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The Effect of Combination of Nitrogen (N) and Phosphorus (P) Fertilizer on Ratoon Rice (*Oryza Sativa* L) Production

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Abstract
Ratoon rice is a plant that can grow back through the regeneration of tillers after the main crop pruned at harvest. However, they can't grow optimal because of the availability of nutrients in the soil becomes reduced at the time after harvest due to the high uptake by the main crop. Therefore, there is a need for nutrient input according to the needs of plants through fertilising nitrogen and phosphorus, which are part of the essential macronutrients. This study aims to determine the right proportion of fertilising dose between N and P for the highest growth and yield in the ratoon system. The research will be conducted from March to May 2017 in the farmer's area located in Kelibhera Village, Mego District, Sikka Regency, West Nusa Tenggara. Research Parameter was Leaf area, total productive tillers per clumps, Weight of grain per clump, Weight of hollow grains per clump, Weight of 1000 items and Yields per hectare. The result of this research was the growth and yield of ratoon rice influenced by N and P fertilisation compared to control or without N and P fertilisers; Fertilizing N and P at a dose of 224.67 kg urea ha-1 added 167.78 kg SP-36 ha-1, is the optimum dose needed by the ratoon rice plant when viewed from the growth and yield growth that looks more when compared with other N and P fertilising doses; Fertilisation of N and P at a dose of 337.01 kg urea ha^{-1} was added 167.78 kg SP-36 ha-1, affecting the reduction in the weight of hollow grains.
Keywords: *Paddy, Ratoon rice, Phosphorus Fertilizer, Nitrogen Fertilizer, Oryza Sativa.*

INTRODUCTION

Ratoon rice is a plant that can grow back through the regeneration of tillers after the main crop pruned at harvest (Susilawati, 2013). Besides, Krishnamurthy (1988) suggested that ratoon rice has the potential to grow in tropical climates, limited humidity, and sufficient water availability after the first harvest season. The age of ratoon rice growth is generally shorter, due to the growth of rat saplings then followed by flowering and panicles so that the rats do not undergo a phase of vegetative growth (Mareza et al., 2016a). The growth of rats from the stump varies between each knuckle. Rat saplings that grow in lower knuckles can produce more grain and more fertile tillers, while saplings that grow in high knuckles affect growing buds faster (Vegara et al., 1988).

The availability of nutrients in the soil becomes reduced at the time after harvest due to the high uptake by the main crop, lost through leaching and evaporation (volatilisation). As stated by Subatra (2013) in the provision of ameliorant, N and P fertiliser in the first season plants, could not meet the needs of plant nutrients in the second season due to decreased availability of soil N and inhibited plant growth and yields in the second harvest season. So the availability of nutrients for plants is crucial because, as a significant factor in increasing plant growth and productivity. Therefore there is a need for nutrient input according to the needs of plants through fertilising nitrogen and phosphorus, which are part of the essential macronutrients. Husnain et al. (2016) explained that the macronutrient requirements such as N, P, and K for lowland rice plants ranged 75-120 kg N ha^{-1}, 20-25 kg P_2O_5 ha$^{-1,}$ and 23-257 kg K_2O ha^{-1}.

In the administration of a dose of 30 kg N ha-1, the highest yield and yield component is 2.8 tons ha-1 or about 45% of the main crop (Shin et al., 2015). As for the addition of a dose of fertilisation also dramatically affects the ratoon results. In the research results, Liu et al. (2012), the application of fertiliser at a dose of 195 kg N ha-1 obtained results, reaching more than 4 tons ha-1. Rice plants are susceptible to fertilisation, and if there are advantages and disadvantages of N, it will harm growth and yield. In addition to N nutrients, there is also phosphorus, which plays a role in the process of plant growth and development. The process of plant metabolism in producing energy, namely ATP (Adenosine triphosphate) as a provider of chemical energy involved in the process of plant metabolism (Hanafiah, 2005). 2015). Application of P fertilisation in ratoon rice can strengthen plants, stimulate the formation of flowers and grains in panicles, improve grain quality, and improve root hairs. From this role, the availability of P nutrients in the soil must be sufficient so that it can be available to plants (Dobermann and Fairhurst, 2000). This study aims to determine the right proportion of fertilising dose between N and P for the highest growth and yield in the ratoon system.

