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Effect on Uptake Ameliorant Some Variety of Rice in Swamp Land Tidal Acid Sulphate New Openings

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Abstract: ***Land new openings is the opening of secondary forest land by way of reclaiming the land and the land has not been planted with anything. Therefore, this area contained in the swamp tidal acid sulfate, then this land belong to the marginal land or problematic. Increasing the productivity of acid sulphate soils new openings required ameliorant (dolomite liming and fertilization NPK). This study objectives to determine the uptake of each variety and find varieties that have the best nutrient uptake, by giving ameliorant (dolomite liming and fertilization NPK) on a tidal swamp land acid sulphate new openings. Research conducted at the Plastics in Areal Tanjungpura Pontianak Faculty of Agriculture and the land taken from the Village of Teluk Pakedai, District of Kubu Raya. The method used is Factorial Experiments with Random Block Design (RBD). Using two factors, namely: 6 Varieties and 3 calcification of dolomite-NPK fertilizer, with 4 replications, so that there are 72 populations. The variables of this study are: the nutrient uptake of N, P, K, Ca, Mg, Fe and S on the roots and the top of the plant (stems and leaves) rice plants. The results showed that among the varieties there are variations in nutrient uptake and Varieties Ringkak Janggut (locally) with calcification of dolomite 2 tons of fertilizer NPK 90 Kg/hectare indicate nutrient uptake the roots of rice plants best and Variety Situ Bagendit (hybrid) with calcification 1 ton-pertilizer NPK 60 Kg/hectare shows the top nutrient uptake of plants (stalks and leaves) best.***

Keywords: ameliorant, tidal wetlands, new openings acid sulfate soil, nutrient uptake, the rice plant.

1. Preliminary

A. Background

Rice (*Oryza sativa*. L) is a rice crop which is a staple food for most Asian societies, even in every continent (3.0 billion and 4.6 billion in 2050). The expansion of land by opening new land (derived from secondary forests) for food crops, is one way to resolve the issue. In West Kalimantan, the opening of new land that can be utilized is marginal land (problems), such as tidal swamp land acid sulfate.

One of the districts that has wetlands and peat is broad enough Kubu Raya. This district has an area of wetlands (acid sulphate), ie 406 689 ha (58.22%) and 291 849 hectares of peat (41.78%). Development of agriculture (rice) in tidal swamp areas of acid sulphate has various problems, such as high soil acidity (volatile), the difficulty of estimating the occurrence of floods and many toxic compounds, such as Fe (Nurzakiah *et al*, 2012). In the anaerobic conditions (acid sulphate), sulfate and iron ions are reduced and turned into iron ions which then ends up forming pyrite (Akhmad, 1996) and (Rosilawati, *et al*, 2014).

Required an in-depth study, if it will use tidal swamp land for rice acid sulfate, especially with regard to test some rice varieties and ameliorant, in order to obtain varieties that adapt well and ameliorant (liming and fertilization) suitable for rice crop. Liming is an effort to improve the biological properties of the soil (Basu *et al*, 2011) and reduce the negative effects of sulfuric acid on acid soils (Sadiq and Umara Babagana, 2012). Liming can reduce soil acidity and Al toxicity in acid sulphate soils (Nurzakiah *et al*, 2012). Calcification can also improve soil fertility, soil pH, cation exchange capacity, swapped Ca, Mg, P and K are available, due to lower aluminum content (Shamsuddin and Fauziah, 2010). Fertilization is intended to improve soil fertility (Akhmad, 1985), because it can provide nutrients for plants (Raut *et al*, 2013). The availability of nutrients or plant nutrients are very important, especially nitrogen in various stages of growth and production of rice (Lavanya and Ganapathy, 2009) and (Assefa *et al*, 2013).

Fertilization is one of the key in the development of tidal land as a center of rice production (Masganti, 2007). Further explained that the productivity of rice in the tidal area is closely related to the ability of the rice plant to absorb nutrients. One of the factors that determine the ability of plants to absorb nutrients is the level of nutrient availability, among others influenced by the level of soil acidity (Marchner, 1986). The availability of nutrients in the soil to encourage an increase in the absorption of nutrients by the plants, in terms of tidal land has a high level of acidity and nutrient deficiency doubles (Zahrah, S., 2010). Therefore, in the land that is so necessary rice plants that are efficient in utilizing nutrient (Susanto *et. al.*, 2003). Described by Makarim *et. al.* (1999). Nutrient absorption is the ability of the plant relative to mine nutrients from the soil and turn it into a part of the plant. The higher the plant's ability to absorb nutrients, the higher results obtained (Masganti, 2007).

Especially for the Village of Teluk Pakedai, which is approximately 1.5 kilometers from the coast is dominated by tidal swamp land, especially land acid sulfate newly opened and derived from secondary forests. Tidal marsh area of land is always under water, well water or a permanent move. The water source can be derived from the ebb and flow of the sea water, as well as from rainwater. Besides this land at a certain time (November to January) is influenced by the tide.

B. Problem Formulation

Problems formulated into the study two topics, namely:
1) Ameliorant yet known influence on the potential uptake of some varieties of rice in the swamp tidal acid sulphate new openings.
2) It is not known varieties that have the best nutrient uptake, in the roots and the top (stem and leaves) rice plants.

C. Objective

The purpose of this study was formulated in a study two topics, namely:
1) Determine the influence of the potential nutrient uptake ameliorant several varieties of rice, the tidal swamp land acid sulphate new openings.
2) Knowing the varieties that have the best nutrient uptake, in the roots and the top (stem and leaves) rice plants.

2. Research Methods

A. Place and Time Research

This research was conducted at the Plastics in Areal Research Faculty of Agriculture, University of Tanjungpura Pontianak. Land use, from the Village of Teluk Pakedai, District of Kubu Raya.

The research lasted for 5 months since the beginning of November to the end of March 2014.

B. Design of Experiments

The research used Factorial Experiments with Random Design (RBD) and there are 2 factors with four replications. As for the treatments in question:

The first factor is the rice varieties that are labeled V, consists of six varieties, namely:
V_1 : Varieties Ciherang
V_2 : Varieties Situ Bagendit
V_3 : Varieties Inpara 3
V_4 : Varieties Mira 1
V_5 : Varieties Si Randah
V_6 : Varieties Ringkak Janggut

The second factor is the dose Dolomite Lime and NPK with the code P consists of 3 levels, as follows:
P_1 : 1 Ton Lime Dolomite - 60 kg NPK / ha.
P_2 : 2 Ton Limestone Dolomite - 90 kg NPK / ha.
P_3 : 3 Ton Limestone Dolomite - 120 kg NPK / ha.

The second of the above factors, there are 18 combinations of treatment with four (4) replicates, so that there are 72 rice plant population.

