DOI : https://doi.org/10.36378/juatika.v3i2.1386
JUATIKA
JURNAL AGRONOMI TANAMAN TROPIKA
VOL.3 NO. 2 July 2021
eissn 2656-1727
pissn 2684-785X
Hal : 148 – 158

RESPONSE OF PAPAYA (Carica papaya L.) SEEDS GROWTH TO THE GIBBERELLIN (GA3) AND COW BIOURINE

Jhon Hardy Purba*, Nyoman Srilaba, Putu Sri Wahyuni, Putu Bayu Wahyuda
Fakultas Pertanian Universitas Panji Sakti, Jln. Bisma No. 22, Singaraja – Bali
*Email: jhon.purba@unipas.ac.id

ABSTRACT

Papaya propagation from seeds has a major problem, namely seeds germination take a relatively long time. Experiment to determine the effect of gibberellin and cow biourine concentrations on the growth of papaya seedlings were carried out at the Main Horticultural Seed Center of the Agriculture and Livestock Service Office of Buleleng Regency with an altitude of ± 200 m above sea level. The experiment used a factorial randomized block design consisting of two factors, namely the concentration of gibberellin and the concentration of bovine biourine. Application of gibberellin significantly affected plant height, root length, root wet weight, root oven dry weight, leaf wet weight, leaf oven dry weight, total fresh weight and total oven dry weight. Gibberellin with a concentration of 150 ppm gave the highest total fresh weight and oven dry weight, namely 14.63 g and 1.44 g respectively compared to other treatments. Concentration of cow biourine had a significant effect on root length, very significantly on plant height 40 dst and 47 dd, stem oven dry weight, leaf wet weight, leaf oven dry weight, total fresh weight, and total oven dry weight. Biourine with a concentration of 200 ml.l-1 gave the highest yield in total oven dry weight per plant, namely 1.19 g. The combination of the concentration of gibberellin and bovine biourine significantly affected the root length of the plant.**Keywords**: Cultivar, Upland Rice, Ultisol

INTRODUCTION

The main problem with papaya propagation from seed are the length of time it takes for the seeds to germinate and the low percentage of germination. In the preliminary germination test, from the 200 hybrid papaya seeds that were germinated, the result was <60% which could germinate normally with a germination time of ± 18 days after sowing (DAS). According to Monteiro et al. (2019), when it is dry, the seed growth inhibitor, namely sarcotesta, adheres to papaya seeds and is difficult to remove even if it is washed or soaked with water. This layer contains phenolic compounds. High oxygen consumption by phenolic compounds in the seed coat during the germination process can limit the supply of oxygen to the embryo, and can form a layer that interferes with the permeability of the seeds, and inhibits the effectiveness of entry of germination stimulating substances so that the seeds become dormant. Efforts that can be made to overcome this problem are by using a plant growth regulator. Gibberellins play a role in cell expansion and division, breakdown of seed dormancy so that seeds can germinate, mobilization of reserve endosperm during early embryo growth, breakdown of bud

dormancy, growth and extension of stems, flower and fruit development (Authors, 2021; Cao et al., 2020). According to (Parmila et al., 2019) the best Eusideroxylon zwageri seed germination rate was obtained by soak the seeds for 24 hours with a sodium nitrophenolate concentration of 0.3%. Cow biourine is a liquid organic fertilizer derived from cow urine which has previously been through a fermentation process involving the role of microorganisms. Fermentation is the activity of both aerobic and anaerobic microorganisms that are able to change or transform chemical compounds into organic substrates. Biourine contains microbes such as Rumino Bacillus (RB) and Azotobacter (AZBA). The application of liquid biological fertilizers significantly increased the growth and yield of shallots (Purba et al., 2020; Rohman et al., 2020).

Currently, biourine is an alternative to increase the availability, adequacy, and efficiency of nutrient absorption for plants containing microorganisms so as to reduce the use of inorganic fertilizers. The content of organic matter in biourine can improve soil physical, chemical and biological properties (Rohman et al., 2020). Organic matter plays a role in soil fertility, namely in the process of weathering rocks and in the process of decomposition of soil minerals, plant nutrient sources, forming stable nutrients, and having a direct effect on plant growth and roots. There were two isolates of endophytic bacteria that can be used as triggers for growth as well as can be used to suppress pathogen growth (Andriani & Oktafiyanto, 2019). The purpose of the study was determine the concentration of gibberellin, bovine biourine, and the combination of the two that can provide the best growth of papaya seeds.

MATERIALS AND METHODS

This research will be carried out at the Main Horticultural Seed Center of the Office of Agriculture and Livestock, Buleleng Regency, Bali with an altitude of ± 200 m above sea level. This research was conducted in May - July 2019 with an effective time of 60 days. The main ingredients to be used in this experiment include Callina papaya seeds (IPB-9), gibberellin, cow urine bio, sand and husks as planting media, NPK Phonska, polybags. While the tools used in this study were plastic tubs, measuring cups, meters, ovens, scales.