MATERIAL AND METHODS

Time and location

The research will be conducted from March to May 2017 in the farmer's area located in Kelibhera Village, Mego District, Sikka Regency, West Nusa Tenggara. The research location has the following specifications: the slope of land 8-60%, soil type of volcanic ash, soil pH 5.5 - 7.5, moderate drainage, an average rainfall of 1009.6 mm/year (BPK Mego, 2016).

Experimental design

This study uses Split Plot Design. At each treatment, the fertiliser doses carried out in three replication to get 48 experimental units.

P fertiliser placed in the main plot, consisting of 4 levels, namely:

1. P0: 0 kg ha^{-1}
2. P1: 50% of P_2O_5 (83,89 kg SP-36 ha^{-1})
3. P2: 100% of P_2O_5 (167,78 kg SP-36 ha^{-1})
4. P3: 150% of P_2O_5 (251,66 kg SP-36 ha^{-1})

Whereas N fertiliser placed on subplots, consisting of 4 levels, namely:

1. N0: 0 kg ha^{-1}
2. N1: 50% of N (112,34 kg urea ha^{-1})
3. N2: 100% of N (224,67 kg urea ha^{-1})
4. N3: 150% of N (337,01 kg urea ha^{-1})

From the above two factors, 16 treatment combination units obtained, as presented in Table 1.

Table 1. Combinations of N and P fertiliser treatments

Treatment	Main Square			
Subsquare	P0	P1	P2	P3
N0	P0 N0	P1 N0	P2 N0	P3 N0
N1	P0 N1	P1 N1	P2 N1	P3 N1
N2	P0 N2	P1 N2	P2 N2	P3 N2
N3	P0 N3	P1 N3	P2 N3	P3 N3

Research Parameter

Component of Growth

A. Leaf area (cm^2)

Obtained by using the correction factor method, namely by measuring the actual leaf area measured using millimetre block and divided by leaf area based on length x width. Measurements carried out by representatives of 3 different leaves, each clump classified between small, medium, and large leaves in order to facilitate field observation. Then the results of these measurements are averaged and determined as a constant value of the leaves of rice plants. Calculating the leaf area carried out by the following formula:

- Leaf area per leaf (cm^2)

$$Leaf\ area\ per\ leaf = length\ x\ width\ x\ constants$$

- Leaf area per clump (cm^2)

$$\text{Leaf area per clump } = \Sigma\ leaf\ x\ Leaf\ area\ per\ leaf$$

B. Total Productive Tillers Per Clumps

The total dry weight of plants per clump obtained by weighing all parts of the plants that have been in the oven at a temperature of 80 oC for 48 hours to obtain a constant weight. Before the oven, all parts of the plant are cleaned first and then put into a paper envelope.

C. Component Results

- Weight of grain per clump
- Weight of hollow grains per clump
- Weight of 1000 items. Randomly weighed seeds in each treatment plot
- Yields per hectare. Calculated by converting yields per plot to per hectare using the formula (Suminarti, 2011) as follows:

$$HPPH = \frac{land\ area\ of\ one\ hectare}{harvested\ plot\ area} \times grain\ weight\ per\ harvest\ plot$$

Data Analysis

Data analyse from observations using analysis of variance (F test) with a level of α = 0.05, which aims to determine whether there is an interaction or a real influence of treatment. If there is a real effect, then proceed with the LSD test with a level of p = 0.05 to determine the difference between treatments.

RESULT AND DISCUSSION

A. Total of leaf

Based on the results of the analysis of variance showed that there was a real interaction between the N and P fertilising doses of the leaf number variable at 35 and 65 days after ratoon observations. The average number of leaves due to the interaction between N and P fertilisation doses shown in Table 2.

