Response of Corn (*Zea mays* L.) Bisi 321 Variety to the Variation of the Concentration of Nano Fertilizers and Urea Treatments

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Abstract. Indonesia is still importing corn to meet its needs. Import volume from January to September 2024 reached 1.38 million tons. Therefore, efforts to increase corn production need to be continued. One effort is planting superior varieties and organic fertilizers with nanotechnology. This study aimed to explore the response of the corn variety Bisi 321 to variation in nano fertilizer concentration, named Paten fertilizer and Paten imun - and Urea fertilizer treatments, using a randomized block design with five treatments and five replications. The maximum nano Paten Fertilizer concentration applied was 0.67 $g.L^{-1}$, Paten imun was 1.07 $mL.L^{-1}$, and a fixed concentration of urea of 21 $g.L^{-1}$. The data were analyzed using *Analysis of Variance* (ANOVA), followed by *Duncan's multiple range test* (DMRT) analysis at the 5% level. The results showed that the treatment of variations in paten fertilizer, paten imun and *urea* in corn (*Zea mays* L.) The Bisi 321 variety had a significant effect on all parameters, except for the number of leaves aged 15 DAP, weight of 100 shelled grains, and grain weight plot. Paten fertilizer, paten imun, and urea concentration changes that tend to produce the optimum development and outcomes in corn plants (*Zea Mays* L.) of the Bisi 321 variety, specifically treatment P4 (paten 0.67 $g.L^{-1}$, paten imun 1.07 $mL.L^{-1}$, *urea* 21 $g.L^{-1}$).

Keywords: Corn, Nano Fertilizer, Urea

1 Introduction

Corn (*Zea mays* L.) is a commodity that has high economic value, is one of the main food crops after rice and wheat, and can be used as a raw material for food, feed, and other industries. In 2023 and 2024, the projected need for corn for seeds is 85.99 thousand $Mg.ha^{-1}$ and 86.79 thousand $Mg.ha^{-1}$, for industrial raw materials 5.73 million $Mg.ha^{-1}$and 5.02 million $Mg.ha^{-1}$, for animal feed raw materials 5.26 million $Mg.ha^{-1}$ and 5.42 million $Mg.ha^{-1}$, for household consumption 437.80 thousand $Mg.ha^{-1}$, and 442, 50 thousand $Mg.ha^{-1}$, and 3.90 $Mg.ha^{-1}$ for food industry raw materials of 4.64

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million $Mg.ha^{-1}$and 5.64 million $Mg.ha^{-1}$ while the projected corn production in 2023 and 2024 is 21.49 million $Mg.ha^{-1}$ and 22.10 million $Mg.ha^{-1}$ [1]. Meeting the increasing demand for corn requires a maximum increase in corn production. Increasing corn production requires supporting factors that can help to achieve optimal production levels. Fertilization is one of the factors supporting the increase in corn production. Fertilizers are a source of the main nutrients that can increase plant growth and production, each of which has its own role and can cause certain symptoms in plants if their availability is lacking [2].

Organic fertilizers play an important role in the agricultural sector. It contains both macro-and micronutrients. Even in small amounts, they can improve the soil structure so that the soil becomes loose, has a high water-holding capacity, and can increase plant resistance. Against disease attacks, it increases the activity of beneficial soil microorganisms and has a positive residual effect, so that plant growth remains optimal and sustainability in the following season can be maintained and increased [3]. The results showed that the combination of compost and NPK was able to accelerate the growth rate of corn plants, and the best time occurred in the fourth week after planting, when compost at a dose of 20-30 $Mg.ha^{-1}$ combined with compound NPK 50-100 $Mg.ha^{-1}$ showed the best results for vegetative growth of corn plants [4].

