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## Growth and Result of Three Line Fe Biofortified Rice for Some Dosages of N Fertilizer

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### ABSTRACT

The aim of this research is finding the optimal N dosage value in every line. This research was conducted from September 2014 to Januari 2015 in Screen House of Plant Breeding and Biotechnology Laboratory, Faculty of Agriculture, University of Jenderal Soedirman. This research was use Completely Randomized Block Design (CRBD) with 3 repetition. There were 3 factors were investigated: (1) Three rice lines as the result of Fe biofortification, those were line 7 (G7), line 27 (G27) and line 37 (G37); and (2) three dosage of N fertilizer, thoe were 100 kg N/ha (N1), 150 kg N/ha (N2) and 200 kg N/ha (N3). Results shows that there is interaction between 3 N fertilizer dosages and 3 lines that were investigated for grain weight based on their clump and the good dosage of line 7 is 200 kg N / ha, line 27 and 37 was 150 kg N / ha. The differences of dosage in giving N fertilizer produces the differences in plant height, numbers of seedlings, numbers of productive seedlings, grain weight for each clump and number of filled grain. Three kinds of lines also were used to produced the difference in the plant height, panicle length, numbers of seedlings, numbers of productive seedlings, blossoming age, grain weight for each clump, weight of 1000 seed and the numbers of filled grain for each clump and line.

**Keywords:** rice as the result of Fe biofortification, N fertilizer, grain weight

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## INTRODUCTION

Rice is cereal plant which has social, politic, and economic value, because it is the main food for more than half of the world's society (Daradjat *et al.*, 2008). In Indonesia, the production of unhulled paddy can not fulfill the food self-supporting. Therefore, we need cultivate rice which produces optimal result and minimal nutrition need, that we can minimize the budget and power but has high quality result.

The new technologies in creating new varieties of rice has been developed to produce new varieties of high productive rice, have many usefulness, overcome the health and increasing concentration of nutrition problems (Indradewa, 2007). Fe biofortified rice is the result of an inovation in plant caring field that has high iron (Fe) to help anemia problem.

There must be short and long term considerations in producing biofortified plant. If there is proper caring in growing this plant, it will have a contribution to optimal biological variety and continuing the food demand (Mew *et al.*, 2003). This case is one of the reason the need of creating Fe biofortified rice and investigating the growth and poduction in some fertilizing dosages.

There must be Nitrogen serving from the first step of plant growing until the plant is productive. However, the numbers of maximum nitrogen must have been served since the first step of growing (Kaushal *et al.*, 2010).

Nitrogen is an important nutrition to produce rice, that is called as limiter factor (Sofi and Shafiq, 2007). There is a correlation between nitrogen absorbence and unhulled paddy result. The nitrogen absorbence and the efficiency of N using is different in location, plant period, numbers and time of N application (Roy *et al.*, 2004).

Application of chemistry fertilizer can compensate the need of rice growth and increase the result. Giving N also can increase the ratio of the hull and content of paddy. The application of various N fertilizer influences some characters to produce hull and content of the paddy (Bahmaniar and Ranjbar, 2007). The aim of this research is finding the optimal dosage for every line.

## METHOD OF THE RESEARCH

This research was conducted in Screen House (without roof) in Laboratory of Plant Breeding and Biotechnology Agriculture Faculty Jenderal Soedirman University. It was from September 2014 until Januari 2015.

The materials in this research are seeds (line G7, G27 and G37 of Fe biofortified rice), urea-based fertilizer, KCl fertilizer, SP-36 fertilizer, pesticide and soil. The instruments in this research are polybag, scissors, labelling paper, rope, digital scales, termohigrometer, leaves colour chart, paper bags, rulers, gauge, bamboo stakes, log books, plastic bags, envelopes, buckets, and stationary.

This research used Completely Randomized Block Design (CRBD) with two investigated factors. The first factor is three lines of Fe biofortified rice, those are Line 7, Line 27, and Line 37; and the second factor is three dosages of N fertilizer, those are 100 kg N/ha (N1), 150 kg N/ha (N2) dan 200 kg N/ha (N3). The experiment consists of 9 combinations of treatment and three repetitions. Each unit consists of 5 polybags, consist of 1 plant for each.