C. Statistical Analysis

This study uses a model of Factorial Experiments with Pattern Group Random Design (RAK), the equation is as follows:
$Y_{ijk} = \mu + R_k + V_i + P_j + V_{Pij} + \Sigma_{ijk}$
Where :
Y_{ijk} = Response variables measured (observed values).
μ = average Influence
V_i = Effect of the i-th level of factor Varieties
P_j = Effect of the j-th level of factor Liming and Fertilization
VP_{ij} = Effect of the interaction between the i-th degree and extent to Vaietas factor-j Dose

Lime and Fertilizer
Σ_{ijk} = Effect of error / errors in the combined treatment on replay to ij-k.

Here in after analysis is HSD test (Gaspersz, V., 2006).

3. Results and Discussion

A. Nutrient Uptake Roots Part A Rice (45 Days After Planting)

1. Nitrogen

Based on the data, it appears that between the two treatments, varieties and dolomite liming-fertilization NPK, no real effect. For Figure 1, can be explained that the combination treatment V_6P_2 shows the highest, while the lowest V_1P_3 a combination treatment.

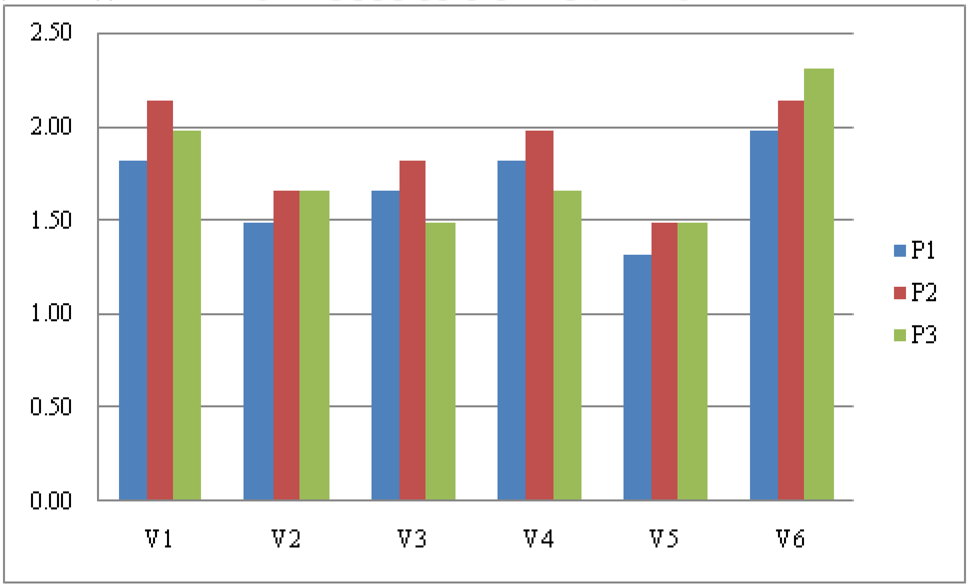

Figure 1: Histogram N Nutrient Uptake

According to Patti *et. al*. (2013) Nitrogen (N) is a major nutrient for plant growth. N function, namely: to increase vegetative growth, increasing the number of tillers and increasing the number of grains/clump as well as increase the size of grain of rice. However, N is the nutrient most often limited to land paddy, the main causes loss of N from the soil paddy is through denitrification and leaching. N fertilization management should pay attention N losses through denitrification and leaching the (Pujiastuti, 2006). This suggests that the nutrients nitrogen uptake in rice plants were the highest when compared with other treatment combinations. This is supported by nutrients in the soil sufficient N available during the growth phase, N deficiency or the presence of metabolic disorders N at a certain time range will limit the generative phase. Therefore, to obtain nutrient uptake and high yields, nutrients must be provided with enough N during the growth phase (Sudjana, 2014).

2. Phosphorus

From the data, it can be explained that between the two treatments, the varieties and dolomite liming-fertilization NPK interaction. While from Figure 2, it appears that a combination treatment V_6P_2 V_1P_2 highs and lows.

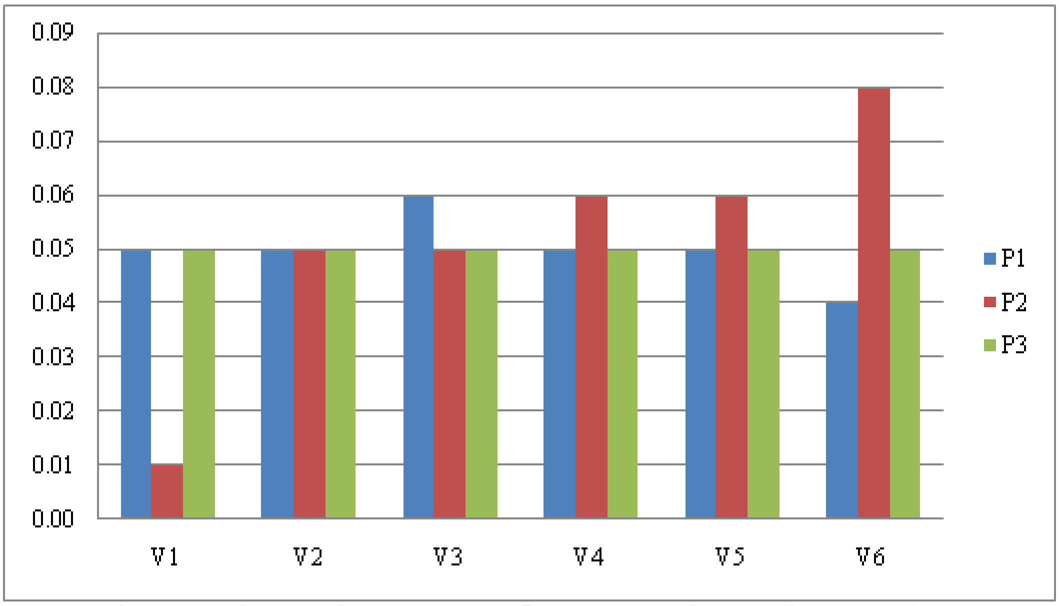

Figure 2: Histogram Phosphorus Nutrient Uptake

Phosphorus (P) is a nutrient required by plants in large amounts (macro), but the number P is smaller when compared with N and K. To serapapan of P in the roots of rice plants ranged from 0.01 to 0.08%, whereas to the top of the plant ranged from 0.08 to 0.21%. According to Makarim (2005) optimal levels of P in the plant during the vegetative growth is from 0.3 to 0.5%. Further explained that the P absorbed by plants in the form of primary orthophosphate ion ($H_2SO_4^-$) and ion secondary orthophosphate ($H_2PO_4^{2-}$) and in small amounts is firofosfat and metaphosphate and organic phosphate compounds that form soluble in water, such as nucleic acids and fitin.