Table 2. The average number of leaves due to interaction between N and P fertilisation treatments at 35 and 65 days after ratoon observations

Days After Ratoon	Treatment	Number of Leaves ($clumps^{-1}$)							
		P Fertiliser Doses							
	N Fertiliser Doses	P0 (0% SP-36)		P1 (50% SP-36)		P2 (100% SP-36)		P3 (150% SP-36)	
		control		83,89 kg ha^{-1}		167,78 kg ha^{-1}		251,66 kg ha^{-1}	
35	N0 (0% Urea)	22.0	a	27.5	b	29.2	b	34.5	c
	control	A		A		A		A	
	N1 (50% Urea)	26.8	a	31.3	b	32.0	b	34.5	c
	112,34 kg ha^{-1}	B		B		B		A	
	N2 (100% Urea)	30.2	a	31.7	a	36.2	b	34.3	b
	224,67 kg ha^{-1}	C		B		C		A	
	N3 (150% Urea)	26.3	a	32.2	b	34.3	b	34.5	b
	337,01 kg ha^{-1}	B		B		BC		A	
	LSD 5% :	2.7							
	KK N (%) :	10.1							
	KK P (%) :	5.2							
65	N0 (0% Urea)	32.0	a	34.4	b	37.2	c	41.1	d
	Control	A		A		A		A	
	N1 (50% Urea)	34.0	a	37.1	b	40.2	c	41.4	d
	112,34 kg ha^{-1}	B		B		B		A	
	N2 (100% Urea)	36.0	a	38.2	b	43.1	c	43.1	c
	224,67 kg ha^{-1}	C		D		D		C	

	N3 (150% Urea)	34.2	a	37.8	b	41.0	c	42.3	d
	337,01 kg ha^{-1}	B		CD		C		B	
	LSD 5% :	0.5							
	KK N (%) :	0.7							
	KK P (%) :	0.7							

Note: Numbers accompanied by the same lowercase letters in the same row or the same uppercase letters in the same column show no significant difference based on the LSD test at the 5% level; (hsr) = days after ratooning; KK = diversity coefficient; N0 and P0 = without urea and SP-36

Table 2 shows that the observed ages of 35 and 65 days after ratooning on the effect of N administration on the level of fertilisation of P. Based on these data, we assume that the addition of N and P fertiliser doses will increase the amount of the number of leaf in ratoon rice plants. The time of application of fertiliser also affects the increase in leaf area where rice aged 65 days after ratoon has a broader leaf area compared to rice aged 35 days after ratoon. Nevertheless, the increase in each treatment was not significantly different.

B. Leaf Area

Based on the results of the analysis of variance showed that there was a real interaction between the N and P fertiliser doses of leaf area variables at observations of 35 and 65 days after ratoon. The average leaf area due to the interaction between N and P fertilisation doses show in Table 3.

Table 3. Average leaf area due to the interaction between N and P fertilisation treatments at 35 and 65 days after ratoon observations

Day after ratoon	Treatment	Leaf area (cm of clumps^{-1})							
		P fertiliser doses							
	N fertiliser doses	P0 (0% SP-36)		P1 (50% SP-36)		P2 (100% SP-36)		P3 (150% SP-36)	
		control		83,89 kg ha^{-1}		167,78 kg ha^{-1}		251,66 kg ha^{-1}	
35	N0 (0% Urea)	195.7	a	318.8	b	305.8	b	316.8	b
	control	A		A		A		A	
	N1 (50% Urea)	236.1	a	324.5	b	326.1	b	344.3	b
	112,34 kg ha^{-1}	B		A		A		A	
	N2 (100% Urea)	316.6	a	338.2	a	339.1	a	328.8	a
	224,67 kg ha^{-1}	C		A		A		A	
	N3 (150% Urea)	268.3	a	333.4	b	341.6	b	321.7	b
	337,01 kg ha^{-1}	B		A		A		A	
	LSD 5% :	37.8							
65	N0 (0% Urea)	407.9	a	437.5	b	460.5	c	432.6	b
	Control	A		A		A		A	
	N1 (50% Urea)	417.4	a	448.0	b	461.4	b	486.0	c
	112,34 kg ha^{-1}	A		AB		A		B	
	N2 (100% Urea)	422.2	a	520.0	b	578.8	c	535.6	b
	224,67 kg ha^{-1}	A		C		C		D	
	N3 (150% Urea)	429.4	a	465.1	b	545.8	d	516.2	c
	337,01 kg ha^{-1}	A		B		B		C	
	LSD 5% :	21.8							