Paten and Paten imun are nanotechnology organic fertilizers that have been studied by agricultural experts for more than 13 years, and Paten is a pioneer of nano technology organic fertilizer in sachet packaging. Paten fertilizer is a ready-to-eat food that can be absorbed by plants using a vertical system (without photosynthesis) so that it can be absorbed directly through the roots, stems, leaves, flowers, and fruit. Nanotechnology allows nutrients to be stored in plant tissues, not evaporate or disappear, and can improve soil quality with sustainable techniques. Paten Imun is a series of products that use patented fertilizers which function to improve the performance of paten fertilizers, save on the use of pesticides, reduce chemical fertilizers, and increase plant immunity to become stronger. The nutrients in paten fertilizers can be stored in plant tissue, do not evaporate or lose, and their continuous use can improve soil quality [5].

Nano-N fertilizer treatment of 1.5 l/ha produced the best ear length, ear diameter, ear weight per plant, and number of seeds per ear [6]. Based on the paten catalog, the recommended use is 5 g paten, 8 ml paten imun, and 314 g urea dissolved in a 15 L spray tank or equivalent to a concentration of 0.33 $g.L^{-1}$ paten, 0.53 $mL.L^{-1}$ paten imun, urea 21 $g.L^{-1}$.

This study aimed to explore the response of the corn variety Bisi 321 to the variation in nano fertilizer concentration and urea fertilizer treatments in Bangun Rejo Village, Tenggarong Seberang District, Kutai Kartanegara Regency, East Kalimantan Province, Indonesia.

2 Material and Methods

2.1 Time and Place

This study was conducted for approximately five months, from December 2022 to April 2023. The study was conducted on farmers' land in Bangun Rejo Village

(-0.34599135503377126, 117.12030181116616), Tenggarong Seberang District, Kutai Kartanegara Regency, East Kalimantan Province, Indonesia.

2.2 Materials and Tools

The materials used in this study were Bisi 321 corn seeds, paten, paten imun fertilizer (registered number 02.03.2021.532), urea fertilizer, dolomite lime, and water.

The tools used in this research were hoes, machetes, labels from folders, stationery, cameras, rulers, meters, calipers, scales, raffia rope, stakes (made of wood), jugs, sprayers, and hand tractors.

2.3 Experiment Design

This study was structured in a randomized block design consisting of five treatments and five replications.

2.4 Research Procedures

Land Preparation. Land preparation is carried out by cleaning existing plant remains using machetes and hoes, spraying weeds with herbicides, and removing existing plant remains from the land area. Soil processing was performed using a hand tractor by digging the soil to a depth of 20 cm. The large chunks were crushed into smaller pieces, resulting in loose soil. Loose soil was then left for 16 d.

Plot Making. The research plots were formed with dimensions of 4 m x 2.5 m, consisting of 25 plots, with a separation distance of 0.5 m between plots.

Liming. Liming was performed using dolomite lime at a dose of 166 g/plot. The soil at the research site had a pH of 5.17; therefore, this process would increase the pH to 6.0. Dolomite lime was evenly spread over the soil surface.

Planting and Plant Spacing. Planting was done by digging to a depth of 2-3 cm, and then one seed was inserted into one planting hole. The planting distance was 70 × 20 cm.

Fertilization. Fertilization was performed by spraying the plants at 5, 14, 28, and 40 (Days After Planting) and by sprinkling at 12 and 26 DAP. Variation in the concentration of nano-fertilizers paten, paten imun, and Urea Treatments (P) consisting of:

p_0 = control,
p_1 = paten 0.17 $g.L^{-1}$, paten imun 0.27 $mL.L^{-1}$, urea 21 $g.L^{-1}$,
p_2 = paten 0.33 $g.L^{-1}$, paten imun 0.53 $mL.L^{-1}$, urea 21 $g.L^{-1}$,
p_3 = paten 0.5 $g.L^{-1}$, paten imun 0.8 $mL.L^{-1}$, urea 21 $g.L^{-1}$,
p_4 = paten 0.67 $g.L^{-1}$, paten imun 1.07 $mL.L^{-1}$, urea 21 $g.L^{-1}$.

Table 1 outlines the time and dose of application of various fertilizer concentrations to the test plants.