3. Potassium

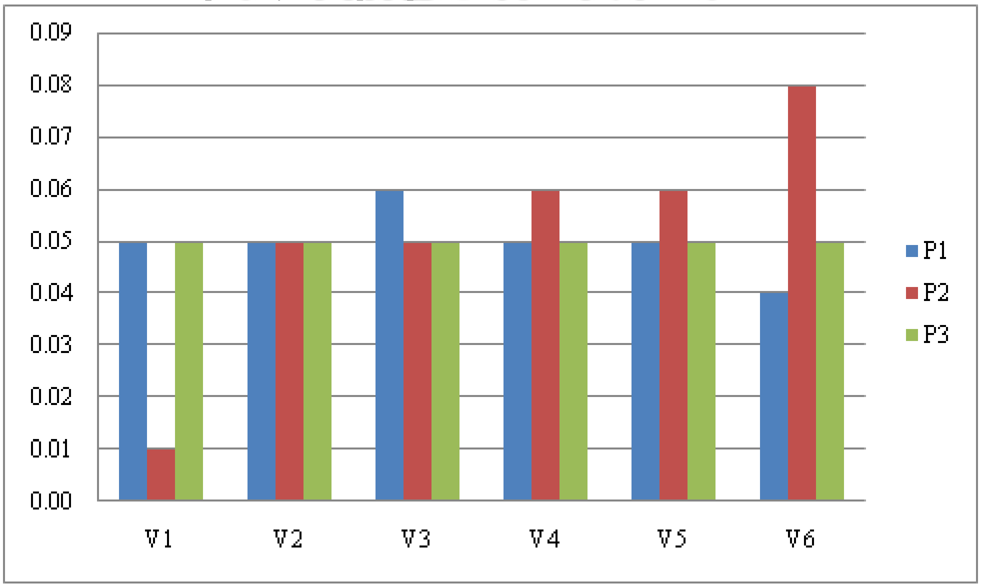

Figure 3: Histogram Potassium Nutrient Uptake

Based on the data, that between the two treatments, the varieties and dolomite liming-fertilization NPK interaction. From Figure 3 can be explained, that is combination treatment V_6P_2 the highest, while the lowest V_1P_2.

Potassium (K) is an essential nutrient in addition to N and P. Although K in the soil is quite large, but the percentage of available for plants during the growing season low. Nutrient uptake by roots of rice plants ranged from 0.01 to 0.08%, while the upper part of plant paddy from 0.08 to 0.21%. According Buckmann and Brady (1982), that the availability of K in the soil can be classified into: K immediately available, slow available K and K are relatively unavailable.

4. Calcium

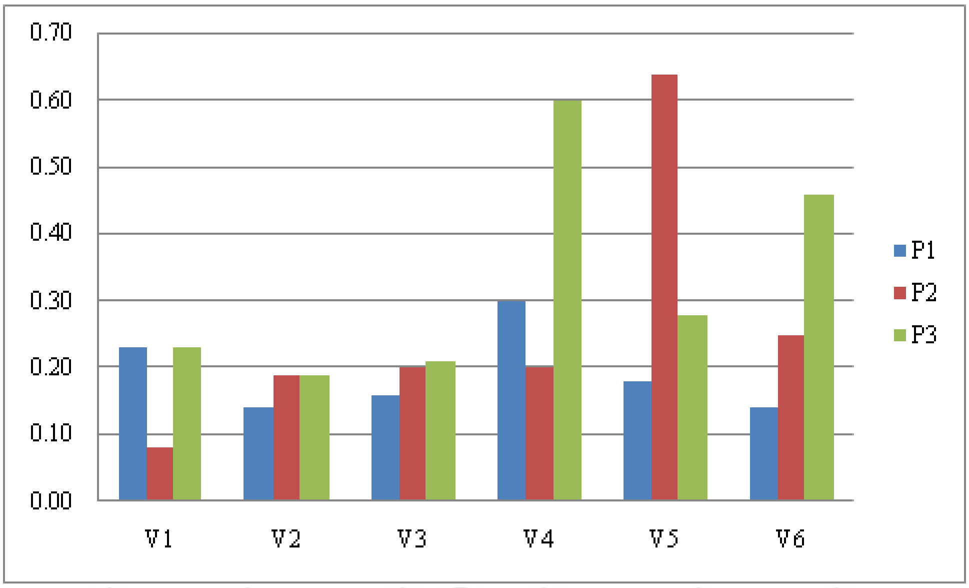

Figure 4: Histogram Calcium Nutrient Uptake

Based on the data, it appears that there is interaction between the two treatments, the varieties and dolomite liming-fertilization NPK. While from Figure 4 can be explained, that is a combination treatment V_5P_2 V_1P_2 highs and lows.

For Ca uptake by roots of rice plants ranged from 0.08 to 0.64, while for the top of the rice plant from 0.24 to 0.44%. Ca nutrients are absorbed in the form of divalent cations Ca^{2+}. Ca^{2+} uptake is limited to the tip of the root: root area of young people who have not experienced the endodermis cell wall suberisasi. Ca enter through the xylem vessel apoplastik. Freight limited penetrate the membrane, root growth is necessary in order to continuously meet the needs of decision-Ca. The transport through the xylem, Ca carried away by the flow of water transpiration, limited mobility through the phloem (Gardner *et. al*., 1991).

5. Magnesium

From the data can be explained, that between the two treatments, the varieties and dolomite liming-fertilization NPK interaction. To Figure 5 can be explained, that is combination treatment V_5P_2 the highest, while the lowest V_1P_2.