Note: Numbers accompanied by the same lowercase letters in the same row or the same uppercase letters in the same column show no significant difference based on the LSD test at the 5% level; (hsr) = days after ratoon; KK = diversity coefficient; N0 and P0 = without urea and SP-36

Table 2 shows that the observed ages of 35 and 65 days after ratooning on the effect of N administration on the level of fertilisation of P. Based on these data, we assume that the addition of N and P fertiliser doses will increase the amount of the leaf area in ratoon rice plants. The time of application of fertiliser also affects the increase in leaf area where rice aged 65 days after ratoon has a broader leaf area compared to rice aged 35 days after ratoon. Nevertheless, the increase in each treatment was not significantly different.

C. Total Productive Tillers

Based on the results of the analysis of variance showed that there was a real interaction between the N and P fertiliser doses of the variable number of productive tillers at 35 and 65 Days after ratoon. The average number of productive tillers due to the interaction between N and P fertiliser doses show in Table 4.

Table 4. The average number of productive tillers due to the interaction between N and P fertilisation treatments at 35 and 65 day after ratoon observations

Days after ratoon	Treatment	Total Productive Tillers (tillers grove^{-1})							
		P Fertiliser Doses							
	N Fertiliser Doses	P0 (0% SP-36)		P1 (50% SP-36)		P2 (100% SP-36)		P3 (150% SP-36)	
		Control		83,89 kg ha^{-1}		167,78 kg ha^{-1}		251,66 kg ha^{-1}	
35	N0 (0% Urea)	1.3	a	4.3	c	3.2	b	6.7	d
	Control	A		A		A		A	
	N1 (50% Urea)	5.3	a	7.3	b	6.8	b	7.8	b
	112,34 kg ha^{-1}	B		C		B		B	
	N2 (100% Urea)	9.7	c	6.3	a	11.5	d	8.0	b
	224,67 kg ha^{-1}	D		B		C		B	
	N3 (150% Urea)	8.5	c	4.8	a	7.7	b	7.8	bc
	337,01 kg ha^{-1}	C		A		B		B	
	LSD 5% :	1.1							
65	N0 (0% Urea)	3.3	a	9.7	b	8.5	b	10.3	b
	Control	A		A		A		A	
	N1 (50% Urea)	10.2	a	12.7	b	13.8	b	15.4	b
	112,34 kg ha^{-1}	B		B		B		B	
	N2 (100% Urea)	14.2	b	10.7	a	19.7	d	17.7	c
	224,67 kg ha^{-1}	C		B		C		C	
	N3 (150% Urea)	11.0	a	12.5	a	12.8	a	16.6	b
	337,01 kg ha^{-1}	B		B		B		B	
	LSD 5% :	1.8							

Note: Numbers accompanied by the same lowercase letters in the same row or the same uppercase letters in the same column show no significant difference based on the LSD test at the 5% level; (hsr) = days after the date; KK = diversity coefficient; N0 and P0 = without urea and SP-36

Table 4 shows that the observed age of 35 days after ratooning on the effect of N administration on the level of P fertilisation showed that the increase was not significantly different when compared to without SP-36. The highest number of productive tillers was produced in the administration of 100% N fertiliser and 100% P. fertiliser, while the least amount of tillers was in the treatment without N and P. fertiliser. The same thing happened in experiments at the observation age of 65 days after ratooning on the effect of N administration on the P fertilisation rate.

D. Grain Weight

Based on the results of the analysis of variance showed that there was a real interaction between the N and P fertilisation doses of the weighted grain content variable. The average weight of grains due to the interaction between N and P fertilisation doses shown in Table 5.