Table 1. Time and dose of fertilizer application

Treatment		Time fertilizer application (days after planting/DAP)					
		5	12	14	26	28	40
p_0	Water (L)	0.60	0.60	0.60	0.60	0.60	0.60
p_1	Paten (g)	0.17	0.17	0.17	0.17	0.17	0.17
	Paten imun (mL)	0.27	--	0.27	--	0.27	0.27
	Urea (g)	--	21.00	--	21.00	--	--
	Water (L)	0.60	0.60	0.60	0.60	0.60	0.60
p_2	Paten (g)	0.33	0.33	0.33	0.33	0.33	0.33
	Paten imun (mL)	0.53	--	0.53	--	0.53	0.53
	Urea (g)	--	21.00	--	21.00	--	--
	Water (L)	0.60	0.60	0.60	0.60	0.60	1.20
p_3	Paten (g)	0.50	0.50	0.50	0.50	0.50	0.50
	Paten imun (mL)	0.80	--	0.80	--	0.80	0.80
	Urea (g)	--	21.00	--	21.00	--	--
	Water (L)	0.60	0.60	0.60	0.60	0.60	1.20
p_4	Paten (g)	0.67	0.67	0.67	0.67	0.67	0.67
	Paten imun (mL)	1.07	--	1.07	--	1.07	1.07
	Urea (g)	--	21.00	--	21.00	--	--
	Water (L)	0.60	0.60	0.60	0.60	0.60	0.60

Observation Parameters. Observations and measurements were performed according to the characteristics and evaluation system guidelines for corn plants. The parameters observed were the vegetative phase at the ages of 15, 30, and 45 DAP and the yield components. Observation of the vegetative phase is the height of the plant starting from the base of the stem, which has been marked until the tallest leaf is straightened, the number of leaves counted is the leaf that has opened completely, the length of the leaf is measured on the third leaf from the top using a meter starting from the tip of the midrib to the tip of the tapered leaf, the width of the leaf was measured on the third leaf from the top using a ruler across the middle, and the diameter of the stem was measured repeatedly with a caliper on the stem that has been marked. Observation of the components of the results is the length of the cob which is measured with a ruler starting from the base of the cob to the tip of the cob, the diameter of the cob which is measured with a caliper in the middle of the cob, counting 10 seeds from the base of the cob, the number of rows of seeds calculated based on the number of rows of seeds that fill the circle on the cob corn, the number of seeds in a row is counted starting from the first row, marked and counted in each row in multiples of 3 (1,4,7 etc.) then averaged, the weight of shelled corn with a moisture content of ±17% 100 grains is obtained by weighing using a digital scale, the weight of the cobs was obtained by weighing all the cobs with a water content of ±17% using a digital scale, the weight of the beans per plot was obtained by weighing all the beans in each plot with a moisture content of ±17% which had been dried in the sun for one week.

Data Analysis Methods. The observational data obtained will be analyzed using an Analysis of Variance (ANOVA) test. The analysis was continued with Duncan's multiple range test (DMRT) analysis at the 5% level on data that showed a significant difference.

3 Results and Discussion

Application of nano fertilizer along with urea affected significantly ($p<0.05$) the growth parameters (plant height, number of leaves, leaf length, leaf width and stem diameter) (Table 2) and production parameter (number of seed row, number of seed in row and seed weight) (Table 3) of the corn (Zea mays BISI 321).

