grains weight and harvest index

Treatment	Weight of 100 Grains		Harvest Index	
	Rainy*	Dry	Rainy*	Dry
p1	10.5 a	10,18 a	0.27 b	0.32 a
p2	10.79 a	9.73 a	0.29 b	0.32 a
p3	10.44 a	10.11 a	0.37 a	0.33 a
z1	10.31 a	9.91 a	0.29 a	0.29 a
z2	10.89 a	9.97 a	0.33 a	0.35 a
z3	10.53 a	10.14 a	0.31 a	0.33 a

Description: The average value followed by the same letter is not significantly different based on Duncan's Multiple Range Test at 5% level. *=showing significant differences among seasons based on a T-test at a 5% level of significance. P fertilizer application frequency (p1=once, p2=twice, and p3=thrice). paclobutrazol application frequency (z1=once, z2=twice, and z3=thrice).

Weight of 100 grains. The weight of 100 grains can be determined by weighing them using an analytical scale. Table 6 showed that there was no interaction between the application frequency of P fertilizer and paclobutrazol on weight of 100 grains. The weight of 100 grains was not significantly affected by the frequency of single P fertilizer application, in both the rainy and dry seasons. Phosphorus plays an important role in fruit and seed formation, and according to (Sitepu et al., 2015), the application of phosphorus fertilizer leads to differences in grain weight by increasing the availability of

sufficient assimilation, which leads to the accumulation of more stored food in the grains.

In addition to fertilization, paclobutrazol did not significantly affect the weight of 100 grains. It is hypothesized that abscisic acid and ethylene play a more crucial role in seed production compared to gibberellin. Therefore, paclobutrazol does not have a significant impact. However, Nurmala et al., (2018) reported that applying paclobutrazol at a concentration of 1000-2000 ppm can improve several growth and yield parameters in job's tears plants, including leaf area index, number of productive tillers, weight of 100 grains, harvest index, broken rice yield, and seed hardness.

Harvest Index. The harvest index is a comparison between the weight of economically valuable plant parts (seeds) and the total weight of the whole plant. Table 4 shows that the frequency of P fertilizer application has a significant effect on the yield index during the rainy season, but not during the dry season. This is likely due to the dry season causing insufficient water supply for plants and hindering the complete dissolution of P fertilizer. Applying P fertilizer three times during the rainy season leads to a higher harvest index compared to other frequencies. A high harvest index indicates efficient photosynthesis in plants, allowing for the translocation of nutrients to the organs intended for harvest (Ruminta et al., 2017). Phosphorus plays a crucial role in directing the outcomes of photosynthesis toward the generative organs of the plant, enhancing the harvest index (Irwan et al., 2017).

There was no significant effect on harvest index from the application of paclobutrazol. This lack of effect may be due to genetic factors, environmental influences, or improper application methods. As noted by Simanjuntak et al. (2013), incorrect timing and application methods can reduce the effectiveness of paclobutrazol. To ensure the effective application and impact of paclobutrazol, it is important to consider the plant's growth stage, weather conditions, and temperature, as noted by Simanjuntak et al. (2013).

Conclusion

1. There was no interaction between the application frequency of P fertilizer and paclobutrazol on the growth components and yield of Job's tears during both rainy and dry season plantings.
2. The twice P fertilizer application treatment significantly affect the number of lateral branches per tiller in rainy season and root-shoot ratio Job's tears in dry season. The thrice P fertilizer application significantly affect the harvest index of Job's tears in the rainy season. The thrice paclobutrazol application had a significant effect on the number of tillers per plant at the age of 17 WAP, the number of seeds per plant when planting in the rainy season, and the number of lateral branches per tiller when planting in the dry season.
3. Planting job's tears in rainy season gave higher growth and yield performance rather than the dry season, except the root-shoot ratio character.

Daftar Pustaka

Cha JY, Lee SC, Lee EJ, Lee K, Lee H, Kim HS, Ahn J, Oh NH. 2023. Canopy leaching rather than desorption of PM2.5 from leaves is the dominant source of throughfall dissolved organic carbon in forest. Geophysical Research Letters, 50(17): 1–9. https://doi.org/10.1029/2023GL103731

Desta B, Amare G. 2021. Paclobutrazol as a plant growth regulator. Chemical and Biological Technologies in Agriculture, 8(1): 1–15. https://doi.org/10.1186/s40538-020-00199-z

El Mazlouzi M, Morel C, Chesseron C, Robert T, Mollier A. 2020. Contribution of external and internal Phosphorus sources to grain P loading in durum wheat (*Triticum durum* L.) grown under contrasting P levels. Frontiers in Plant Science, 11(June): 1–10. https://doi.org/10.3389/fpls.2020.00870

Fahmi A, Syamsudin, Utami SNH, Radjagukguk B. 2009. The role of Phosphorus fertilization on the growth of maize (*Zea mays* L.) in Regosol and Latosol soils. Berita Biologi, 9(6): 745–750.