Table 5. The average weight of grains due to the interaction between N and P fertilisation doses

Treatment	Weight of Grain Fill (g plot $^{-1}$)
	P Fertiliser Dose

N Fertiliser Dose	P0 (0% SP-36)		P1 (50% SP-36)		P2 (100% SP-36)		P3 (150% SP-36)	
	Control		83,89 kg ha^{-1}		167,78 kg ha^{-1}		251,66 kg ha^{-1}	
N0 (0% Urea)	58.0	b	57.3	a	57.3	a	129.3	C
Control	A		A		A		A	
N1 (50% Urea)	80.8	a	121.3	c	107.1	b	248.3	D
112,34 kg ha^{-1}	B		B		B		B	
N2 (100% Urea)	93.6	a	187.6	b	313.8	d	265.0	C
224,67 kg ha^{-1}	C		C		D		C	
N3 (150% Urea)	103.2	a	193.8	b	229.7	c	295.7	d
337,01 kg ha^{-1}	D		D		C		D	
LSD 5% :	0.1							

Table 5 shows that the observed age of 35 and 65 days after ratooning on the effect of N administration on the level of P fertilisation showed that the increase was not significantly different when compared to without SP-36. The weightiest of grain content found at a dose of 100% N and 100% P.

E. Empty Grain Weight

Based on the results of the analysis of variance showed that there was a real interaction between the N and P fertilisation doses of the empty grain weight variable. The average empty grain weight due to the interaction between N and P fertilisation doses show in Table 6.

Table 6. The average empty grain weight due to the interaction between N and P fertilisation doses

Treatment	Empty grain weight (g plot^{-1})							
	P Fertiliser Dose							
N Fertiliser Dose	P0 (0% SP-36)		P1 (50% SP-36)		P2 (100% SP-36)		P3 (150% SP-36)	
	control		83,89 kg ha^{-1}		167,78 kg ha^{-1}		251,66 kg ha^{-1}	
N0 (0% Urea)	80.3	d	78.0	c	76.0	b	74.1	A
control	D		D		D		D	
N1 (50% Urea)	62.2	d	60.4	c	58.2	b	57.0	A
112,34 kg ha^{-1}	B		B		C		C	
N2 (100% Urea)	61.0	c	62.7	d	54.2	a	55.0	B
224,67 kg ha^{-1}	A		C		B		B	
N3 (150% Urea)	67.8	d	59.1	c	53.0	a	54.0	B
337,01 kg ha^{-1}	C		A		A		A	
LSD 5% :	0.2							

Note: Numbers accompanied by the same lowercase letters in the same row or the same uppercase letters in the same column show no significant difference based on the LSD test at the 5% level; N0 and P0 = without urea and SP-36

According to table 6, the effect of N administration on the level of P fertilisation showed that the increase was not significantly different when compared to without SP-36. However, The weightiest of empty grain content found at a dose of 150% N and 100% P. a decrease followed a significant increase in the dose of P fertiliser in the weight of the dry grain in each treatment.

F. Weight of 1000 rice grains

Based on the results of the analysis of variance showed that there was a real interaction between the N and P fertilisation doses of the 1000 weight variable. The mean weight of 1000 items due to the interaction between N and P fertilisation doses show in Table 7.

Table 7. The average weight of 1000 grains of rice due to interaction between N and P fertiliser treatments after harvest

Treatment	Weight of 1000 rice grains (g $plot^{-1}$)							
N Fertiliser Dose	P Fertiliser Dose							
	P0 (0% SP-36)		P1 (50% SP-36)		P2 (100% SP-36)		P3 (150% SP-36)	
	control		83,89 kg ha^{-1}		167,78 kg ha^{-1}		251,66 kg ha^{-1}	
N0 (0% Urea)	18.7	a	21.7	b	24.0	C	24.0	c
Control	A		A		A		A	
N1 (50% Urea)	19.0	a	22.7	b	27.0	C	27.3	c
112,34 kg ha^{-1}	A		A		B		B	
N2 (100% Urea)	20.3	a	24.7	b	29.0	C	28.0	c
224,67 kg ha^{-1}	AB		B		C		B	
N3 (150% Urea)	21.3	a	25.0	b	28.7	C	27.7	c
337,01 kg ha^{-1}	B		B		C		B	
BNT 5% :	1.6							

Note: Numbers accompanied by the same lowercase letters in the same row or the same uppercase letters in the same column show no significant difference based on the LSD test at the 5% level; (hsr) = days after the date; KK = diversity coefficient; N0 and P0 = without urea and SP-36

According to table 7, the effect of N administration on the level of P fertilisation showed that the increase was not significantly different when compared to without SP-36. However, The weightiest of empty grain content found at a dose of 100% N and 100% P.