The variables in this research are plant height (cm), penicle lenght (cm), the numbers of total seedlings for each clump (branch), the numbers of productive seedlings for each clump (branch), blossoming age (hst), colour of green leafes, weight of grain for each clump (g), filled paddy percentage (%), weight of 1000 seeds (g) and the numbers of filled paddy for each clump (seed).

The data was analyzed using analysis of variance. If there was a real difference, there would be Duncan Multiple Range Test (DMRT) at 5% level of the test.

**RESULT AND DISCUSSION**

The result of the research shows that the dosage of N fertilizer influences the growth, production component, and production of rice. The influence of weight of grain for each clump based on the tested line. This dosage influence can be seen in the weight of the unhulled paddy for each clump, height of the plant, the numbers of variance, the numbers of productive variance, the numbers of filled paddy for each clump. However, it does not exist in the panicle length, blossoming age, leaves colour, the percentage of filled paddy and the weight of 1000 seeds. The difference of growth and production are between tested lines, except on the colour of leaves and percentage of filled paddy (Table 2).

**Table 2: Matrix of analysis variance result on the growth variable and production of rice**

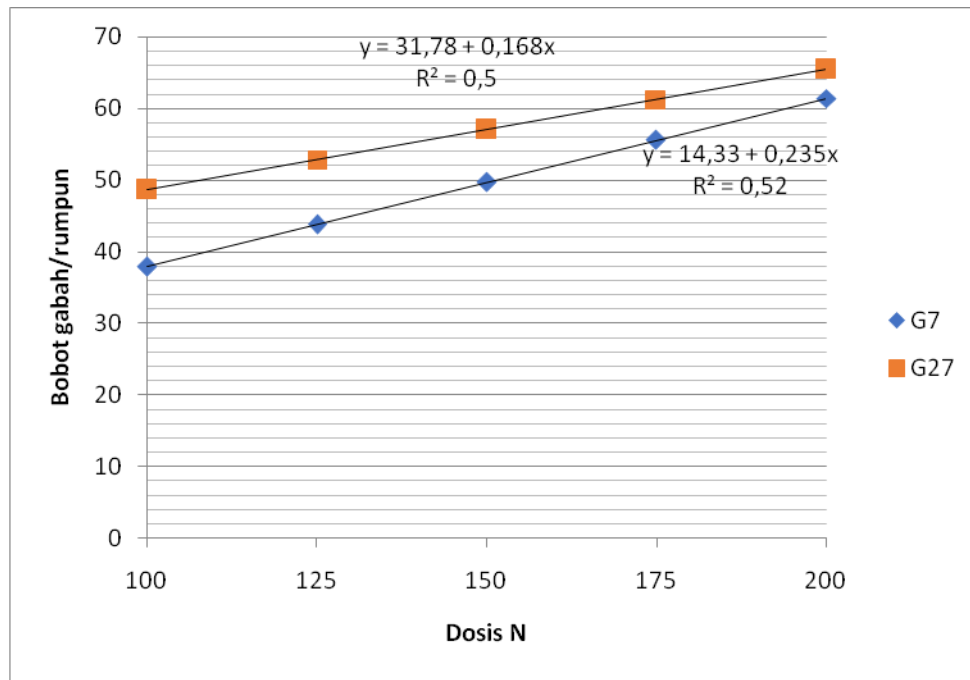
No.	Variable	Line	N dosage	Line X N dosage
1	Plant heigh	*	*	Ns
2	Panicle length	*	ns	Ns
3	Numbers of seedling	*	*	Ns
4	Numbers of total seedling	*	*	Ns
5	First blossoming age	*	ns	Ns
6	30% blossoming age	*	ns	Ns
7	Colour of green leafes	ns	ns	Ns
8	Weight of grain for each clump	*	*	*
9	Filled paddy percentage	ns	ns	Ns
10	Weight of 1000 seeds	*	ns	Ns
11	Numbers of grain for each clump	*	*	tn

ns : not significantly different at 5% level of the F test

\* : different significantly at 5 % level of the F tes

Table 3 shows that the line response to dosages of N fertilizer is different. The weight of rgrain for each clump Line G7 and G27 responds to every N dosage addition increases the linear weight of grain for each clump, as on figure 1. On the other hand, line G37 does not show the clear relationship between dosage of N fertilizer and the weight of grain for each clump. Therefore, we have not found the optimal N dosage for both lines. However, the relationship between the weight is not enough because of the low determination coefficient ( $R^2$ ), that is 0.5, that must be other approach, that is Duncan's Multiple Range Test. However, by using Duncan's Multiple Range Test, we get some information for line G27, that adding the dosage from 150 kg N/ha to 200 kg N/ha can not increase the weight of grain for each clump. This Duncan's Multiple Range Test also gives information that the proper dosage for line G37 is 150 kg N/ha, because adding the dosage from 150 kg N/ha to 200 kg N/ha decreases the weight of grain for each clump.