This research was a factorial experiment using a randomized block design (RBD) which consists of two factors. The first factor is the concentration of gibberellin which consists of four levels, namely 0 ppm (G0), 75 ppm (G1), 150 ppm (G2), and 300 ppm (G4). The second factor is the concentration of bovine biourine with four levels, namely 0 $ml.l^{-1}$ (B_0), 100 $ml.l^{-1}$ (B_1), 200 $ml.l^{-1}$ (B_2), 400 $ml.l^{-1}$ (B_4). The treatment was repeated three times.

Papaya seeds are soaked in warm water for 5 minutes, then dried and then given gibberellin according to the treatment and soaked within 48 hours. The seeds are planted according to the treatment in nursery tubs. Each nursery tub functions as 1 treatment. Each tub was sown with 100 papaya seeds. Sowing is done by attaching the pointy part of the seed to the bottom, then gently pressing it into the seeding medium, then covered with a thin sand.

The medium plant used in this experiment was a mixture of soil, husk, and bokashi with a ratio of 1: 1: 1. Mixing is done evenly and then put in a poly bag with a size of 10 cm x 12 cm. At 16 days after the seedlings were transplanted into the prepared polybags. The application of bovine biourine was carried out on 11 DAP plants then repeated every 1 week, by spraying it evenly on all parts of the plant according to the treatment.

Maintenance of seeds includes watering, weeding, fertilizing and controlling pests and diseases. Papaya seed fertilization is carried out at the age of 10 DAP. Fertilization is done by providing NPK phonska fertilizer of 10 g per plant. Observation of the variable growth of seedlings started from the age of 19 DAP, with 7 days intervals until the age of 47 DAP.

Data Analysis

Data were analyzed statistically with analysis of variance according to the design used. If one treatment had a

significant or very significant effect, the analysis was continued with the mean difference test with the LSD (Least Significant Difference) test at the 5% level. If the interaction between the gibberellin concentration and the application of biourin had a significant or very significant effect, then proceed with a 5% DMRT level using SPSS 20.

RESULTS AND DISCUSSION

Germination

Gibberellin with a concentration of 150 ppm (G2) gave the highest germination percentage, 87% until the 16th day after seeding. (Table 1).

Table 1. Effect of gibberellin concentration on germination

Treatment	Seed number	Number of seeds germinating (DAS)									Percen-tage
		8	9	10	11	12	13	14	15	16	(%)
G_0	100	4	11	39	52	64	67	72	75	77	77
G_1	100	2	10	40	51	59	64	70	74	75	75
G_2	100	3	13	46	61	73	80	84	87	87	87
G_4	100	3	10	36	49	60	66	72	76	79	79
Total	400	12	44	161	213	256	277	298	312	318	79.5

Plant height

The application of gibberellin has a significant effect on plant height at the age of 19 days, and very significant at the age of 26, 33, 40, and 47 DAP. The best plant height growth was given to gibberellin with a concentration of 150 ppm (G2). The effect of gibberellins from the beginning of the observation had shown clear evidence. The growth of plant height was fast due to its influence starting from the age of 33 to 47 dst observations (Figure 4). The application of gibberellin gave plant height at a concentration of 150 ppm at all ages of observation. Plant height at the age of 47 dast showed that by giving gibberellin concentration of 150 ppm (G2) it reached the highest plant height, namely 13.83 cm, or 11.41% significantly higher than without gibberellin (G0) (Table 2).

Biourine application had a very significant effect on plant height at the age of 40 DAP and 47 DAP, but had no significant effect at the ages of 19 DAP, 26 DAP, and 33 DAP (Table 2). The best plant height growth is given by giving biourine 200 ml.l-1 (B2). Giving biourine at a concentration of 200 ml.l-1 (B2) gave the highest plant height at all ages of observation. Plant height at the age of 47 DAP shows that the highest plant height occurs at B2, namely 13.05 cm. The complete effect of biourine concentration on plant height is presented in Table 2. The interaction of gibberellin and biourine had no significant effect on plant height at the age of 19 DAP, 26 DAP, 33 DAP, 40 DAP, and 47 DAP (Table 2).

Table 2. Effect of gibberellin and biourine on plant height

Treatment	Plant height (cm)									
	19		26		33		40		47	
Gibberellin:										
0 ppm (G_0)	6,02	b	7,38	b	8,30	b	10,55	c	12,42	c
75 ppm (G_1)	6,19	ab	7,42	b	8,53	a	10,95	b	12,63	b
150 ppm (G_2)	6,34	a	7,63	a	8,66	a	11,76	a	13,83	a
300 ppm (G_4)	5,94	b	7,08	c	8,08	c	10,51	c	12,45	bc
LSD 5%	0,28		0,19		0,15		0,20		0,18	
Biourine:										
0 $ml.l^{-1}$ (B_0)	6,30	a	7,31	a	8,48	a	10,68	b	12,63	c
100 $ml.l^{-1}$ (B_1)	6,03	a	7,35	a	8,31	a	10,93	a	12,74	bc
200 $ml.l^{-1}$ (B_2)	6,19	a	7,48	a	8,43	a	11,11	a	13,05	a
400 $ml.l^{-1}$ (B_4)	5,98	a	7,35	a	8,36	a	11,05	a	12,92	ab
LSD 5%	-		-		-		0,20		0,18	