Table 2. Response of application of nano fertilizer and urea on growth of corn

Treatment	Days After Planting (DAP)					
	15	30	45	15	30	45
	Plant height (cm)			Number of leaves (sheet)		
p_0	37.64^{b}	111.43 ^{c}	148.13 c	4.78	7.10 e	7.40 d
p_1	37.62^{b}	120.38 ^{bc}	165.58 abc	4.93	7.93 abcd	8.10 bcd
p_2	39.60^{ab}	132.23 ^{ab}	173.00 abc	4.73	8.28 abc	8.40 abc
p_3	40.16^{ab}	130.30 ^{ab}	182.85 ab	4.85	8.68 a	9.00 ab
p_4	43.58^{a}	140.05 ^{a}	186.13 a	4.95	8.65 ab	9.10 a
	Leaf length (cm)			Leaf width (cm)		
p_0	30.10 b	74.40 d	81.28 d	3.00 c	7.24 d	7.74 d
p_1	29.37 b	79.93 bcd	87.30 abcd	3.27 bc	7.87 cd	8.66 abcd
p_2	30.90 ab	84.54 abc	88.65 abc	3.32 bc	8.51 abc	9.37 abc
p_3	31.64 ab	86.61 ab	93.33 a	3.41 b	8.78 ab	9.59 ab
p_4	33.77 a	89.23 a	91.15 ab	3.82 a	8.98 a	9.65 a
	Stem diameter (cm)					
p_0	0.63 c	1.62 e	1.65 d			
p_1	0.71 abc	1.81 d	1.82 abcd			
p_2	0.72 abc	1.97 abc	2.00 abc			
p_3	0.75 ab	2.02 a	2.05 a			
p_4	0.83 a	2.01 ab	2.01 ab			

Note: Data (mean) are from five replications. Data were analyzed using ANOVA. For each parameter, data within the same row followed by different letters indicates significant differences (DMRT, $p<0.05$).

Table 3. Response of application of nano fertilizer and urea on production of corn

Treat ment	Long cob (cm)	Cob diameter (cm)	Amount Seed Row (row)	Number of Seeds in Rows (grain)	Weight of 100 corn kernels (g)	Seed Weight Cob (g)	Seed Weight per plot (g)
p_0	9.77 c	3.53 c	14.80 e	21.38 b	26.01	41.61 c	859.37
p_1	10.05 c	3.66 c	16.08 abc	22.48 b	24.33	51.77 abc	933.29
p_2	11.58 abc	3.74 c	15.65 abcd	25.72 ab	26.15	55.14 abc	1,060.86
p_3	12.74 ab	4.11 a	16.80 ab	27.38 ab	26.04	71.78 ab	1,235.76
p_4	12.78 a	4.09 ab	16.85 a	29.26 a	26.46	75.68 a	1,216.85

Note: Statistical analysis refers to the notes in Table 2.

3.1 Effect of Nano Fertilizer and Urea on Growth Attributes of Corn

Plant Height. The p_4 treatment tended to give the highest average plant height in the 15 DAP period, 43.5 cm, 30 DAP, 140.5 cm, and 45 DAP, 186.13 cm. The average growth of plant height showed a positive response; the average plant height of the Bisi-18 corn variety to the application of this type of palm oil plantation waste compost reached 201.54 cm [7].

The nutrients absorbed by plants influence plant height growth, especially the elements N and P, which support vegetative growth, one of which is plant height. Nutrient N: 2.50%, P_2O_5:0.83% K_2O: 2.16%, contained in paten fertilizer, paten imun N+ P_2O_5 + K_2O: 5.17%, N-organic: 2.62%, added urea is thought to be able to encourage vegetative growth, in this case, plant height. The process of absorbing nanosized nutrients is thought to be more effective and targeted through roots and leaves. Applying liquid fertilizer can overcome nutrient deficiencies, does not lead to leaching of nutrients, and provides nutrients quickly [8]. Soil pH conditions below 6 are also thought to inhibit the performance of variations in paten fertilizer, paten imun, and urea to provide nutrition to plants. The nutrients in the treatment work optimally if the surrounding conditions are favorable.

Number of Leaves. The number of leaves was significantly influenced by the application of nano-phosphorus fertilizer, either through the soil or by spraying the leaves. The application of 75% RDP + 5% RDP—NP1+ FS of 1% RDP—NP1 provided a significant maximum number of leaves at 30 HST per plant at 7.27 pieces [10].