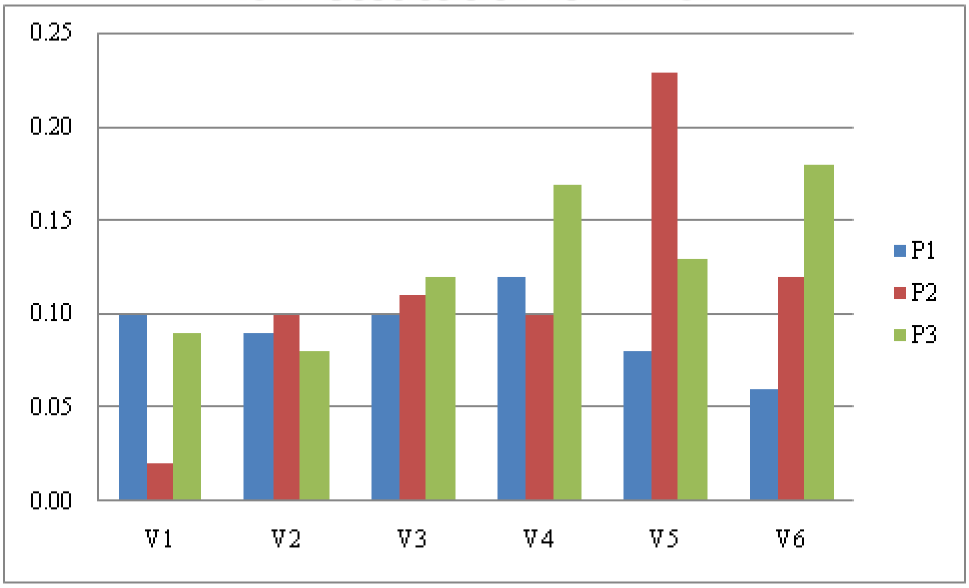

Figure 5: Histogram Nutrient Absorption Magnesium

Mg nutrient uptake by roots of rice plants ranged from 0.02 to 0.23%, while for the top of the rice plants ranged from 0.13 to 0.23%. Mg is absorbed by plants in the form of Mg^{2+}. The most decisive cation exchange reaction behavior of Mg in the soil. Rapid equilibrium between dissolved confused with: supporting Mg exchanged in solution, remember the factors of quantity and intensity of Gardner *et. al.* (1991).

6. Ferrum

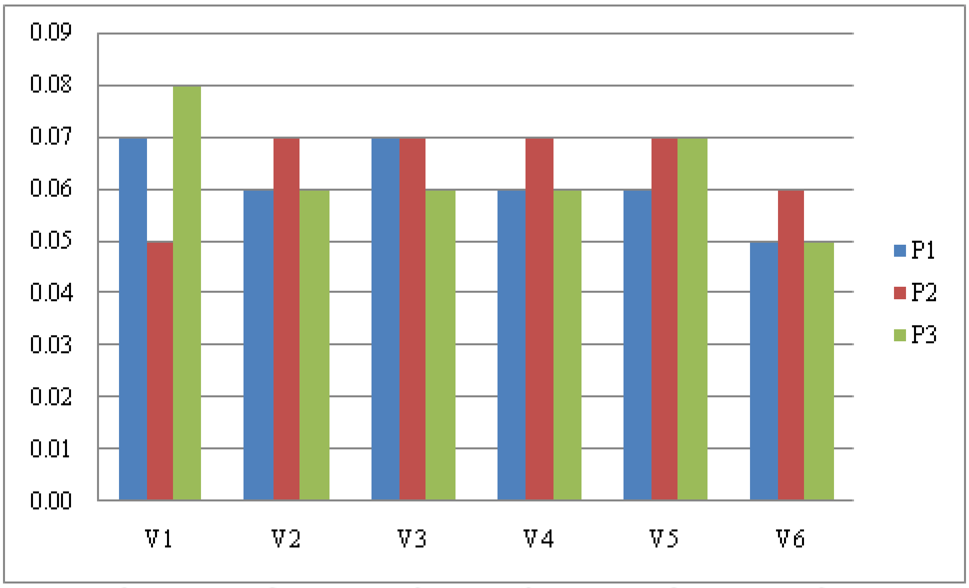

Figure 6: Histogram Nutrient Uptake Fe

From the data, it appears that there is no real influence, between treatment varieties and dolomite-calcification treatment NPK fertilization. As for Figure 6 can be explained, that is combination treatment V_1P_3 terrtinggi, while the lowest V_1P_2.

Fe uptake by roots of rice plants varies from 0.05 - 0, 08%, whereas Fe uptake by the top of the plant ranged from 0.03 to 0.05%. Fe uptake through leaves is considered faster than passing roots, especially in plants deficient Fe. The function of nutrient Fe is a chloroplast protein synthesis and respiration as peroxide enzyme, catalase, pyridoxine and cytochrome oxidase. Another function is as executor Fe electron transfer in metabolic processes. The process is for example the reduction of N_2, sulfate reductase and nitrate reductase. (Gardner *et. al* (1991).

7. Sulfur

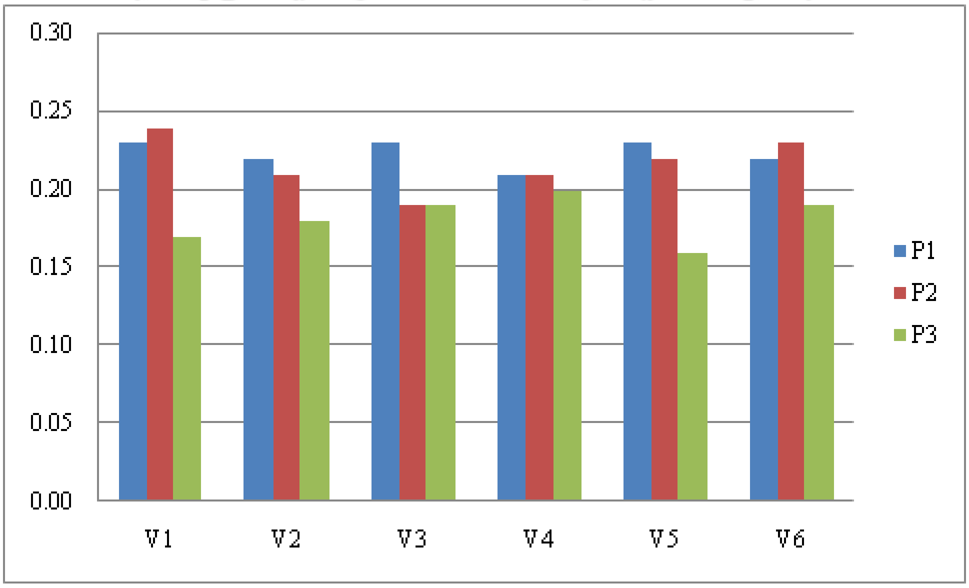

Figure 7: Histogram Sulfur Nutrient Uptake

Based on the data, it can be explained that between the two treatments, varieties and dolomite liming-fertilization NPK interaction. While the combination treatment V_1P_2, V_2P_1 highs and lows (Figure 7).

According to Salisbury and Ross (1995) Nutrient Sulfur (S) is required plants in relatively high amounts, less than N or K and is similar to P, Ca and Mg. Nutrient uptake by roots barkisar sulfate 0.16 to 0.24%, while the top of the rice plants ranged from 0.19 to 0.34%. The amount of nutrients absorbed by plants is determined by the amount of nutrients in the soil solution. Elements of S in the soil can be absorbed by plants as SO_4^{2-} soluble in the soil solution, so the plant roots are able to absorb the S element. The greater efficiency of absorption S, then S is absorbed bigger plants. So that plant growth is also good.

