Growth and Total Content of Phyllantin and Hypophyllantin in Green Meniran (*Phyllanthus niruri* L.) and Red Meniran (*Phyllanthus urinaria* l.) in Various Ways of Fertilization

Eva Oktavidiati [1)], M. Ahmad Chozin[2)], Nurheni Wijayanto[3)], Munif Ghulamahdi[4)], Latifah K. Darusman[5)] Sunaryadi[6)]

1),6) University of Muhammadiyah Bengkulu
2),3),4)5) Institut Pertanian Bogor
Email : evaoktavidiati@umb.ac.id

ABSTRACT

The objective of this research was to identify the effects of various ways of fertilizer on growth and *phyllantin* contents and also *hypophyllantin* of two species *Phyllanthus* (*Phyllanthus niruri* L. and *Phyllantus urinaria* L.) The research was conducted at Lahan Penelitian IPB Babakan Sawah Baru, Bogor, West Java with an altitude of 250 m above sea level from February to May 2010. Experiment based on randomized block design (RBD) factorial which divided in two factors. The first factor was about the fertilization (P) that consisted of soil (P0 = without fertilizer), manure (P1), fertilizer NPK (P2), manure + NPK fertilizer (P3). The second factor was two species of meniran (*Phyllanthus*) which consists of M1 = green meniran (*Phyllanthus niruri* L.) from Bangkalan (A6), M2 = green meniran (*Phyllanthus niruri* L.) from Gresik (A7), and M3 = red meniran (*Phyllanthus urinaria* L.) from Bangkalan (A13). The results said that to increase growth and achieve high biomass production; green meniran (*Phyllantus niruri* L.) accession (A6 and A7) need a combination of fertilizer manure + NPK. Green meniran (A7) found to contain the highest amounts of *phyllanthin* (0.17% dry weight) and *hypophyllantin* (0.26% dry weight) with given of manure.

Key words: biomass, green meniran, hypophyllantin, phyllantin, red meniran

INTRODUCTION

The content and number of primary and secondary metabolites as a component in the production ofmedicinal plants is influenced by the nutrients absorbed by plants. The adequacy ofthe amount and type of nutrients in the form of fertilizer and natural soil is crucial in the growth, development and optimal crop production. According to Fageria (2009) the need of the amount of the higher nutrient associated with its role in the formation of carbohydrates, protein, and fat. While, them of major micro nutrients play a role in enzymatic processes in the plant.

Increased production can be done through fertilization. Djauharia *et al*. (1993) found the growth and production of herbaceous meniran increased with the use of 400kg^{ha-1}of urea (46% N), 150kg^{ha-1}SP-36 (36% P_20_5) and 200kg^{ha-1}KCl(60% K_20) and manure (organic fertilizer) 20 tons per hectare. It is not known yet due to the increase in content of bioactive plant fertilization. In general, the production of bioactive materials is the product of the weight of harvested plants with bioactive ingredients. Complete NPK fertilization on peppermint (*Mentha piperita* L.) increases the height and weight of biomass by18-79% while the level of volatile oil is increased to 23-86%.

Potassium fertilizer can increase the levels of pyrethrin which correlated with K concentration in the apical of the pyrethrum plant (*Tanacetum cinerariifolium*). Its effect lasted for 2 seasons. While fertilizer P increase bioactive pyrethrum and correlated with an increase of the concentration of P in the soil, in leaf tissues, the production of biomass and concentration of pyrethrin (Salardini *et al*., 2006).

This study aims to determine the effect of fertilization on the growth, biomass production and content of bioactive phyllantin and hypophyllantin of two types of meniran.

MATERIALS AND METHODS

Time and Place Research

The experiment was conducted at Lahan Penelitian IPB Babakan Sawah Baru, Bogor, West Java for 2 months. Analysis of phyllantin and hypophyllantin bioactive content was done at Laboratorium Terpadu Biofarmaka IPB.

Materials and Equipment

The materials used in the field research are two kinds of meniran seed, namely the origin Bangkalan green meniran, the origin of green meniran from Gresikand origin red meniran from Bangkalan, NPK fertilizer consisted of 400kgha^{-1}of urea (46% N), 150kgha^{-1}SP36 (36% P205) and 200kg^{ha-1}KCl (60% K20). Manure (chicken manure) 20 tons per hectare.