The treatment of variations in paten fertilizer, paten imun, and urea on corn plants (*Zea mays* L.) of the Bisi 321 variety had a positive influence on the number of leaves at 30 and 45 DAP, but was not significant at 15 DAP. This shows that paten fertilizer can be used to stimulate the vegetative growth of corn plants. The p_4 treatment tended to give the highest average number of leaves in the 15 DAP period of 4.95 pieces and the 45 DAP 9.10 pieces and the p_3 treatment tended to give the highest average number of leaves in the 30 DAP period of 8.68 pieces. The growth in the number of leaves at the age of 15 DAP suggests that the plant is still adapting to its environment and root system spread widely so that the nutrients contained in fertilizer cannot be absorbed properly; young plants generally do not have their roots fully formed, especially hair roots, so the absorption of nutrients from the growing medium is not optimal [9]. Developed roots and the need for adequate nutrients can have a significant influence on the vegetative growth of plants; in this case, the number of leaves at 30 DAP and 45 DAP. The number of corn plant leaves can also be increased by the addition of sufficient P nutrients to the plant.

The number of leaves was significantly influenced by the application of nano phosphorus fertilizer either through the soil or through spraying the leaves, the application of 75% RDP + 5% RDP - NP1+ FS of 1% RDP - NP1 was able to provide a significant maximum number of leaves at 30 HST per plant of 7.27 pieces [10].

Leaf Length. Variations in paten fertilizer, paten imun, and urea on corn plants (Zea mays L.) of the Bisi 321 variety had a positive influence on leaf length at 15, 30, and 45 DAP. This shows that paten fertilizer can be used to stimulate the vegetative growth of corn plants. The p_4 treatment (paten 0.67 $g.L^{-1}$, paten imun 1.07 $mL.L^{-1}$, urea 21 $g.L^{-1}$) tends to give the highest average leaf length in the period 15 DAP (29.37 cm), 30 DAP (74.40 cm) and p_3 treatment (paten 0.5 $g.L^{-1}$, paten imun 0.8 $mL.L^{-1}$, urea 21 $g.L^{-1}$) tended to give the highest average leaf length in the 45 DAP period (93.33 cm).

The growth of corn plants, one of which is leaf length, is greatly influenced by the adequacy of macro- and micro-nutrients in the soil and the uptake of nitrogen, which is useful for supporting the growth of leaf length in corn plants, and the nitrogen nutrient in fertilizer applied to the soil and plants is thought to be able to accelerate the growth of leaf length. The growth in leaf length affects the leaf area of the plant year, where nitrogen and potassium treatments have a positive influence on plant growth, especially on plant height and plant leaf area ratio [11]. The increase in the number of leaves is also supported by the chlorophyll content which is a site for photosynthesis, where the more chlorophyll the photosynthesis will increase so that it can increase plant growth such as plant height and number of leaves which is supported by the fulfillment of nitrogen nutrients, according to the statement that fertilization affects plant growth Corn, in particular, provides nitrogen elements which play a role in increasing plant height and chlorophyll formation [12].

Leaf Width. Variations in paten fertilizer, paten imun, and urea on corn plants (*Zea mays* L.) of the Bisi 321 variety had a positive influence on leaf width at 15, 30, and 45 DAP. Paten fertilizer can be used to stimulate the vegetative growth of corn plants.

Leaves are the main photosynthetic-producing organ, and good leaf growth supports the growth of corn plants. The p_4 treatment tended to yield the widest average leaf width in the 15 DAP (3.82 cm), 30 DAP (8.98 cm), and 45 DAP (9.65 cm) periods. The growth of leaf width is influenced by the uptake of nutrients both from the soil and from the treatment, and nitrogen nutrients are sufficient to support good leaf width growth, where leaves that lack the nutrient N will show symptoms with a V shape, yellowing from the tip of the leaf then widening and towards the leaf base [13].

Stem Diameter. Variations in paten fertilizer, paten imunand urea on corn plants (*Zea mays* L.) of the Bisi 321 variety had a real and positive influence on stem diameter at 15, 30, and 45 DAP. This shows that paten fertilizer can be used to stimulate the vegetative growth of corn plants. The p_4 treatment tends to give the highest average stem diameter in the 15 DAP period (0.83 cm), and P_3 treatment (paten 0.5 $g.L^{-1}$, paten imun 0.8 $mL.L^{-1}$, urea 21 $g.L^{-1}$) tends to give the highest average stem diameter in the period 30 DAP (2.02 cm) and 45 DAP (2.05 cm).

