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The Effect of Plant Growth Regulator to Yield of Job's Tear (*Coix lacryma-jobi* L.) in Sumedang Indonesia

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Abstract: ***Job's tear is a cereal plant that can be used as food and feed with high contains of protein, fat, and vitamins. Productivity of job's tears need to be developed and improved through the adjustment of the genoypes and cultivation techniques. The objective of this research were to select the genotypes of job's tear with high yield, and to study the interaction effect of genotypes with the plant growth regulator application to yield. The experiment was conducted from June 2014-February 2015 in Rancakalong Sumedang Indonesia. The experimental design used in this research was factorial randomized block design with four replications. The first factor was six genotypes of job's tear and the second factor was plant growth regulator application (gibberelins and paclobutrazol). The differences among treatment means were compared using Least Significant Difference (LSD) test at 5% probability level. The result showed that was the interaction effect between application of gibberellins and paclobutrazol with six genotypes of job's tear on seeds weight per hill, seeds weight plot, seeds weight per ha, and harvest index. The best genotype of job's tear was G38 with the highest yield reached 4.09 tons ha^{-1} which was treated with giberellins and paclobutrazol 12 ml L^{-1}.***

Keywords: Job's tear, genotype, yield, gibberellins and paclobutrazol

1. Introduction

Job's tear *(Coix Lacryma*-jobi L.*)* is a plant of the family gramineae that can be used as food and feed. Job's tear contains protein, fat, and vitamins higher than other cerealia crops which had long been grown in Indonesia such as sorghum, oats, buckwheat and millet. Job's tear turns potential and grow uniformly almost all provinces in Indonesia. Maintenance and planting easier, in terms of nutritional content is not inferior to rice [1], [2], [3]. Different parts of coix (hull, bran, testa, endosperm, and seed) contain a range of chemical components. The major component of the seeds is starch with an A-type polymorph and granule size of ~27−36 μm. Normal and waxy genotypes with amylose contents of 0 to 27% were noted [4].

Qosim and Nurmala [5] reported that the study of exploration, identification and analysis of genetic diversity Job's tear in five districts in West Java, the results showed that there were 41 germplasm Job's tear based on morphological characters in situ. The diversity of germplasm need to be preserved, one effort to utilize seed Job's tear as nutritious food using the 6 genotypes Job's tear indigenous selected and regions of origin, namely genotypes 9 of Tanjungjaya, genotypes 26 of Wado, genotypes 37 of Cilengkrang, genotypes 38 of Ciparay, genotypes 44 Punclut and genotyping of 45 of Garut.

One of the main roles of gibberellins in plant is the stimulation of cell clongation. When gibberellin production is inhibited, cell division still occurs, but the new cell do not clongate, resulting in stems with the same number of leaves and shorter internodes [6]. Gibberellins can be effectively used in controlling lodging problems in grain crops. There is still a vast scope for generating new knowledge through the use of plant growth retardants regulate crop heights per unit area, minimize stresses, secure assured water supply, conserve plant germplasm, and cultivate plants that yield products of high economic returns [7]. Expression correlated endogenous GA1 content with GA3 treatment, which stimulated cell division and ovary growth, mostly in *C. Clementina*, instead, paclobutrazol (GA biosynthesis inhibitor) negated cell division and reduced fruit set [8].

Paclobutrazol as potent specific inhibitor of GA3 biosynthesis. Paclobutrazol slightly decreased the length of the shoots and Leaf area reduction by paclobutrazol was reported and increased total leaf chlorophyll content. Paclobutrazol has been reported to increase yield of fruit trees [9]. Shuiji et al. [10] stated that the appropriate time of paclobutrazol application can reduce canola plant height. The results indicated that the plant height was reduced by 27% with paclobutrazol applied at 10 cm stalk height. The seed yield was significantly improved by mean increment of 21%. A reduction in Gibberellin levels by Paclobutrazol appears to prevent Pre maturity amylase in the susceptible wheat genotype Rialto [11]. Paclobutrazol can inhibit cell elongation and elongation of stem segments by inhibiting the biosynthesis of gibberellins so the plants become shorter. Paclobutrazol can also inhibit / shortening rate of vegetative growth that assimilates directed against the grain filling, which can ultimately shorten the life of crops Job's tear [12].