Research Design

The study is designed based ona randomized block design factorialwhich consists two factors. The first factor is the fertilization (P) consisting of soil (P0 = without fertilizer), manure (P1), fertilizer NPK (P2), and manure + NPK (P3). The second factor is the type of meniran (M) consisting of M1= green meniran from Bangkalan (A6) M2= green Meniran from Gresik(A7) and M3= red meniran from Bangkalan (A13). There are 12 combinations of treatments that were repeated 3 times so that the overall were 36 combinations of treatments. The diversity of the observation data is tested. The Analysis of variance used SAS software 9.1, if there is a real significant effect, it is continued with the test of Duncan's Multiple Range Test (DMRT) at 5% level (Mattjik and Sumertajaya 2002).

Observations

The observation was done toward the several morphological characters, phyllantin and hypophyllantin bioactive content as follows: plant height (cm), number of compound leaves, the number of branches, stem diameter (mm), production of wet biomass (g), production of dry biomass (g), analysis of High Performance Liquid Chromatography (HPLC) phyllantin (% dry weight) and hypophyllantin (% dry weight) based on Tripathi *et al*. (2006) that were modified.

RESULTS AND DISCUSSION

Plant Growth

The fertilization treatment and the type of meniran give significant effect on the number of branches and stem diameter (Table 1).

Table1. The effect of fertilization on the number of branches and a stem diameter of two types meniran age of 10 weeks after planting

Treatment	Change in observation	
	Number of branches	Stem diameter (mm)
Types of Meniran		
Green from Bangkalan (A6)	112.54 [a]	6.59 [a]
Green from Gresik (A7)	79.38 [b]	6.89 [a]
Red from Bangkalan (A13)	71.21 [b]	3.73 [b]
Fertilization		
Without fertilizer	45.56 [c]	4.07 [c]
Manure	73.56 [b]	5.41 [b]
NPK fertilizer	101.78 [a]	5.97 [b]
Manure + NPK	129.94 a	7.49 [a]

The average number in the same column followed by the different letters are significantly different (P<0.05).

In Table1, it can be seen green meniran from Bangkalan have the maximum number of branches (112.54) and significantly different from Gresik green meniran (79.38) and red meniran from Bangkalan (71.21). While green meniran from Gresik has the largest stem diameter (6.89 mm) and not significantly different from the original green meniran from Bangkalan (6:59 mm). Bangkalan red meniran origin has the smallest stem diameter (3.73 mm).

Green meniran origin Bangkalan and Gresik in general showed better vegetative growth than red meniran. Allegedly this is related to the ability to use existing nutrients effectively and efficiently. Green meniran indicates the ability to use the nutrients nitrogen, phosphorus and potassium, which is higher than the red meniran.

Dry Weight of Plant

The Results of the variance indicate that the type of meniran and fertilization give a very significant effect on stem dry weight and total plant dry weight. While root dry weight and leaf dry weight were not significantly different. There is interaction between the type of meniran with fertilization toward the stem dry weight.

Table 2 shows that the green meniran from Bangkalan which is given NPK + manure has a maximum dry weight of stems (11.19 g of plant^{-1}) followed bygreen meniran from Gresik with manure + NPK (8.17 g of plant^{-1}) and green meniran from Bangkalan with NPK fertilizer (7.09 g of plant^{-1}). Green meniran from Bangkalan has good response on stem dry weight parameters with fertilization whether with the use of manure, NPK fertilizer or a combination of both. Green meniran from Gresik gives a good response to NPK fertilizer and manure + NPK combination on stem dry weight. While the lowest stem dry weight (0.70 g of plant^{-1}) is shown by the red meniran from Bangkalan at different fertilization treatment.

Table2. Interaction of fertilization on the dry weight of the stem of two types meniran age 10 weeks after planting.

Fertilization	Types of Meniran		
	Green from Bangkalan (A6)	Green from Gresik (A7)	Red from Bangkalan (A13)
Without fertilizer	0.87 ^{f}	1.05 ^{f}	0.70 ^{f}
Manure	4.42 ^{cde}	1.78 ^{ef}	1.07 ^{f}
NPK fertilizer	7.09 ^{abc}	5.26 ^{bcd}	1.44 ^{ef}
Manure + NPK	11.19 ^{a}	8.17 ^{ab}	2.10 ^{def}

The average number in the same row followed by the different letters are significantly different (P<0.05).

Based on Table 3 it can be seen that the fertilization treatment significantly affected the root dry weight, leaf dry weight and meniran total weight. Treatment of meniran types significantly affect the total dry weight and no significant effect on root dry weight and leaf dry weight.