G. Harvest Results

Based on the results of the analysis of variance showed that there was a real interaction between the fertilising dose of N and P on the yield variable. Average yields due to interactions between N and P fertilisation doses show in Table 8.

Table 8. Average yields due to interactions between N and P fertiliser treatments

Treatment	Harvest Result (ha^{-1})							
N Fertiliser Dose	P Fertiliser Dose							
	P0 (0% SP-36)		P1 (50% SP-36)		P2 (100% SP-36)		P3 (150% SP-36)	
	control		83,89 kg ha^{-1}		167,78 kg ha^{-1}		251,66 kg ha^{-1}	
N0 (0% Urea)	0.6	a	0.5	a	0.5	A	0.8	b
control	A		A		A		A	
N1 (50% Urea)	0.6	a	0.7	b	0.7	B	1.2	c
112,34 kg ha^{-1}	A		B		A		B	
N2 (100% Urea)	0.6	a	1.0	b	1.5	D	1.3	c
224,67 kg ha^{-1}	A		C		C		B	
N3 (150% Urea)	0.7	a	1.0	b	1.1	B	1.4	c
337,01 kg ha^{-1}	A		C		B		B	
BNT 5% :	0.1							

Note: Numbers accompanied by the same lowercase letters in the same row or the same uppercase letters in the same column show no significant difference based on the LSD test at the 5% level; (hsr) = days after ratoon; KK = diversity coefficient; N0 and P0 = without urea and SP-36

According to table 8, the effect of N administration on the level of P fertilisation showed that the increase was not significantly different when compared to without SP-36. However, The weightiest of empty grain content obtained at a dose of 100% N and 100% P.

DISCUSSIONS

Inorganic fertilisation used to overcome the lack of pure minerals from nature that plants need for sustainable growth for production. Needed for ratoon rice needs are very much needed fertilisation. It is because after harvesting the main crop, nothing included in the soil has diminished.

Ratoon rice is a rice crop that results from the regeneration of harvested rice. The process of growing ratoon rice From 65 days after ratoon. Among them, for 35 days the vegetative transition phase is short and then the generative phase followed by the growth of new shoots or saplings from the stems of the primary rice plants and flowering that will produce panicles. After that, for 30 days, the cooking phase was marked by the formation of grain and filling ratoon rice seeds. Ratoon rice if it works well it will succeed in getting a second crop. According to Ambarita et al. (2017) states that proper and balanced fertilisation is needed so that it can increase the growth and yield of ratoon rice.

Based on observations at the research location, about 80% of ratoon rice panicles began to form at the age of 25 days after ratoon. Mareza et al. (2016b) found that the Ciherang variety of ratoon rice flowered in the age range of 17-40 days after ratoon. The results of the study for each component of ratoon rice growth were: number of leaves, leaf area, number of productive tillers and total dry weight at 35 and 65 days after ratoon (Tables 2, 3, 4 and 5). If seen from the interaction with the dose of N fertiliser to each increase in the dose of P fertiliser and vice versa, the contribution of ratoon rice during the growth process mostly determined in the administration of the dose of N and P fertiliser compared to control or without fertiliser. Ratoon rice during growth improvement in the plot without N and P shows the condition of plants that look stunted, withered, leaves turn yellow earlier and even fall. As stated by Fahmi et al. (2010) why there are symptoms of chlorosis and necrosis found in plant organs, which will cause damage to the leaves which will have an impact on the formation of chlorophyll and also the formation of plant tissue causing nutrient deficiency of N and P.