B. Nutrient Uptake At The Top (Stems and Leaves) Rice (45 Days After Planting)

1. Nitrogen

Based on the data, it appears that the treatment varieties and dolomite liming-fertilization NPK interaction. While the Figure 8 apat explained, that V_2P_1 and V_3P_1 a combination treatment of the highest and lowest V_5P_1.

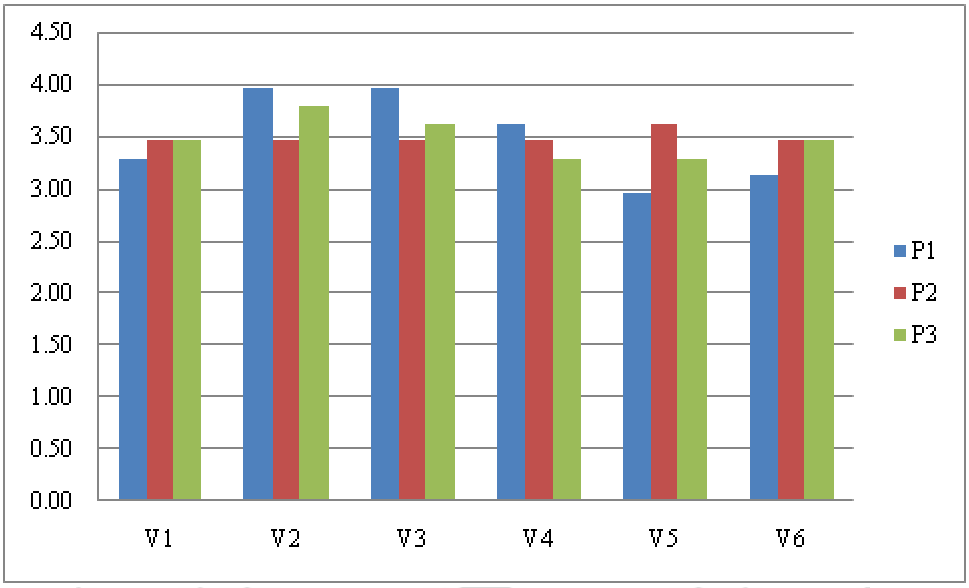

Figure 8: Histogram Nitrogen Nutrient Uptake

The existence of N in paddy soil greatly affect the vegetative growth of rice crops. It is also explained by Nurmegawati *et. al*. (2007), that portion of N transported crop, partly back as crop residues, lost to the atmosphere and back again and lost through leaching.

N absorbed by plants in the form of NO^{3-} or NH^{4+} ion from the ground. Rice plants are able to absorb elements from the soil N sekitas 19-47%. While the absorption of N fertilizer applied to crops is only about 40-50%. Average N content in the plant tissue is 2-4% dry weight (Mukherjee, 1986). N content of the research results for root uptake rice plant at maximum vegetative phase ranged from 1.32 to 2.32%, while for the top crop N uptake ranged from 2.98 to 3.97%.

2. Phosphorus

Based on the data can be explained that there is interaction between treatment varieties with dolomite liming-fertilization NPK. From Figure 9, it appears that a combination treatment V_2P_1, V_4P_1 highs and lows.

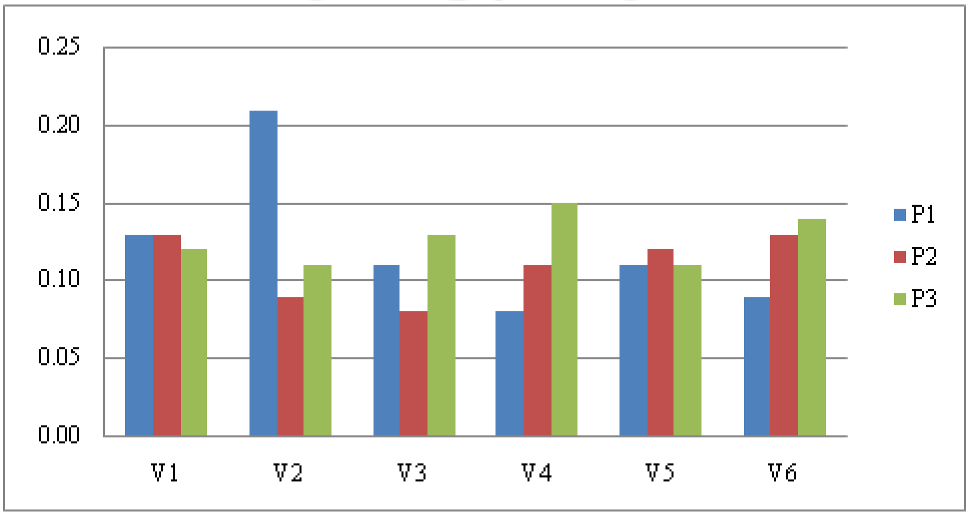

Figure 9: Histogram Phosphorus Nutrient Uptake

Phosphorus is absorbed in the form of inorganic ions quickly turned into an organic phosphate compound. Phosphorus is easy to move between cars or plant tissue. P nutrient uptake by plant roots can only be through interception and diffusion within a short distance (<0.02 cm), so that the efficiency of fertilizer is generally very low, around 10%. While the majority of P fertilizers that are not absorbed by the plant will not disappear washed, but became stable of P that is not available to the plants and then fixed as Al-P and Fe-P in acid soils (pH <5.5) (Zahrah, S ., 2010).

3. Potassium

Judging from the data, it turns out the treatment between varieties and dolomite liming-fertilization NPK interaction. While from Figure 10, can be explained that V_2P_1 is a combination of the highest and lowest V_4P_1.