The diameter of the stem influences the standing of the plant; the larger the diameter of the plant's stem, the less easily it collapses, and the potassium element supports the increase in stem sclerenchyma, which provides thickening and strength to the stem tissue so that cell enlargement and elongation of the stem diameter increase.

The growth of stem diameter is greatly influenced by the availability of nutrients in the soil or given to plants, and fertilizer treatment containing the macro nutrients N, P, and K in the form of nanoparticles can support the growth of plant stem diameter well, according to the statement that with nano fertilizer treatment NPK formula with added sulfate can produce corn plants with maximum height, number of leaves, and stem diameter [14].

3.2 Effect of Nano Fertilizer and Urea on Yield Attributes of Corn

Cob Length. Variations in paten fertilizer, paten imunand urea on corn plants (*Zea mays* L.) of the Bisi 321 variety had a positive influence on cob length. This shows that patent fertilizer can be used to stimulate the generative growth of corn plants. The p_3 treatment tended to result in the highest average cob length, namely 12.78 cm. The longest corn cob length of the Bisi-16 variety with a dose of 100% inorganic and 60 kg ha^{-1} of biological fertilizer was 19.15 cm [15]. The length of the corncobs of the Bisi-18 variety when used as compost from palm oil plantation waste reached 14.42 cm [7]. Long corncobs support the benefits of corn yields, where the longer the cob, the higher the grain production. The macro-and micronutrients in fertilizer support good cob length growth, and the provision of nutrients must be right on target so that the plant can use it well for its growth.

Nutrient N: 2.50%, P_2O_5:0.83% K_2O: 2.16%, contained in paten fertilizer, paten imun N+ P_2O_5 + K_2O: 5.17%, N-organic: 2.62%, added urea is thought to be able to increase plant yields, where paten fertilizer treatment with nanotechnology maximizes nutrient uptake in plants, and with the use of nanotechnology fertilizer, there is minimal leaching and evaporation, so it can stimulate increased production potential [16].

Cob Diameter. Variations in paten fertilizer, paten imun, and urea on corn plants (*Zea mays* L.) of the Bisi 321 variety had a positive influence on cob diameter. This shows that patent fertilizer can be used to stimulate the generative growth of corn plants. The p_3 treatment tended to yield the highest average cob diameter, namely 41.08 mm. The average diameter of corncobs of the Bisi-16 variety with a dose of 50% inorganic and 60 $kg.ha^{-1}$ of biological fertilizer was 4.61 cm [15]. The plant ear diameter of the Bisi-

18 corn variety on the application of palm oil plantation waste compost reached 3.27 cm [7].

The significant influence on cob diameter is thought to be due to the availability of nutrients absorbed by the plant for development. The elements N, P, and K are relatively large nutrients needed by corn plants for their growth and development [17]; therefore, with the availability of N, P, and K, the diameter of the ears will increase because the nutrients absorbed by the plants are under optimal conditions. The P nutrient, which is well absorbed by plants, can also support the development of a good cob diameter. The combination of nano-fertilization with potassium through the soil and through leaves at a concentration of 2,500 ppm provides the best cob diameter, namely 17.2 cm [18].

Number of Seed Rows. The treatment with variations in paten fertilizer, paten imun, and urea on corn plants (*Zea mays* L.) of the Bisi 321 variety had a positive influence on the number of rows of seeds. This shows that patent fertilizer can be used to stimulate the generative growth of corn plants.

The number of rows of corn seeds can be used to calculate the production of corn plants, and the increase in the number of rows of seeds supports corn production. The absorption of N nutrients, especially P and K, supports the yield of corn plants, one of which is the number of seed rows. Research using P_3 treatment tended to give the highest average number of rows of seeds, namely 16.85 rows, which is better than the application of NPK nano-fertilizer with a concentration of 150 ppm. gives the best results on the cob row, which are 13.51 rows [19], and is equivalent to a combination treatment of potassium fertilization through the soil and through nano leaves with a concentration of 2,500 ppm giving the best number of rows of seeds, namely 16.8 rows.