The numbers followed by the same letter in the same column mean that they are not significantly different in the 5% LSD test

Root length

The interaction of gibberellin and biourine has a significant effect on root length. The interaction between gibberellin and biourine shows that gibberellin concentrations of 0–75 ppm have a negative effect on biourine concentrations. The concentration of gibberellin 75 ppm - 150 ppm with the concentration of biourine initially has a positive effect, then a negative effect occurs (Figure 1). The effect of the interaction between gibberellin and biourine are the best given to the combination treatment of gibberellin with a concentration of 150 ppm and a concentration of 200 ml.l-1 (G2B2) which gives the longest root length, which is 22.0 cm, or 41.03% longer when compared without gibberellin and biourine (G0B0) (Table 3).

Table 3. Interaction of application of gibberellin and biourine on root length

Treatment	Biourine							
	0 ml.l^{-1} (B_0)		100 ml.l^{-1} (B_1)		200 ml.l^{-1} (B_2)		400 ml.l^{-1} (B_3)	
Giberelin								
0 ppm (G_0)	15,58	g	16,92	defg	18,17	cde	17,58	cdef
75 ppm (G_1)	17,08	defg	16,79	defg	16,79	defg	17,04	defg
150 ppm (G_2)	18,29	bcd	19,25	bc	21,96	a	19,88	b
300 ppm (G_4)	16,33	fg	16,83	defg	15,50	g	16,54	efg

The numbers followed by the same letter in the same column mean that they are not significantly different in the 5% DMRT

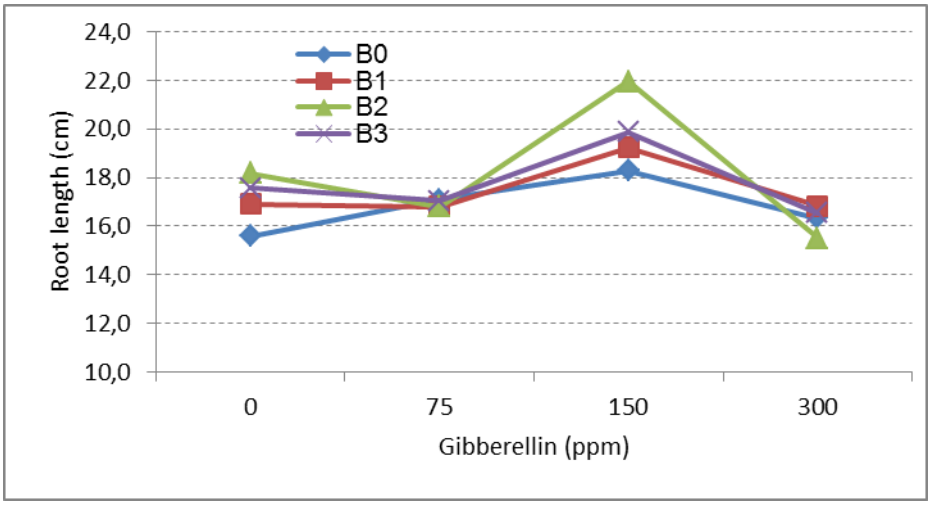

Figure 1. Interaction of application of gibberellin and biourine on root length

Fresh and oven dry roots weight per plant

The application of gibberellin significantly affected the fresh and oven dry weight of roots per plant. The heaviest weight of fresh and dry oven roots per plant was achieved in the application of gibberellin at a concentration of 150 ppm (G2), namely 4.42 g and 0.42 g, respectively, or 19.90% and 50.37% significantly heavier than those without gibberellin (G0) (Table 4).

The application of biourine has not significantly affect root fresh weight per plant, but had a very significant effect on oven dry weight of roots per plant. Application of biourine 200 ml.l-1 (B2) gave the heaviest fresh and oven-dry weight of roots per plant, namely 3.95 g and 0.34 g, or significantly heavier 4.46% and 25.19% compared to the weight of fresh and oven-dried roots per plant in the absence of biourine (B0). The effect of biourine concentration on fresh and oven dry weight of roots per plant is presented

in Table 4. The interaction of gibberellin and biourine administration had no significant effect on fresh and oven dry root weight per plant.

Stem fresh and dry weight per plant

The application of gibberellin has a very significant effect on fresh and oven dry weight of stems per plant. The heaviest fresh and dry weight of oven stems per plant was achieved in the application of gibberellin at a concentration of 150 ppm (G2), namely 4.35 g and 0.32 g, respectively, or 19.90% and 50.37% significantly heavier than those without gibberellin (G0) (Table 4).