Table 3. The effect of fertilization on the dry weight of roots, leaves and a total of two meniran types with age of 10 weeks after planting

Treatment	The observation change		
	Root dry weight (g plant^{-1})	Leaf dry weight (g plant^{-1})	Total dry weight (g plant^{-1})
Types of Meniran			
Green from Bangkalan (A6)	3.47	6.95	16.31 ^{a}
Green from Gresik (A7)	4.48	6.04	14.58 ^{a}
Red from Bangkalan (A13)	3.72	4.57	9.63 ^{b}
Fertilization			
Without fertilization	1.48 ^{c}	2.58 ^{c}	4.94 ^{d}
Manure	3.21 ^{b}	4.17 ^{c}	9.81 ^{c}
NPK fertilizer	4.48 ^{ab}	6.59 ^{b}	15.67 ^{b}
Manure + NPK	6.39 ^{a}	10.06 ^{a}	23.61 ^{a}

The average number in the same column followed by the different letters are significantly different (P<0.05).

The results of HPLC analysis of the total content phyllantin and hypophyllantin three meniran accessions at different fertilization treatment are presented in Figure 1 (data were not statistically analyzed).

Green meniran from Bangkalan and Gresik showed total content of phyllantin and hypophyllantin higher than the red meniran. Manure application on green meniran from Gresik showed

the highest content of total phyllantin 0.18% dry weight and the highest hypophyllantin was 0.26% dry weight.

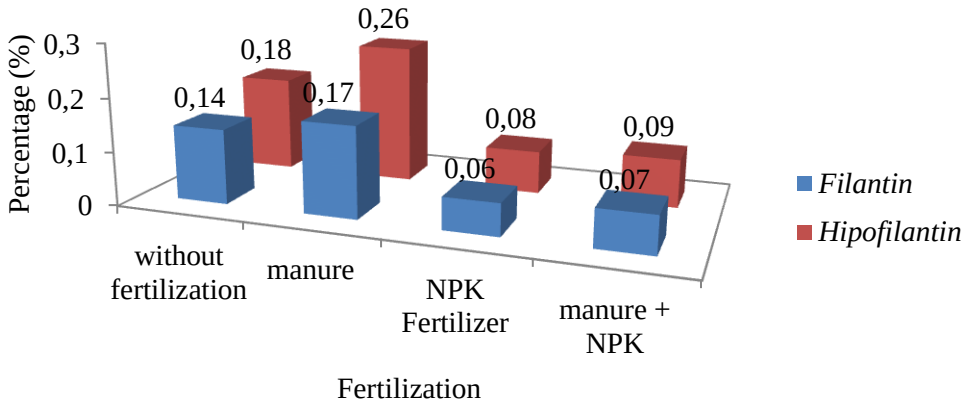

Figure 1. Total content of phyllantin and hypophyllantin green meniran from Gresik in various fertilization treatments.

CONCLUSION

From the research that has been conducted, it can be concluded as follows:

Green Meniran requires the application of fertilizer in the form of a combinatior K + manure to generate growth and high biomass production

Green Meniran requires manure to produce the high total content of phyllantin and hypophyllantin.

REFERENCES

Djauharia, E., Emmyzar, and R. Undang. 1993. Pengaruh pemupukan terhadap pertumbuhan dan produksi meniran (*Phyllanthus niruri* L.) Prosiding Seminar Meniran dan Kedawung. Bagian I:Meniran, *Phyllanthus niruri* L. Surabaya:13-14 Agustus. Kelompok Kerja Nasional Tumbuhan Obat Indonesia.

Figueira, G.M., P.M. De Magalhaes, V.I.G. Rahder, A. Sartoratto, and A.P.A.Vaz. 2006. Chemical preliminary evaluation of selected genotype of *Phyllanthus amarus* Schumach. Grown in four different counties of Sao Paulo State. Rev Bras Pl Med 8:43-45.

Mattjik, A.A.and I.M. Sumertajaya. 2002. Perancangan Percobaan: Dengan Aplikasi SAS dan Minitab. Jilid I ed.ke-2. Bogor: IPB Press.

Salardini, A.A. and K.S.R. Chapman, and R.J. Holloway. 2006. Effect of basal sidedressed phosphorous on the achene tield and pyrethrins concentration in the achenes of pyrethrum (*Tanacetum cinerafolium*) and soil and plant phosphorous. Aus J Agric Res 45(3):647-656. Abstract.

Tripathi, A.K., R.K.Verma, A.K. Gupta, M.M. Gupta, and S.P.S. Khanuja. 2006. Quantitative determination of phyllantin and hypophyllantin in *phyllanthus* species by high-performance thin layer chromatography. Phytochem Anal 17:394-397.