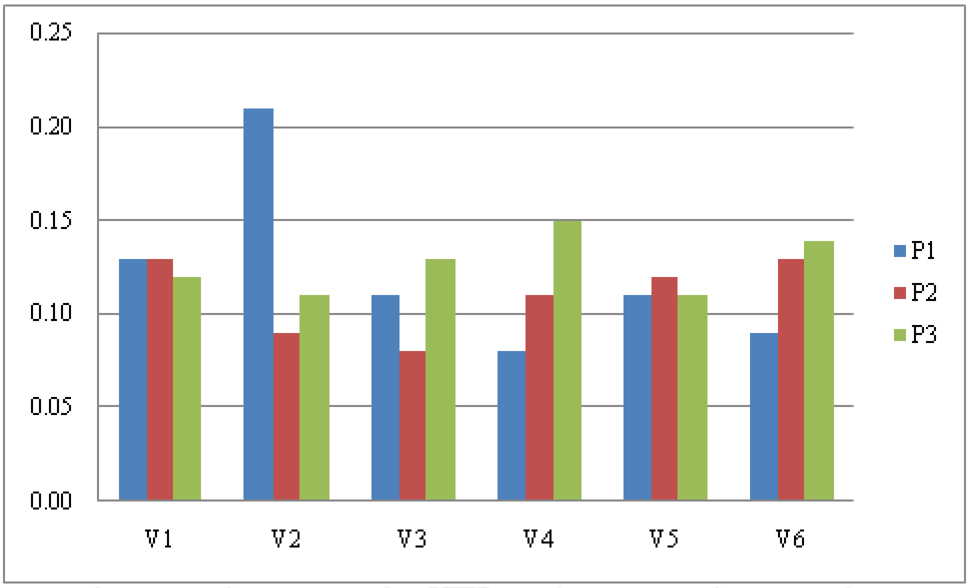

Figure 10: Histogram Potassium Nutrient Uptake

Reported that most of the land of Asia does not require K as N or P, and that only a slight increase in the results obtained with fertilizer K (Pujiastuti, 2006). According to Marschner (1998) especially for rice plants K serves to: (1) Strengthening of straw, (2) Accelerating the process of the formation of proteins, (3) Improving kualias plants, (4) Help translocation of starch, (5) Increase the resistance of plants to pests and disease and (6) Making more pithy grain and lower percentage of empty grain. Further explained that K deficiency will block the process of photosynthesis, metabolism and translocation of carbohydrates from leaves to the grain, resulting in decreased dry matter production.

4. Calcium

From the data can be explained, that the treatment varieties and dolomite liming-fertilization NPK interaction. As for Figure 11 can be explained, that is a combination treatment V_2P_1 , V_2P_2 highs and lows.

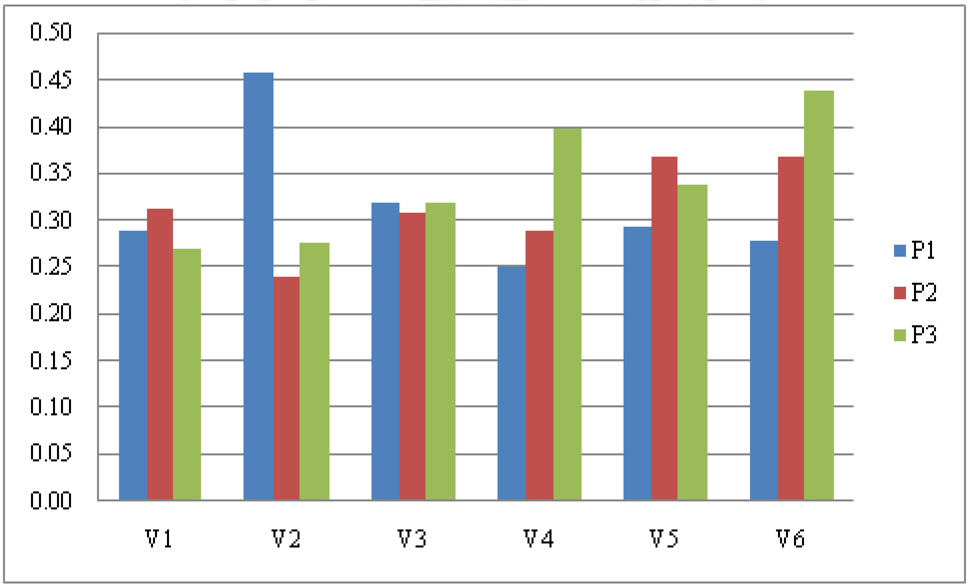

Figure 11: Histogram Calcium Nutrient Uptake

Calcium (Ca) is a macro nutrients that plants need large enough, less than N and K, a similar amount to the P, S and Mg. Most Ca is located in the cell wall and membrane wall, the main function are outside the cytoplasm, its role in the metabolism slightly, into divalent linking bridge between molecules and is reversible. Structural components of cell membranes, maintaining the stability and integrity of cell membranes: regulate ion uptake selectivity, set vermeabilitas membrane and prevent leakage of the solution. A structural component of the cell wall, in the form of Ca-pectat in lamela middle between adjacent cell walls serves to strengthen the cell walls and resistance to fungal infections, or are among the cell wall with the plasma membrane, the membrane function (Salisbury and Ross, 1995).

5. Magnesium

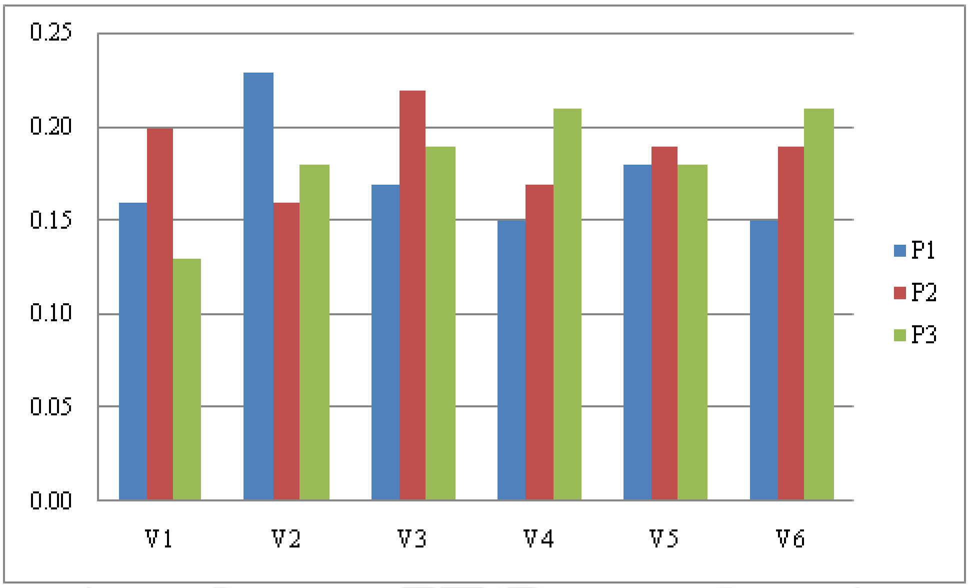

Figure 12: Histogram Nutrient Absorption Magnesium

Based on the data, it appears that there is interaction between treatment varieties and dolomite-calcification treatment NPK fertilization. While from Figure 12, can be explained that a combination treatment V_2P_1 , V_1P_3 highs and lows.

Magnesium (Mg) is a secondary nutrient, required plants in relatively high amounts, less than N and K, a similar number to the P, S and Ca, Mg generally <Ca. Essential for photosynthesis: be the central atom of the chlorophyll molecule, the numbers 15-20% total Mg in plants. A structural component of the ribosome: protein synthesis. Enzyme activity: the transfer of phosphate and carboxyl groups, namely the reaction of ATP and energy transfer, CO_2 fixation RuBP carboxylase (Salisbury and Ross, 1995).