Table 4. Effect of gibberellin and biourine application on root length, wet and dry weight of root oven per plant

Treatment	Root length (cm)		Root fresh weight per plant (g)		Root oven dry weight per plant (g)		Stem fresh weight per plant (g)		Stem oven dry weight per plant (g)	
Gibberellin:										
0 ppm (G_0)	17,06	b	3,69	b	0,28	b	3,62	b	0,20	c
75 ppm (G_1)	16,93	b	3,75	b	0,29	b	3,70	b	0,24	b
150 ppm (G_2)	19,84	a	4,42	a	0,42	a	4,35	a	0,32	a
300 ppm (G_4)	16,30	b	3,74	b	0,27	b	3,70	b	0,19	c
LSD 5%	0,85		0,23		0,03		0,21		0,02	
Biourine:										
0 $ml.l^{-1}$ (B_0)	16,82	b	3,79	a	0,27	b	3,83	a	0,21	b
100 $ml.l^{-1}$ (B_1)	17,45	a	3,83	a	0,32	a	3,83	a	0,23	b
200 $ml.l^{-1}$ (B_2)	18,10	a	3,95	a	0,34	a	3,88	a	0,26	a
400 $ml.l^{-1}$ (B_4)	17,76	a	4,02	a	0,33	a	3,83	a	0,25	a
LSD 5%	0,85		0,23		0,03		0,21		0,02	

The numbers followed by the same letter in the same column mean that they are not significantly different in the 5% LSD test

The application of biourine has no significant effect on stem fresh weight per plant, but had a very significant effect on oven dry weight of stems per plant. The best fresh and dry weight of oven stems per plant was produced by giving biourine with a concentration of 200 ml.l-1 (B2), namely 3.88 g and 0.26 g, or 1.47% and 21.36% significantly heavier. compared with fresh and oven dry weight of stems per plant in the absence of biourine (B0). The complete effect of biourine on fresh and dry weight of oven stems per plant is presented in Table 4. The interaction of gibberellin and biourine administration has no significant effect on fresh and dry weight of oven stems per plant.

Fresh and oven dry weight of leaves per plant

The application of gibberellin has a very significant effect on the fresh and oven dry weight of leaves per plant. The best fresh and dry weight of leaf oven per plant was given by giving gibberellin a concentration of 150 ppm (G2). The heaviest weight of fresh and dry oven leaves per plant was achieved by giving gibberellin concentrations of 150 ppm (G2), namely 5.75 g and 0.69 g, respectively, or 38.35% and 45.41% significantly heavier than those at without gibberellin (G0) (Table 5).

The application of biourine has a very significant effect on the fresh weight and the oven dry weight of the leaves per plant. Treatment using biourine at a concentration of 200 ml.l-1 (B2) gave the heaviest leaf oven dry and fresh weight per plant, namely 4.81 g and 0.58 g, or 14.70% and 21.74% heavier compared to with fresh and oven dry weight of leaves per plant in the absence of biourine (B0). The interaction between gibberellin and biourine had no significant effect on fresh and oven dry weight of leaves per plant.

Table 5. Effect of gibberellin and biourine on wet and dry weight of leaves per plant

Treatment	Leaf fresh weight per plant (g)		Oven dry weight per plant (g)		Total fresh weight per plant (g)		Total oven dry weight per plant (g)	
Gibberellin:								
0 ppm (G_0)	4,16	c	0,48	c	11,60	bc	0,96	c
75 ppm (G_1)	4,49	b	0,51	b	12,08	b	1,05	b
150 ppm (G_2)	5,75	a	0,69	a	14,63	a	1,44	a
300 ppm (G_4)	3,70	d	0,45	c	11,33	c	0,91	c
LSD 5%	0,22		0,04		0,49		0,07	
Biourine:								
0 ml.l^{-1} (B_0)	4,19	c	0,48	b	11,94	c	0,97	c
100 ml.l^{-1} (B_1)	4,47	b	0,51	b	12,30	bc	1,05	b
200 ml.l^{-1} (B_2)	4,81	a	0,58	a	12,79	a	1,19	a
400 ml.l^{-1} (B_4)	4,62	ab	0,56	a	12,61	ab	1,15	a
LSD 5%	0,22		0,04		0,49		0,07	

The numbers followed by the same letter in the same column mean that they are not significantly different in the 5% LSD test

Total oven fresh and dry weight per plant

The application of gibberellin significantly affected the total fresh and dry weight of the oven per plant. The heaviest total fresh and dry oven weight per plant was achieved in the application of gibberellin at a concentration of 150 ppm (G2), namely 14.63 g and 1.44 g, respectively, or 26.10% and 50.22% heavier compared to without gibberellin (G0) (Table 5). Regression analysis between gibberellins concentration and total oven dry weight per plant, obtained a quadratic relationship, namely = 0.897 + 5.10-3x – 2.10-5x2 (R2 = 50.90%), where Xopt = 125 ppm, and max = 1.21 g (Figure 2).