Number of seeds per row: Variations in paten fertilizer, paten imun, and urea on corn plants (*Zea mays* L.) of the Bisi 321 variety had a positive influence on the number of seeds in the row. This shows that patent fertilizer can be used to stimulate the generative growth of corn plants. The p_3 treatment tended to give the highest average number of seeds in rows, namely 29.26 grains, less than the combination treatment of potassium fertilization through the soil and through nano leaves with a concentration of 2,500 ppm, which gave the best number of seeds in rows (41.3). The number of seeds in a row can affect corn production; corn with longer cobs yields higher yields because the length of the cob is related to the number of seeds and the number of rows of seeds per cob. The number of seeds in a row is also greatly influenced by pollination, and good pollination assistance can increase the number of plant seeds [20].

Weight of 100 Corn Shells. The treatment of variations in paten fertilizer, paten imun and urea on corn plants (*Zea mays* L.) The Bisi 321 variety had no significant effect on the weight of 100 grains of corn. Treatment p_3 (paten 0.67 $g.L^{-1}$, paten imun 1.07 $mL.L^{-1}$, urea 21 $g.L^{-1}$) tends to give the highest average weight of 100 grains of corn, namely 26.46 g. The weight of 100 grains of corn of the Bisi-18 variety used for compost from palm oil plantation waste reaches 27.25 g [7].

Corn seed weight is influenced by carbohydrate storage during photosynthesis. The better the absorption of nutrients by plants, the availability of water and sunlight, and the photosynthesis process will proceed so that the weight of corn seeds also increases. Phosphor nutrients that are available and can be absorbed by plants become photosynthates, which are allocated to corncobs and seeds so that the cob becomes larger and the seed weight increases. The role of P fertilizer is very important for the growth and yield of corn plants, and fertilizer in the form of nano-phosphate can influence corn growth and increase corn production [21].

Weight of Cobs. The treatment of variations in paten fertilizer, paten imun and urea on corn plants (*Zea mays* L.) The Bisi 321 variety had a significant effect on cob seed weight. The treatment of variations in paten fertilizer, paten imun, and urea on corn (*Zea mays* L.) variety Bisi 321 plants had a significant effect on cob seed weight. The p_4 treatment yielded the highest average cob seed weight of 75.64 g.

The length of the cob and the diameter of the cob affect the weight of the cob, where the bigger the corn cob, the greater the weight of the cob. The weight of corn grains is influenced by the replenishment of photosynthesis, resulting from the nutrients absorbed by the plant. Corn plants require an adequate supply of nutrients to meet the requirements of filling corn grains. The increase in corn growth and yield is greatly influenced by the availability of potassium absorbed by the plant, where potassium treatment can increase the length of the cob, number of seeds per cob, and weight of a thousand grains of corn [22].

Seed weight per plot: The weight of the seeds per plot can support corn production, which has a real influence on the weight of the cobs but has a significantly different effect on the weight of the seeds per plot because the population per plot is not uniform. The decline in the plant population is caused by the growing power of corn, attacks by pests and diseases, and competition between embroidered corn plants that cannot grow as well as in general. The p_3 treatment tended to give the highest average seed weight per plot, at 1,235.76 g. The weight of seeds per plot was influenced by the amount of corn produced in the plot and seed weight. Phosphor fertilizer is very important for the growth and yield of corn plants, and fertilizer in the form of nano-phosphate can influence corn growth and increase corn production [21].

4 Conclusion

There was a positive response of corn plants (*Zea mays* L.) of the Bisi 321 variety to the treatment of variations in paten fertilizer, paten imun, and urea, which could yield significantly different results for all parameters except for the number of leaves at 15 DAP, weight of 100 corn kernels, and seed weight per plot. Composition of variations in paten, paten imun and urea which tends to provide the best growth and results for corn plants (*Zea mays* L.) variety Bisi 321, namely treatment p_4 (paten fertilizer 0.67 $g.L^{-1}$, paten imun 1.07 $mL.L^{-1}$, urea 21 $g.L^{-1}$).

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