This fenomena shows that the proper dosage of N fertilizer for G27 and G37 is 150 kg N/ha. On the other hand, 200 kg N/ha of N fertilizer for G7 can increase the result. The weighest grain by giving 150 kg N/ha for G37 can be seen in table 4.



**Figure 1: The curve relationship weight of grain per clump G7 and G27 with dosage of N fertilizer**

**Table 3: Weight of grain per panicle of three rice lines in different dosage of N**

N dosage	G7	G27	G37
N1	39,88333 ax	45,87333 ay	50,47803 az
N2	45,67667 bx	62,43333 by	66,6 cz
N3	63,43479 cx	62,67667 bx	63,04333 bx

Description : the numbers followed by the same alphabet in the same each column means are not different significantly at 5 % DMRT

The result of analysis of variance shows that there is interaction among the weight of grain for each clump from each line with various dosages of N fertilizer. Different responses among those lines toward the different dosages of N fertilizer show that the lines have different capability in using the fertilizer. Noviana (2013) said, the proper genotip in its environment will have higher result than the improper genotip. Every line has its own capability to be productive based on the nutrition it has got. The higher N dosage, the higher weight of the grain.

Adding dosage of N fertilizer can increase the weight of grain and the numbers of grain for each clump. Related to this case, Sutanto (2002) as cited in Dahlan *et al* (2012) said that the availability of nutrient needed by plant can be fulfilled by adding proper nitrogen fertilizer, that accelerate nutrient absorption. Schulze and Caldwell (1995) also said that the proper dosage of urea-based fertilizer will increase the N in rhizosfer, optimize N spreading and stimulate absorption and use N efficiently. Certainly, this case can optimize the plant production.

However , the addition of N with increasing dosage not certain to yield maximum production. As can be seen on grain yield G37 where an increase in weight of grain per clump of N1 to N2 dosage, but rather a decline in weight of grain per clump at a dosage of N2 to N3. In accordance with the opinion of Munawar (2011 ) that the optimum N supply can support the growth and production of plants with optimal. Sufficient supply of N to plants characterized by high photosynthetic activity , a good vegetative growth and dark green color of plants. N supply overload can result in delayed crop maturity .



**Table 4: Components of growth and production of the three line of rice with different dosage of N**

Treatment	Weight of grain for each clump (g)	Numbers of grain for each clump	Weight of 1000 seeds (g)	Plant heigh (cm)	Panicle length (cm)	Numbers of seedling (branch)	Numbers of productive seedling (branch)	Umur Berbunga Pertama (hst)	Umur Berbunga 30% (hst)
N1	45,41 a	1591,13 a	26,58 a	120,13 a	28,50 a	18,32 c	17,69 b	61,89 a	65,97 a
N2	58,24 b	2098,24 b	25,70 a	128,62 b	28,41 a	17,21 b	16,73 b	62,16 a	65,87 a
N3	63,05 c	2058,24 b	26,77 a	128,11 b	29,36 a	13,58 a	12,77 a	61,81 a	65,55 a
F count	9,14*	5,10*	1,75	7,66*	1,76	10,62*	10,89*	0,33	0,30
F table 5%	3,63	3,63	3,63	3,63	3,63	3,63	3,63	3,63	3,63
G7	49,66 a	1626,30 a	26,40 b	116,67 a	24,42 a	18,74 c	17,56 b	66,69 c	72,36 c
G27	56,99 b	2322,33 b	22,34 a	127,85 b	29,83 b	17,19 b	16,77 b	59,24 a	62,1 a
G37	60,04 c	1799,67 a	30,31 c	132,34 c	32,02 c	13,18 a	12,86 a	59,92 b	62,92 b
F count	7,90*	8,46*	84,19*	22,04*	96,34*	14,22*	10,10*	170,39*	201,64*
F table 5%	3,63	3,63	3,63	3,63	3,63	3,63	3,63	3,63	3,63
G7N1	39,88 a	1340,72 a	27,35 b	113,54 a	23,87 a	15,28 d	13,8 bc	66,58 d	72,55 g
G7N2	45,68 b	1736,5 c	25,13 b	119,44 c	24,29 a	19,69 e	17,84 d	66,6 d	72,6 g
G7N3	63,43 d	1801,67 cd	26,73 b	117,03 b	25,10 b	22,25 g	21,03 f	66,9 d	71,94 f
G27N1	45,87 b	1887,44 cd	22,36 a	118,67 bc	28,93 c	14,03 bc	13,63 bc	59,53 b	62,97 d
G27N2	62,43 d	2597 e	21,91 a	131,18 e	29,88 d	19,73 f	19,27 e	59,47 b	61,4 a
G27N3	62,68 d	2482,56 e	22,74 a	133,71 f	30,67 e	17,8 e	17,4 d	58,73 a	61,93 b
G37N1	50,48 c	1547,56 b	30,03 c	128,19 d	32,68 f	11,42 a	10,87 a	59,57 b	62,38 bc
G37N2	66,6 e	1961,22 d	30,05 c	135,24 f	31,05 e	13,2 b	13,07 b	60,4 c	63,6 e
G37N3	63,04 d	1890,11 d	30,85 c	133,6 f	32,32 f	14,92 cd	14,65 c	59,8 b	62,77 cd
F count	4,26*	3,39*	21,48*	7,43*	24,52*	6,21*	5,25*	42,68*	50,49*
F table 5%	2,59	2,59	2,59	2,59	2,59	2,59	2,59	2,59	2,59