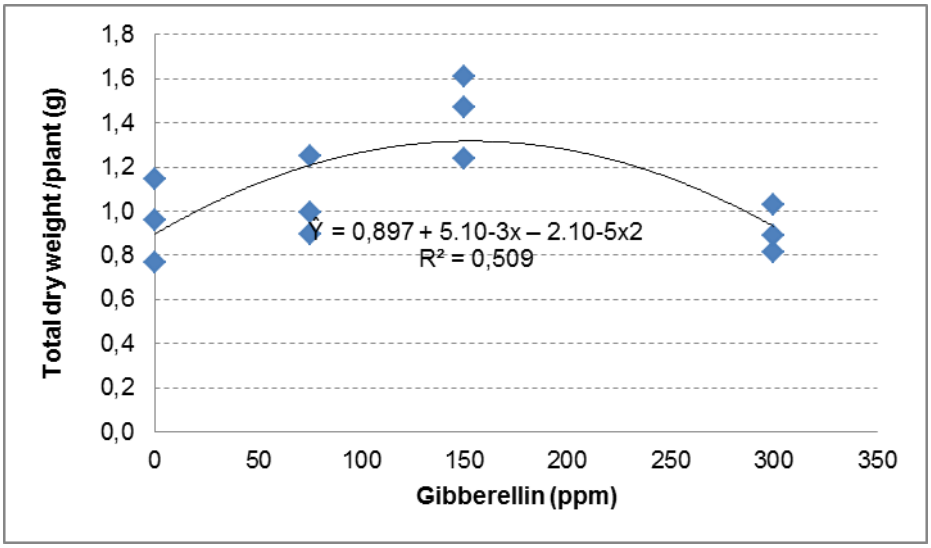

Figure 2. Effect of gibberellin concentration on total oven dry weight per plant.

The application of biourine significantly affected the fresh weight and oven dry weight of the leaves per plant. The administration of biourine at a concentration of 200 ml.l-1 (B2) gave the heaviest total fresh and oven dry weight per plant, namely 12.79 g and 1.19 g, or significantly heavier 7.10% and 22.63% compared to with total oven dry and fresh weight per plant in the absence of biourine (B0). Regression analysis between biourine concentration and total oven dry

weight per plant obtained a quadratic relationship, namely Ŷ = 0.954 + 1.10-3x - 3.10-6x2 (R2 = 27.50%) and obtained Bopt = 166.67 ml.l-1 with Ŷmax = 1.04 g (Figure 3). The interaction between gibberellin and biourine had no significant effect on total oven dry and fresh weight per plant.

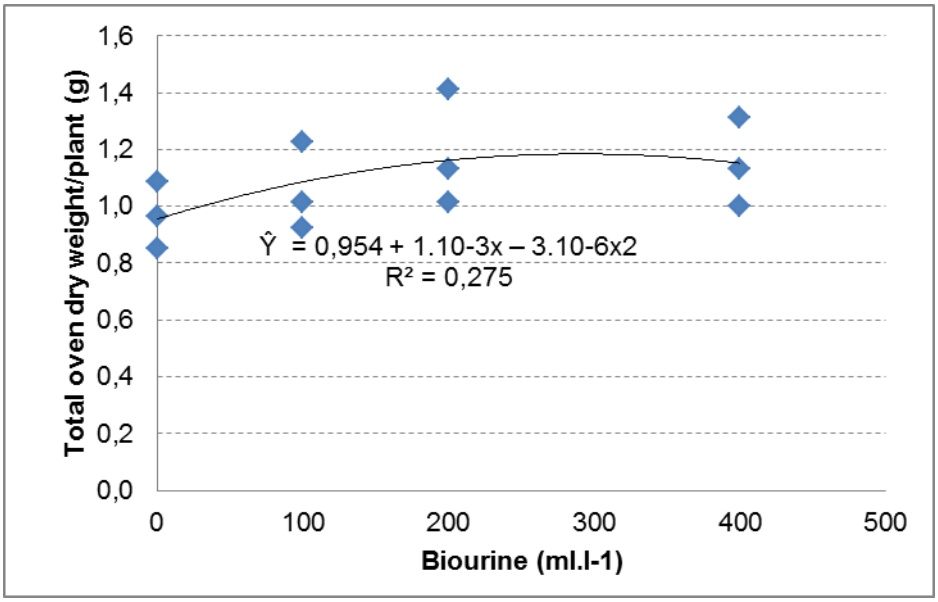

Figure 3. Effect of biourine concentration on total oven dry weight per plant

Discussion

Effect of Gibberellin

The application of gibberellin significantly affected plant height at almost all ages of observation. This can occur because the application of gibberellin has been carried out before the seedlings are immersed for 48 hours, so that from the beginning of the observation, plant height has shown its effect on plant height growth.

Gibberellins are able to encourage the orientation of the microtubules towards the cell growth axis and accumulate cellulose and eventually the cells enlarge only to the growth axis so that the plant is elongated. The effect of GA3 in spurring the increase in plant height is caused by several things, first, cell division is stimulated at the end of the canopy, especially in the meristematic cells located below which grow long lines of cortical cells and pith cells. Second, GA3 stimulates cell growth because this hormone plays a role in increasing the hydrolysis of starch, fructan and sucrose into glucose and fructose molecules; and third, GA3 affects the increase in cell wall plasticity (Chaudhary et al., 2019). Stem elongation is common in the internodus region because GA3 affects stem elongation in the intercalary meristem region. The role of gibberellin not only stimulates seed germination, but also controls the active growth of plants. The physiological effect of gibberellin on plants causes elongation of stems and leaves. In addition, some plants have increased leaf area.