Nutrient uptake at low or high doses is very varied, as support for generative growth or cooking of ratoon rice. Also available after harvesting Paddy is available after harvesting 2.78-3.05 ppm P2O5 (low) so that with the help of P fertiliser can be maximised ratoon rice. Giving high doses of P fertiliser to the optimal level will continue to increase P in the soil (Fitriatin et al., 2008 in Fitriatin et al., 2009). This research also proves that P nutrient is not very successful during the period of growth and development of ratoon rice plants. The absence of P nutrients available for ratoon rice needs allows the roots of plants to develop properly. Lestari et al. (2017) discuss how to overcome P in plant tissue, able to minimise overcoming root damage and overcome poisoning Al, (Setiawan et al., 2009) accelerate and increase the growth of young plants to be free, improve flowering, (Cahyono and Hartati, 2013) also produce plant biomass.

Application of N and P fertilisation shows the effect on the growth pattern of ratoon rice. Large quantities of N nutrient is needed by plants to form amino acids, nucleic acids, nucleotides and chlorophyll. High nitrogen can help cell division which is assisted by photosynthesis so that the development of saplings and leaves can be more (Dobermann and Fairhurst, 2000). Besides that, the application of P is not to play as a regulator of various processes in metabolism such as photosynthesis, mobilising nutrients from the roots to the leaves, asymmetric displacement of the leaves throughout the plant tissue. The nutrient element P is also related to the hardness of plant leaves and can bind the leaves, so they do not fall (Sumarno, 1986; Sutarto et al., 1988; Prawinata et al., 1991 in Lubis et al., 2013). In the research of Kasno et al. (2016), the number of productive tillers produced without N and P was significantly lower, while the contribution of N and P fertiliser quantities could increase the number of productive tillers.

CONCLUSION

From the previous discussion, we conclude that the growth and yield of ratoon rice influenced by N and P fertilisation compared to control or without N and P fertilisers; Fertilizing N and P at a dose of 224.67 kg urea ha-1 added 167.78 kg SP-36 ha-1, is the optimum dose needed by the ratoon rice plant when viewed from the growth and yield growth that looks more when compared with other N and P fertilising doses; Fertilisation of N and P at a dose of 337.01 kg urea ha^{-1} was added 167.78 kg SP-36 ha-1, affecting the reduction in the weight of hollow grains.

REFERENCE

i. *Ambarita, Y., D. Hariyono dan N. Aini. 2017. Aplikasi Pupuk NPK dan Urea Pada Padi (Oryza sativa L.) Sistem Ratun. J. Produksi Tanaman. 5 (7): 1228-1234.*

ii. *BPK Mego. 2016. Spesifikasi Wilayah Kecamatan Mego Kabupaten Sikka*

iii. *Cahyono, O. and S. Hartati. 2013. Improvement of Phosphate Fertilization Method in Wetland Rice. J. Agrivita. 35(1): 81-87.*

iv. *Dobermann, A., and T. Fairhurst. 2000. Rice Nutrient Disorders and Nutrient Management. Potash and Phosphate Institute (PPI) and the International Rice Research Institute (IRRI). Oxford Graphic Printers Pte Ltd. Canada. Phil. p. 35-43.*

v. *Fahmi, A., Syamsudin, S. Nuryani, H. Utami dan B. Radjagukguk. 2010. Pengaruh Interaksi Hara Nitrogen dan Fosfor Terhadap Pertumbuhan Tanaman Jagung (Zea Mays L) Pada Tanah Regosol dan Latosol. Berita Biologi. 10(3): 297-304.*

vi. *Fitriatin, B.N., A. Yuniarti, O. Mulyani, F.S. Fauziah dan M.D. Tiara. 2009. Pengaruh Mikroorganisme Pelarut Fosfat Dan Pupuk P terhadap P Tersedia, Aktivitas Fosfatase, Populasi Mikroorganisme Pelarut Fosfat, Konsentrasi P Tanaman dan Hasil Padi Gogo (Oryza sativa. L.) pada Ultisols. J. agrikultura. 20(3).*

vii. *Hanafiah, K.A. 2005. Dasar-Dasar Ilmu Tanah. Raja Grafindo Persada Prees. Jakarta. hal. 251-352.*