6. Ferrum

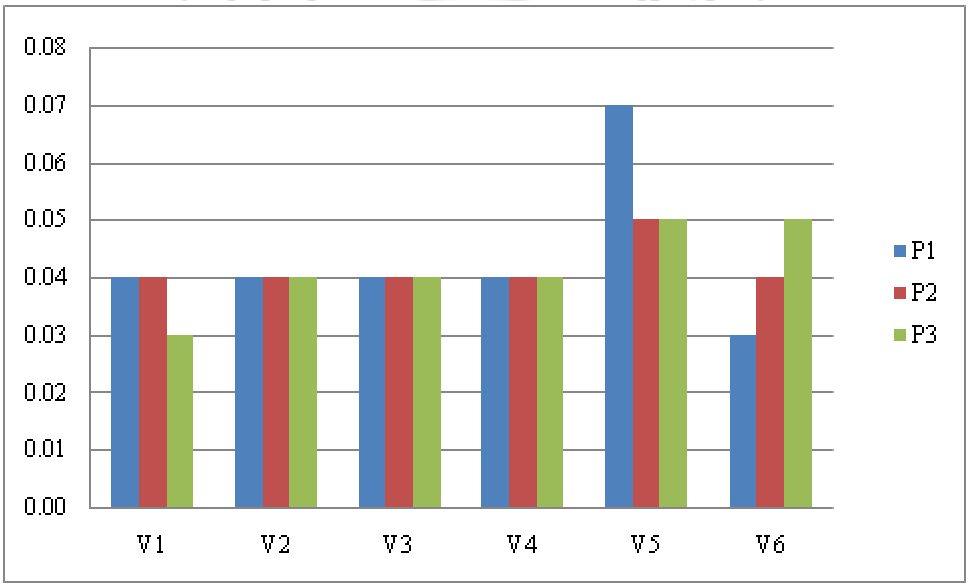

Figure 13: Histogram Nutrient Uptake Fe

Based on the data, it appears that the treatment of variety and dolomite lime-treatment interaction NPK fertilizer. While from Figure 13, can be explained that a combination treatment V_5P_1 V_6P_1 highs and lows.

Nutrients iron (Fe) is a micro elements are absorbed by plants in the form of Ferric ions (Fe^{3+}) or Ferro (Fe^{2+}). Fe can be absorbed in the form chelate (bond metals with organic materials). Fe chelate used is Fe-EDTA, Fe-DTPA and chelate others. Fe in about 80% of plants are found in chloroplasts and cytoplasm. The essence of this nutrient is as a prosthetic group of enzymes catalase and peroxidase and as a constituent contained peredoxin role in chlorophyll (Salisbury and Ross, 1995).

7. Sulfur

From the data, it can be explained that there is interaction between treatment varieties and dolomite-calcification treatment NPK fertilization. While Figure 14 shows that the combination treatment V_2P_1 shows the highest and lowest V_3P_2.

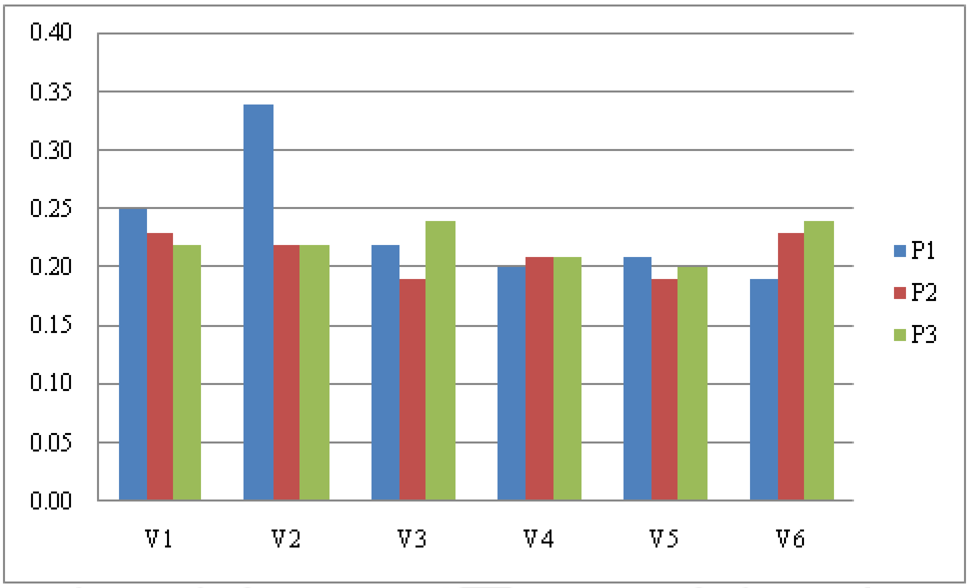

Figure 14: Histogram Sulfur Nutrient Uptake

The element S can be lost because of the volatisasi (Dierolf *et al*., 2001). Further explained that the rice plant to absorb S about 7.2 Kg / ha. It showed that the soil had excess element S which can be toxic to available will be transformed into sulfide (H_2S). Reduction of Fe^{3+} to Fe^{2+} precede SO_4^{2-}, then Fe will always be found in soil solution when H_2S is formed, so that the H_2S is converted into a soluble form FeS. These reactions can protect microorganisms and plants of H_2S poisoning. According to Tisdale *et. al.* (1990) serves as a sulfur forming chloroplasts are closely related to photosynthesis and participating in various metabolic reactions, such as the metabolism of carbohydrate, fat and protein, so that when photosynthesis goes well then fotosintat produced too much, fotosintat this will be accumulated in the plant body.

4. Cover

A. Conclusion

1) Between the varieties showed a response uptake of N, P, K, Ca, Mg, Fe and S are varied.
2) Local variety Ringkak Janggut with 2 tons of dolomite liming-fertilization NPK 90 Kg / ha showed the best nutrient uptake to the roots. At the top of the plant (stems and leaves) is shown by the variety Situ Bagendit with 1 ton of dolomite liming-fertilization NPK 60 kg / hectare.

B. Suggestion

1) Research in Plastichouse to come, to observe the adaptation and production of each variety.
2) The studies should be done in dry conditions (oxidation), in order to obtain comparative rice plant nutrient uptake in these conditions.

References

[1] Akhmad, A, 1985. *Effect of NPK Fertilization on Growth and Production of Upland Rice Varieties Sentani In Rubber Planting Young Village Ngarak*. Essay. Faculty of Agriculture, University Tanjungpura. Pontianak.

[2] --------, 1996. *Study Constraints Some Types of Soil On Land Tidal Marsh Receding For Rice Cultivation in Sungai Kakap Well as Efforts Solution*. Thesis. Program Postgraduate UB. Malang.