The results of this study indicate the best plant height growth is given to the application of gibberellin with a concentration of 150 ppm at all ages of observation. Plant height at the age of 47 DAP shows that with the use of a concentration of 150 ppm the highest plant height was obtained, namely 13.83 cm, or 11.41% significantly higher than that without the application of gibberellin. The use of gibberellin with a higher concentration (300 ppm) shows a lower effect when compared to the effect at a lower concentration (150 ppm). The use of gibberellin at concentrations higher than 150 ppm can be toxic to plants. The resulting toxic nature is failure of germination and inhibits plant growth.

This effect is related to the role of gibberellin in cell division. The role of

gibberellin not only stimulates seed germination, but also controls the active growth of plants. The physiological effects of gibberellin on plants cause stem elongation, increase in stem size, and leaf area. Gibberellin is widely used in plant physiological research, and most plants respond to the application of GA3, with increasing stem length, cell division and elongation of plant apical parts as growth hormones in plants, carbohydrate mobilization during germination and other physiological aspects (Ummah & Rahayu, 2019).

The application of gibberellin significantly affected root length, root fresh weight and root oven dry weight per plant. The effect of the use of gibberellin is caused by one of the effects of gibberellin which is to encourage the synthesis of enzymes in seeds such as amylase, protease, and lipase, where these enzymes hydrolyze starch and protein which will provide energy for plant development. GA3 has a role in supporting cambium activity and the formation of new RNA and protein synthesis. For the purposes of survival, there is enzymatic decomposition, which is a change of starch into sugar which is then translocated as an energy source for growth (Xiong et al., 2021).

The application of gibberellin had a very significant effect on fresh and oven dry weight of stems per plant, fresh and oven dry weight of leaves per plant. The heaviest fresh and dry weight of oven stems per plant was achieved in the application of gibberellin at a concentration of 150 ppm (G2), namely 4.35 g and 0.32 g, respectively, or 19.90% and 50.37% heavier compared to on without the application of gibberellins. The heaviest fresh and dry weight of leaf oven per plant was achieved in the application of gibberellin at a concentration of 150 ppm (G2), namely 5.75 g and 0.69 g, respectively, or 38.35% and 45.41% heavier than the actual weight. on without the application of gibberellins. Plant fresh weight can indicate plant metabolic activity and the value of plant fresh weight is influenced by tissue water content, nutrients and metabolic products. Gibberellins are able to increase cell size (cell enlargement) and increase cell number (cell division). Increasing the size and number of cells will ultimately increase the plant weight (Purba et al., 2019; Singh et al., 2017).

Regression analysis between gibberellin concentration and total oven dry weight per plant obtained a quadratic relationship, namely $\hat{Y}$ = 0.897 + 5.10-3x - 2.10-5x2 (R2 = 50.90%) and obtained Xopt = 125 ppm with $\hat{Y}$max = 1.21 g. This relationship shows that the higher the gibberellin concentration given the greater the total plant dry weight obtained, but at concentrations higher than 125 ppm the effect of gibberellin application showed a decrease. This is in accordance with the opinion (R. Singh et al., 2017) which suggests that when the concentration of a given hormone continues to increase, growth begins to decline because the hormone becomes inhibitory. High application of gibberellic acid (GA3) can lead to decreased transcription of GA20 oxidase which is the main target in feedback regulation. If the transcription of GA20 oxidase decreases, there will be a blockage of GA3 biosynthesis so that the activity of gibberellic acid decreases (Degefu & Tesema, 2020). When the activity of gibberellic acid decreases, there is a decrease in cell division and growth and protein synthesis. This reduction will result in a decrease in the overall fresh weight and dry weight of the plant.

Effects of biourine

The application of biourine has a very significant effect on plant height at the age of 40 and 47 dst, but had no significant effect at the ages of 19, 26, and 33 days. At 47 DAP, the highest plant height occurred at 200 ml.l-1 concentration of biourine, namely 13.05 cm. Administration of biourine began to show its effect at the age of 40 DAS.

The effect of this cow biourine is because it contains growth hormones and

various elements that are needed by plants. Organic fertilizers also contain growth hormones from the auxin and gibberellins which can stimulate growth from sprouts to fruit (Parmila et al., 2019; Purba et al., 2019). Cow urine contains a lot of nutrients, one of which is nitrogen, so it is beneficial for plant vegetative growth. The nutrient content of cow feces that has been processed into liquid fertilizer has an N content of 0.44%, P2O5 0.53% and K2O of 1.04% (Widyaswari et al., 2017).

Biourine stimulate plant growth at the right concentration, but biourine application at excessive concentrations actually has a toxic effect on plants because there is an ammonia content in biourine, which can inhibit plant growth and development (Singh, 2019).