viii. *Husnain, A. Kasno, S. Rochayati. 2016. Pengelolaan Hara dan Teknologi Pemupukan Mendukung Swasembada Pangan di Indonesia. J. Sumberdaya Lahan. 10(1): 25-36.*

ix. *Kasno, A., T. Rostaman dan D. Setyorini. 2016. Peningkatan Produktivitas Lahan Sawah Tadah Hujan Dengan Pemupukan Hara N, P, dan K dan Penggunaan Padi Varietas Unggul. J. Tanah dan Iklim. 40(2): 147-157.*

x. *Krishnamurthy. 1988. Rice Ratooning as an Alternative to Double Cropping in Asia. In: Smith, W.H., V. Kumble., E.P. Cervantes. Editor. Rice Ratooning. IRRI. Los Banos. Phil. p. 3-15.*

xi. *Lestari, T., Trikoesoemaningtyas, S.W. Ardie dan D. Sopandie. 2017. Peranan Fosfor Dalam Meningkatkan Toleransi Tanaman Sorgum Terhadap Cekaman Aluminium. J. Agron. Indonesia. 45(1): 43-48.*

xii. *Liu, K., J. Qin, B. Zhang and Y. Zhao. 2012. Physiological Traits, Yields and Nitrogen Translocation of Ratoon Rice in Response to Different Cultivations and Planting Periods. Afric. J. of Agric Res. 7(16): 2539-2545.*

xiii. *Lubis, A.I., Jumini dan Syafruddin. 2013. Pertumbuhan dan Hasil Tanaman Kacang Tanah (Arachis hypogeal L.) Akibat Pengaruh Dosis Pupuk N dan P Pada Kondisi Media Tanam Tercemar Hidrokarbon. J. Agrista. 17(3): 119-126.*

xiv. *Mareza, E., Z.R. Djafar, R.A. Suwignyo, and A.Wijaya. 2016 a. Rice Ratoon Yield Response to main Crops Cutting Height in Tidal Swamp Using Direct Seeding Sistem. J. of Agric. Sci. 38(2): 126-132.*

xv. *Mareza, E., Z.R. Djafar, R.A. Suwignyo. 2016 b. Morfofisiologi Ratun Padi Sistem Tanam Benih Langsung Di Lahan Pasang Surut. J. Agron. Indonesia. 44(3): 228-234.*

xvi. *Setiawan, A., J. Moenandir dan A. Nugroho. 2009. Pengaruh Pemupukan N, P, K Pada Pertumbuhan dan Hasil Padi (Oryza Sativa L.) Kepras. J. Fakultas Pertanian. Universitas Brawijaya. Malang.*

xvii. *Shin, J., Sang-Kuk K and Sang-Gu P. 2015. Effects of Stubble Height, Irrigation and Nitrogen Fertilization on Rice Ratooning in Korea. J. Crop Sci. 60(4): 431-435.*

xviii. *Subrata, K. 2013. Pengaruh Sisa Amelioran, Pupuk N dan P Terhadap Ketersediaan N, Pertumbuhan dan Hasil Tanaman Padi Di Musim Tanam Kedua Pada Tanah Gambut. J. Lahan Suboptimal. 2(2): 159-169.*

xix. *Suminarti, N.E. 2011. Teknik Budidaya Tanaman Talas (Colacasia esculenta L) Schott Var. Antiquorum Pada Kondisi Kering dan Basah. Disertasi. Universitas Brawijaya. Malang.*

xx. *Susilawati. 2013. Peningkatan Produktivitas dan Efisiensi Usaha Tani Padi Sistem Ratun Di Lahan Pasang Surut. Buletin Inovasi Teknologi Pertanian. 1(1): 12-17.*

xxi. *Vegara, B.S., F.S.S. Lopes, and J.S. Chauhan. 1988. Morphology and Physiology of Rice Ratoons. In: Smith, W.H., V. Kumble., E.P. Cervantes. Editor. Rice Ratooning. IRRI. Los Banos. Phil. p. 31-41.*