The objective of this research was to study the effect of gibberellin and paclobutrazol application to increase the yield of six genotypes Job's tear.

2. Materials and Methods

The experiment was conducted on dry land farmers as production centers are in locations Rancakalong Sumedang Indonesia, with altitude of 850 m above sea level and the order of land in three locations is Inceptisols. The experiment was conducted from June 2014-February 2015. The materials used in these experiments are six indigenous genotypes Job's tear seed as a collection of the Laboratory of Production and Plant Breeding, Faculty of Agriculture Padjadjaran: G9, G26, G37, G38, G44 and G45 and plant growth regulator (PGR) : gibberelins and paclobutrazol. The experiment method using a factorial randomized block design (FRBD) with two factors, the first factor PGR concentration with three levels (0 ml /L, 6 ml/L, and 12 ml/L) and factor 2 with 6 genotypes Job's tear (G9, G26, G37, G38, G44, and G45) that was repeated four times. There were 18 treatment combinations of PGR and genotypes Job's tear randomly placed in experimental plots 3x4m. All other agronomic practices were used according to local recommendations and kept normal and uniform for all the treatments. The screened Coix grains were hydro-primed for 12 h and incubated for 6 h before sowing. Pre-germinated seeds were sown on the medium plates. After four days, the shootings were transferred to the experiment field. The observed variables were 100-seed weight, number of seeds per hill, seed weight per hill, seed weight per plot, weight of seed per hectare, and the harvest index. The data were statistically analyzed according to the method appropriate for FRBD using software SPSS version 16. The differences among treatment means were compared using Least Significant Difference (LSD) test at 5% probability level.

3. Results and Discussions

Results of analysis of variance no interaction between genotypes combination gibberellin and paclobutrazol on 100-seed weight and number of seeds per hill. Results of analysis of variance there was interaction between the genotypes and the combination gibberellin and paclobutrazol on seed weight per hill, seed weight per plot, weight of seed per hectare, and the harvest index.

Qosim and Nurmala [5] reported that weight of 100 seeds of job's tear based on general description of 6.5-7.5 g, whereas when compared with result of research above average that is equal to 11.78-13.27 g. Merlyn and Hamdani [13] described that paclobutrazol may inhibit giberelin biosynthesis in potato plants. The inhibitory process occurs in a sub-apical meristem by inhibiting the oxidation of ent-chlorine into the ent-chlorinoid acid which is a precursor of gibberellin formation. Inhibition of gibberellin production will decrease the rate of elongation and cell division, so that root growth is reduced. More seed yields are determined by the optimum conditions of the plant growth phase such as flowering period, seed filling, maturation and cooking. The process is related to the total leaf area at the flowering phase which may affect the availability of photosynthesis in panicles. The percentage of seeds ruptured in each genotype shows no significant difference. The percentage of seeds ruptured on the activities of photosynthesis during the reproductive phase of the plant. Gardner et al. [14] suggested that for the filling of seeds, the genotype and the treated gibberellins.

Table 1: Independent Effects of Different Genotypes with Gibberellin and Paclobutrazol Concentrations on weight of 100 seeds and number of seeds per hill

Treatment of Genotype (G)	Weight of 100 seeds	Number of seeds per hill
G9	12,68 a	859,17 a
G26	12,45 a	953,12 a
G37	13,27 a	979,24 a
G38	11,78 a	1042,05 a
G44	12,82 a	912,99 a
G45	11,96 a	1087,30 a
Treatment of Gibberellin and Paclobutrazol (z)		
z0	12,36 a	971,39 a
z1	12,32 a	1019,14 a
z2	12,80 a	926,41 a

Description: The average value followed by Duncan Multiple Range Test at 5% level.

The result of variance analysis of interaction between genotype and combination of gibberellin and paclobutrazol on seed weight per hill, seed weight per plot, weight of seed per hectare and on harvest index showed in Table 2, Table 3, and Table 4.