The results showed that biourine application at a concentration of 200 ml.l-1 gave the longest root length, which was 18.10 cm, or was significantly longer than the root length without biourine. Good root growth will also increase seedling growth. Application of biourine at a concentration of 200 ml.l-1 gave the heaviest root oven dry weight per plant, namely 0.34 g, or 25.19% heavier than the oven dry weight of roots without biourine. It also relates to the oven dry weight of the stems and leaves. Application biourine at a concentration of 200 ml.l-1 gave the heaviest oven dry weight of stems and leaves per plant, namely 0.26 and 0.58 g, or 21.36% and 21.74% significantly heavier than the oven dry weight. stems and leaves per plant on no biourine. There is a close relationship between root length and oven dry weight of roots, stems and leaves per plant, namely r = 0.977 **, 0.950 ** and 0.962 **. This means that the longer the roots are due to the influence of biourine, the heavier the oven dry weight of the roots and leaves

Significant and very significant effect of biourine on papaya seedling growth was because cow urine also contains auxin hormones consisting of auxin-a (auxentriollic acid), auxin -b, and other auxins (hetero auxin) which are IAA (Indole Acetic Acid). The IAA content in cow urine is 704.26 mg.l-1. This hormone comes from various substances contained in the protein of various forage cows, where the auxin cannot be broken down in the body so that it is excreted with urine as a filtrate. This auxin hormone plays a role in helping the process of accelerating plant growth through the process of cell division (Fadilah & Kusuma, 2019; Widyaswari et al., 2017).

Regression analysis between biourine concentration and total oven dry weight per plant showed a quadratic relationship, namely $\hat{Y}$ = 0.954 + 1.10-3x - 3.10-6x2 (R2 = 27.50%) and obtained Bopt = 166.67 ml.l-1 with $\hat{Y}$max = 1.04 g This relationship provides an indication that the correct concentration of biourine is 166.67 ml.l-1 giving the heaviest total oven dry weight of 1.08 g. Application of biourine with a concentration higher than 166.67 ml.l-1 has shown a negative effect. The effect of biourine on total oven dry weight per plant is closely related to root length and leaf oven dry weight per plant, with correlation values (r) equal to 0.987 ** and 0.990 **. Biourine also contains several microbes that play a positive role in plant growth and development. The biourine content includes Rumino bacillus and Azotobacter. Rumino Bacillus contains Ruminococcus plavifasius and Bacillus thuringiensis bacteria as well as organic materials that can stimulate growth and suppress the development of pathogenic bacteria in plants. Azotobacter is a non-symbiotic aerobic gram-negative bacteria that functions as a free N-binding agent, so that these bacteria have an influence on the physical and chemical properties of the soil in increasing soil fertility (Singh, 2019).

Effect of interaction between gibberellins and biourine

The interaction of gibberellin and biourine has a significant effect on root length, but it was not significant for other variables observed. The best interaction effect of gibberellin and biourine occurred

in the combination treatment of gibberellin with a concentration of 150 ppm and a concentration of 200 ml.l-1 which gave the longest root length, which was 22.0 cm, or 41.03% longer when compared to those without gibberellin and biourin. The interaction that was not significantly different was probably due to the gibberellin given when it was still seed, while the biourine was given after planting the seeds at the age of one week after planting in the nursery. So it still takes time for the synergy effect to occur between the combination of these two treatments.

CONCLUSION

Regression analysis showed gibberellin with a concentration of 125 ppm had the highest effect on most of the variables observed on the growth of papaya seedlings. Cow biourine application showed that the highest growth was obtained at a concentration of 166.67 ml.l-1 which produced total fresh and oven dry weight per plant heaviest respectively 12.79 g and 1.19 g. The interaction of gibberellin and bovine biourine had no significant effect on most of the observed variables. This shows that the growth of papaya seeds at different gibberellin concentrations and cow biourine concentrations did not give a different response to most of the observed variables.

REFERENCE

Andriani, D. and Oktafiyanto, M.F. 2019. Potensi Bakteri Endofit dari Tanaman Paitan *Titonia Deversifolia s*ebagai *Biofertilizer* dan *Biopestisida. JUATIKA: Jurnal Agronomi TanamanTropika, 1(2), 4-90.*

Authors, T. (2021). Underground gibberellin activity: differential gibberellin response in tomato shoots and roots. *New Phytologist*, *229*, 1196–1200. https://nph.onlinelibrary.wiley.com/doi/epdf/10.1111/nph.16876

Cao, H., Han, Y., Li, J., Ding, M., Li, Y., Li, X., Chen, F., Soppe, W. J., & Liu, Y. (2020). Arabidopsis thaliana SEED DORMANCY 4-LIKE regulates dormancy and germination by mediating the gibberellin pathway. *Journal of Experimental Botany*, *71*(3), 919–933. https://doi.org/10.1093/jxb/erz471