[3] Alihamsyah, T., 2002. *Optimization of Land Utilization Tidal Swamp*. Papers Presented to the National Seminar on Optimizing Utilization of Land Resources. In Cisarua, dated August 6 to 7, 2002. Center for Soil and Agro-climate.

[4] Assefa, A., Tilahun Tadese and Minale Liben, 2013. *Influence of Time of Nitrogen Application on Productivity n Nitrogen Use Efficience of Rain-Fed Lowland Rice (Oryza sativa. L) in the Vertisols of Fogera Plain, Northwestern Ethiopia.* Ethiopian Science and Technology Journal. Vol. VI. Number 1. 25-31. February 2013. ISSN: 1816 to 3378.

[5] Basu, M., P.B.S. Bhadoria and S.C. Mahapatra, 2011. *Influence of Soil Ameliorants, manures and Fertilizers on Population Bacterial, Enzyme Activities, N Fixation*

and P solubilization in Peanut Rizhosphere Lateritic Under Soil. British Microbiology Research Journal 1 (1) 10-25. 2011. Sciencedomain International.

[6] Buckman, H.O. and Brady. N.C., 1982. *The nature and characteristics of the Land*. Translated By Soegiman. Work Bhatara Script. Jakarta.

[7] Dierolf, T., Fairhurst, T. and Mutert. E, 2001. *A Tollkit for Acid, Upland Soil Fertility Management In Southest Asia*. Oxpord Graphic Printers.

[8] Gardner, F.P., R.B. Pierce and R.L. Mitchel, 1991. *Physiology of Crop Plants (Plant Physiology Aquaculture, over the English by Susilo)*. Ui Press. Jakarta.

[9] Gaspersz, V, 2006. *Analysis Techniques in Experimental Research*. Volumes 1 and 2. Matter Into 3. Publisher Tarsito. Bandung.

[10] Makarim, A.K., I. Las, A.M. Djulin and Sutoro, 1999. *Determination of the dose Fertilizer To Rice Based System Analysis and Simulation*. Agronomica 1 (1): 32-39.

[11] Lavanya, G.A. and M. Ganapathy, 2009. *Studies on Yield Maximization in Rice Based Cropping Sequence of Northern Coastal Couvery Delta*. Journal of Rice Research. Vol. 3. Number 1 Marschner, H., 1986. Mineral Nutrition of Higher Plants. San Diego: Academic Press Inc., Hourcourt Brace Javanovich Publ. 674 p

[12] Masganti, 2011. *Difference Nutrient Absorption Some Rice Varieties In Different Land Types in Tidal Land*. Food Crops Research Vol. 30 No. 1. 2011.

[13] Mukherjee, SK, 1986. Chemical *Technology for Producing Fertilizer Nitrogen In The Year 2000*. Drawn from, (http://cms.lm-bio.com/bagan/warna leaf-bed /), [22.01.2013].

[14] Nurmegawati, W., Makruf E., Sugandi D. and T. Rahman, 2007. *The level of fertility and Recommended Fertilization of NPK Land Rice South Bengkulu*. Teknology Assessment Institute for Agriculture. Bengkulu.

[15] Nurzakiah, S., Nurita and Linda Indrayati, 2012. *Enhanced Soil Chemical Properties and Rice Yield in Acid Sulphate Soil by Application of Rice Straw*. Journal Tropica Soil. Vol. 17. Number 1. 2012: 31-36. ISSN: 0852-257x.

[16] Patti, P.S., E. Rich and Ch. Silahooy, 2013. *Analysis of Soil Nitrogen Status In Relation With Uptake N By Plants Waimital Rice Village, District Kairatu, West Seram regency*. Agrologia, Journal of Crop Science. Vol. 2, No. 1, 2013.. 51-58. ISSN 2301-7287.

[17] Pujiastuti, Elisabeth Sri, 2006. *Nutrient Management Rice On Rice Land For The Sake Of Enhanced Efficiency Fertilizers*. Scientific magazine Media Unika. Year 18. No. 62. (September-October), 2006. ISSN 0852-1832.

[18] Raut, S., N. Sahoo and P.S.B. Anand, 2013. *Influence of Ameliorants on Water and Soil Water Retention Functional Reletionships Studied in Two diffrent Soils of Odisha, India*. Academia Journal of Environmental Sciences 1 (8): 152-158, October 2012. ISSN: 2315-778x.

[19] Rosilawati, AK, Shamsuddin J. And Fauziah CI, 2014. *Effect of incubating an Acid Sulphate Soil Treated With Various Liming Materials Under Submerged and Moist Conditions on pH, Al and Fe*. African Journal of Agriculture Research. Vol. 9 (1). pp. 94-112. 2 January 2014. ISSN: 1991-637x @ 2014.

[20] Sadiq, A.A. and Umara Babagana, 2012. *Influence of Lime Materials to Ameliorate Acidity on Irrigated Paddy Field: A Review*. www.JournalSavap.org.pk 413. ISSN-L: 223-9553. ISSN: 2223-9553. Vol. 3. Number 1. July 2012.

[21] Salisbury, F.B. and Ross, C.W., 1978. *Plant Phisiology* 2rd Edition. California: Wadsworth Publishing Co. Inc.

[22] Shamsuddin, J. and I. Che Fauziah, 2010. *Alleviating Acid Soil Infertility constrains Using Basalt, Ground Magnesium Limestone and Gypsum in a Tropical Environment*. Malaysian Journal of Soil Science. Vol. 14: 1-13 (2010). ISSN: 1394-7990.

[23] Sudjana, Briljan, 2014. *Effect of Biochar and NPK Compound Against Biomass and Nitrogen Uptake in Leaves of Maize (Zea Mays) In the Land Typic Dystrudepts*. Journal of Agriculture and Fisheries. Vol. 3. No. 1.: 63-66. ISSN 2302-6308.

[24] Suriadikarta, DA, 2005. *Stewardship acid sulfate for Agricultural Enterprises*. Journal of Agricultural Research. 24 (1), 2005.

[25] Susanto, U., A.A. Daradjat and B. Suprihatno, 2003. *Development of Rice Breeding in Indonesia*. Food Crops Research Journal 22 (3): 125-131.

[26] Tisdale, S.L. & Nelson, WL, 1993. *Soil Fertility and Fertilizer*. 3rd Edition. New York: The Mac Millan Publ. Co.

[27] Zahrah, S., 2010. *Nutrient Uptake of N, P, K and Results Various Plant Variety Rice with ameliorant Giving Ion Cu, Zn, Fe on Peat*. Natur Indonesia Journal 12 (2), April 2010: 102-108. ISSN 1410-9379, Accreditation Decision No. 65a / DIKTI / Kep / 2008.