Description: the numbers followed by the same alphabet in the same each column of the same group or the same factors treatment means not different significantly at 5 % DMRT

Large weights of grain also affected by the number of grains. The more numbers of grain, produced of weight of grain will be increased. In accordance with the opinion of Wangiyana et al . (2009 ), that to obtain high yields, the grains of rice should be filled through the process of photosynthesis and photosynthate partitioning a high rate during grain filling phase.

Production of grain by the rice plant can not be separated from the growth factor. Plants with good growth and optimal production also can produce optimal . It certainly can not be separated from nutritional factors. Low dosage of N (100 kg N/ha) led to the growth of plant height lower than plants with higher N dosage. Therefore, nitrogen is given at a dosage of more generating plants with higher growth. The higher canopy owned plants, will increase the physiological processes including photosynthesis, so produced of the grain that will be more.

In addition to dosage of N fertilizer which gives distinction to the growth and production of plants, the adaptability of each plant also provides influence. Each plant has a genetic makeup and come from different parents. So as to allow for differences in growth and production generated by each plant . Gosh and Kashyap (2003 in Dahlan et al., 2012 ) suggest the influence of variability in terms of growth and production are different from each variety of rice varieties caused each has its own adaptability to the conditions of the biophysical environment.

Experiments show that the number of grain produced more than G7 G27, in accordance with the weight of grain per clump. But the numbers of grain G37 fewer than G27, but has a weight of grain per clump is greater. This can be attributed to differences in the morphology of grain produced. Morphologically, the G37 has a rounded grain shape, larger than the other two lines, long panicles, and the resistance loss, so that the resulting grain tends to be more severe. Unlike the G27 which have a more dense grain per clump, but more slender shape and a size smaller than the G37, so that the weight of grain per panicle and weight of a thousand seeds produced lower than the G37.

The diversity of the value of the grain weight per panicle rice lines can also be affected by the strain of plant height. Plant height increment each strain is parallel with grain weight per clump produced. Moreover, it seems that plant height differences among lines are also in line with the difference in panicle length produced each line. Lines that have higher plant height will result in a longer panicle length anyway. This can occur due to high plant can obtain maximum exposure. Fotosintat generated will be higher as the photosynthesis process that goes too high. Grain production will also increase along with it.

## CONCLUSION AND SUGGESTION

### Conslusion

- N fertilizer effect on grain weight per clump produced by each line.
- Dosage of fertilizer N corresponding to each Fe biofortification of rice lines G7 is 200 kg N/ha with grain produced per clump as much as 63,43 g, G27 is 150 kg N/ha grain yield per clump with as many as 62,43 g and G37 is 150 kg N/ha grain yield per clump as much as 66.6 g .

### Saran

Need to do further research on rice lines of Fe biofortification in order to know more details of the properties and released as varieties, given the benefit of the results of biofortification Fe rice.

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