Chaudhary, A., Adhikari, B. B., & Shrestha, J. (2019). Effect of weed species on drought tolerant rice genotypes at Sundarbazar, Lamjung, Nepal. *Open Agriculture*, *4*(1), 65–78. https://doi.org/10.1515/opag-2019-0006

Degefu, M.Y. and M. Tesema. 2020. Review of Gibberellin Signaling. *International Journal of Engineering Applied Sciences and Technology,* Vol. 4(9): 377-390, ISSN No. 2455-2143, Published Online January 2020 in IJEAST (http://www.ijeast.com)

Fadilah, H. F., & Kusuma, M. N. (2019). Pemanfaatan Bioslurry Dari Digester Biogas Menjadi Pupuk Organik Cair. *Prosiding Seminar Nasional Sains …*. https://ejournal.itats.ac.id/sntekpan/article/view/584

Monteiro, L. N. H., Boliani, ; Aparecida Conceicao, Ferreira, ; Antonio Flavio Arruda, Rodrigues, ; Maria Gabriela Fontanetti, Faria, ; Glaucia Amorim, Silva, ; Marcela Sant'anna Cordeiro da, Oliveira, ; Marcela Pacola, Cunha, ; Silvia Regina, & Ribeiro, ; Luiza Rocha. (2019). Implication of some pre-germination treatments on seeds and initial seedling growth of pomegranate ("Punica granatum" L.). *Australian Journal of Crop Science*, *13*(4), 558–565. https://search.informit.org/doi/pdf/10.3316/informit.457556947032946?download=true

Parmila, P., Purba, J. H., & Suprami, L. (2019). Pengaruh Dosis Pupuk Petroganik Dan Kalium Terhadap Pertumbuhan Dan Hasil Semangka (*Citrulus vulgaris* SCARD). *Agrobali : Agricultural Journal*, *2*(1), 37–45. https://doi.org/https://doi.org/10.37637/ab.v2i1.407

Purba, J. H., Sasmita, N., Komara, L. L., & Nesimnasi, N. (2019). Comparison of seed dormancy breaking of Eusideroxylon zwageri from Bali and

Kalimantan soaked with sodium nitrophenolate growth regulator. *Nusantara Bioscience*, *11*(2), 146–152. https://doi.org/10.13057/nusbiosci/n110206

Purba, J. H., Suwardike, P., & Suwarjata, I. G. (2019). Pengaruh Konsentrasi Giberelin dan Jumlah Buah terhadap Pertumbuhan dan Hasil Melon (Cucumis melo Linn.). *Agro Bali: Agricultural Journal*, *2*(1), 8–20. https://scholar.google.com/citations?view_op=view_citation&hl=en&user=a56xZ28AAAAJ&pagesize=100&citation_for_view=a56xZ28AAAAJ:ULOm3_A8WrAC

Purba, J. H., Wahyuni, P. S., Zulkarnaen, Sasmita, N., Yuniti, I. G. A. D., & Pandawani, N. P. (2020). Growth and yield response of shallot (Allium ascalonicum L. var. Tuktuk) from different source materials applied with liquid biofertilizers. *Nusantara Bioscience*, *12*(2), 127–133. https://doi.org/10.13057/nusbiosci/n120207

Rohman, A. N., Barchia, M. F., & Murcitro, B. G. (2020). Effect of Biourine on N Uptake and Cabbage (Brassica oleracea L) Growth on Lowland Ultisol. *TERRA : Journal of Land Restoration*, *3*(2), 39–44. https://doi.org/10.31186/terra.3.2.39-44

Salisbury, F. B., & Ross, C. W. (1995). *Plant Physiology, 4th edition*. Wadsworth Publishing Co.

Singh, R., Asre, A., Kumar, A., & Karde, A. (2017). Studies on seed germination and seedling growth of papaya (Carica papaya L.) as influenced by growing media, cow urine, cow dung and cow dung slurry under net house condition. *Journal of Pharmacognosy and Phytochemistry*, *6*(4): 1448–1451. https://doi.org/10.5958/2249-5258.2020.00023.8

Singh, S. (2019). *Biochemical appraisal of Gomutra (Cow urine) 8*(3): 4089–4092.

Ummah, K., & Rahayu, Y. S. (2019). The Effect of Gibberellin Extracted from Eichhornia crassipes Root on the Viability and Duration of Hard Seed Germination. *Journal of Physics: Conference Series*, *1417*(1): 73–86. https://doi.org/10.1088/1742-6596/1417/1/012037

Widyaswari, E., Herlina, N., & Santosa, M. (2017). Pengaruh Biourin Sapi dan Pupuk Anorganik pada Tanaman Bawang Merah (Allium ascalonicum). *Produksi Tanaman*, *5*(10), 1700–1707.

Xiong, M., Chu, L., Li, Q., Yu, J., Yang, Y., Zhou, P., Zhou, Y., Zhang, C., Fan, X., Zhao, D., Yan, C., & Liu, Q. (2021). Brassinosteroid and gibberellin coordinate rice seed germination and embryo growth by regulating glutelin mobilization. *Crop Journal*, *xxxx*. https://doi.org/10.1016/j.cj.2020.11.006