Handayani F, Sumarmiyati, Rahayu SP. 2019. Morphological characterization of local jelai (Coix lacryma-jobi) in East Kalimantan. Proceeding of National Seminar on the Indonesian Biodiversity Society, 5(2): 228–

233. https://doi.org/10.13057/psnmbi/m050215

Hütsch BW, Kehm L, Schubert S. 2023. Does the plant growth regulator paclobutrazol enhance root growth of maize exposed to drought stress during flowering? Journal of Agronomy and Crop Science, 209(5): 673–688. https://doi.org/10.1111/jac.12646

Irwan AW, Nurmala T, Nira TD. 2017. The effect of different planting distances and various doses of chicken manure on the growth and yield of hanjeli pulut (Coix lacryma-jobi L.) plants in the Punclut highlands. Jurnal Kultivasi, 16(1): 233–245. https://doi.org/10.24198/kultivasi.v16i1.11719

Kamran M, Wennan S, Ahmad I, Xiangping M, Wenwen C, Xudong Z, Siwei M, Khan A, Qingfang H, Tiening L. 2018. Application of paclobutrazol affect maize grain yield by regulating root morphological and physiological characteristics under a semi-arid region. Scientific Reports, 8(1): 1–15. https://doi.org/10.1038/s41598-018-23166-z

Luo X, Mazer SJ, Guo H, Zhang N, Weiner J, Hu S. 2016. Nitrogen: Phosphorous supply ratio and allometry in five alpine plant species. Ecology and Evolution, 6(24): 8881–8892. https://doi.org/10.1002/ece3.2587

Lusiana. 2020. Effect of combination of N, P and K fertilizer doses on the growth and yield of red rice variety Inpari 24 (*Oryza nivara* L.). Jurnal Agrorektan, *7*(1).

Mahdiannoor, Istiqomah N. 2015. Growth and yield of two hybrid corn varieties as multi storey cropping under rubber stands. Ziraa'Ah, 40(1): 46–53.

Nurmala T. 2011. Potential and Prospects for Development of Hanjeli (Coix lacryma jobi L) as a Nutritious Food Rich in Fat to Support Food Diversification Towards Independent Food Security. Pangan, 20(1): 41–48. https://doi.org/https://doi.org/10.33964/jp.v20i1.10

Nurmala T, Wahyudin A, Ruminta. 2018. Growth response and yield of Hanjeli Batu (*Coix lacryma-jobi* L.) due to application of liquid silica fertilizer and paclobutrazol. Jurnal Kultivasi, 16(3): 474–481. https://doi.org/10.24198/kultivasi.v16i3.14298

Roseli ANM, Ying TF, Ramlan MF. 2012. Morphological and physiological response of *Syzygium myrtifolium* (Roxb.) Walp. to paclobutrazol. Sains Malaysiana, 41(10): 1187–1192.

Ruminta, Nurmala T, Irwan AW, Surbakti YA. 2019. Response of growth and yield of hanjeli plants (*Coix lacryma-jobi* L.) to a combination of plant distance and type of manure in the medium plains of Sukasari, Sumedang. Jurnal Kultivasi, 18(2): 903–911. https://doi.org/10.24198/kultivasi.v18i2.22436

Ruminta, Nurmala T, Yuwariah Y, Pratiwi NY. 2018. Growth response and yield of hanjeli plants in the early harvest due to the application of biosilica and paclobutrazol fertilizer doses in Jatinangor dry land. Jurnal Kultivasi, 17(3): 694–700. https://doi.org/10.24198/kultivasi.v17i3.18438

Ruminta, Yuwariah Y, Sabrina N. 2017. Growth and yield response of hanjeli plants (*Coix lacryma-jobi* L.) to planting distance and liquid complementary fertilizer. Agrikultura, 28(2): 82–89. https://doi.org/10.24198/agrikultura.v28i2.14958

Septian FI, Nurmala T, Wahyudin A, Wicaksono FY. 2023. Effect of NPK fertilizer dose and GA3 concentration on growth, yield, and yield quality of *Coix lacryma-jobi* L. var. ma-yuen from ratoons. Jurnal Kultivasi, *22*(1): 101–107. https://doi.org/10.24198/kultivasi.v22i1.37505

Simanjuntak NC, Bayu ES, Nuriadi I. 2013. Test the effectiveness of paclobutrazol on the growth balance of three peanut varieties (*Arachis hypogaea* L.). Jurnal Online Agroekoteknologi, 62(13): 1–9.

Sitepu L, Zuhry E, Nurbaiti. 2015. Application of several doses of phosphorus fertilizer for growth and production of several sorghum varieties. JOM Faperta, 2: 1–12.

Sitompul SM, Guritno B. 1995. Analisis pertumbuhan tanaman. Gadjah Mada University Press. Yogyakarta.

Wang D, Lv S, Jiang P, Li Y. 2017. Roles, regulation, and agricultural application of plant phosphate transporters. Frontiers in Plant Science, 8(May): 1–14. https://doi.org/10.3389/fpls.2017.00817

Watson GW. 2006. The effect of paclobutrazol

treatment on starch content, mycorrhizal colonization, and fine root density of white oaks (*Quercus alba* L.). Arboriculture and Urban Forestry, 32(3): 114–117. https://doi.org/10.48044/jauf.2006.015

Wicaksono FY, Suganda TW, Ruminta, Sinniah UR, Yuwariah Y, Nurmala T. 2022. Short Communication: Preharvest drought stress varies grain physical characteristics, milling percentage, and nutritional quality of two Job's tears varieties. Biodiversitas, 23(3): 1443–1448. https://doi.org/10.13057/biodiv/d230331

Xi XJ, Zhu YG, Tong YP, Yang XL, Tang NN, Ma SM, Li S, Cheng Z. 2016. Assessment of the genetic diversity of different job's tears (*Coix lacryma-jobi* L.) accessions and the active composition and anticancer effect of its seed oil. PLoS ONE, 11(4): 1–22. https://doi.org/10.1371/journal.pone.0153269

Xia X, Tang Y, Wei M, Zhao D. 2018. Effect of paclobutrazol application on plant photosynthetic performance and leaf greenness of herbaceous peony. MDPI. https://doi.org/10.3390/horticulturae4010005

Zulfaniah S, Darmawati A, Anwar S. 2020. Effect of P fertilization dosage and paclobutrazol concentration on edamame soybean growth and production (*Glycine max* (L.) Merrill). NICHE Journal of Tropical Biology, 3(1): 8–17. https://ejournal2.undip.ac.id/index.php/niche