Table 2: The effect of gibberellin and paclobutrazol (GPR) application to seed weight per hill of Job's tear

Genotype\PGR	0 ml/L		6 ml/L		12 ml/L	
G9	116.40	a	150.09	a	194.97	ab
	A		A		B	
G26	150.42	a	181.94	ab	152.54	a
	A		A		A	
G37	150.54	a	185.80	ab	177.95	ab
	A		A		A	
G38	140.06	a	205.49	b	245.67	c
	A		B		B	
G44	161.17	a	195.48	ab	187.53	ab
	A		A		A	
G45	146.18	a	180.39	ab	214.52	bc
	A		AB		B	

Description: The average number followed by lowercase letters (the vertical direction) and a capital letter (the horizontal direction) of the same not significant according to Duncan's Multiple Range Test at the 5% significance level.

Based on Table 2, 3 and 4, that the influence of the six indigenous genotypes Job's tear and treatment combinations of paclobutrazol and gibberellin significance lies with genotypes 38 amounted to 245.67 kg; 3.75 g; and amounted to 4.09 tons showed the greatest results at the level of treatment 12 ml/L against the grain weight per panicle, per plot and per hectare. Factors to consider in the use of gibberellins and paclobutrazol among other phase of the plant, concentration and dosage, route of administration, part of which was given, species and cultivar and environmental factors that affect the growth of plants in order to provide effective results [15].

Table 3: The effect of gibberellin and paclobutrazol (GPR) application to seed weight per ha of Job's tear

Genotype\GPR	0 ml/L		6 ml/L		12 ml/L	
G9	1.98	a	2.50	a	3.25	b
	A		A		B	
G26	2.51	a	3.06	ab	2.48	a
	A		A		A	
G37	2.51	a	3.10	ab	2.97	ab
	A		A		A	
G38	2.33	a	3.42	c	4.09	c
	A		B		B	
G44	2.69	a	3.26	c	3.13	ab
	A		A		A	
G45	2.44	a	3.03	ab	3.58	bc
	A		AB		B	

Description: The average number followed by lowercase letters (the vertical direction) and a capital letter (the horizontal direction) of the same not significant according to Duncan's Multiple Range Test at the 5% significance level.

Table 4: The effect of gibberellin and paclobutrazol (GPR) application to harvest index of Job's tear

Genotype\GPR	0 ml/L		6 ml/L		12 ml/L	
G9	0,32	a	0,20	a	0,34	a
	AB		A		B	
G26	0,26	a	0,35	b	0,45	a
	A		AB		B	
G37	0,31	a	0,43	b	0,41	a
	A		B		AB	
G38	0,29	a	0,33	b	0,42	**a**
	A		AB		B	
G44	0,21	a	0,36	b	0,36	**a**
	A		B		B	
G45	0,48	b	0,45	b	0,40	**a**
	A		A		A	

Description: The average number followed by lowercase letters (the vertical direction) and a capital letter (the horizontal direction) of the same not significant according to Duncan's Multiple Range Test at the 5% significance level.

Results of analysis of variance showed there was interaction between the treatment and the administration of the combination giberelin paklobutrazol against various types of genotypes 45 (0,48 %). Table 4 shows the effect of treatment of each genotypes no significant difference in any combination of gibberellin and paklobutrazol. Gibberellin and paclobutrazol treatment against various types of genotypes Job's tear on his level provide a response to each harvest index of Job's tear. Plants with seed cultivation as Job's tear to increase grain yields are mainly due to increased harvest index. Plants are no longer producing total dry weight but more to divide the dry weight to grain yields [13]. Experiments showed the results of assimilation is widely used for the production of such high-growth vegetatip plant so that during filling seeds mostly the result of assimilation used for the process.

4. Conclusions

There was no interaction between the treatment of gibberellins and paclobutrazol with 6 indigenous genotypes Job's tear on 100-seed weight and number of seeds per hill. But there was interaction between the genotypes and the combination giberelin and paklobutrazol on seed weight per hill, seed weight per plot, weight of seed per hectare, and the harvest index. The best treatment of six genotypes and the concentration of gibberellins and paclobutrazol obtained in the treatment of genotypes 38 at a concentration of PGR 12 ml/L of the seed weight per hill, seed weight per plot and seed weight per hectare.

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