Growth of Terna Long Pepper (*Piper retroractum* Vahl.) with Various Techniques of Fertilizer Application

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ABSTRACT

Fruits of long pepper (*Piper retroractum* Vahl.) [Rerofracti fructus] can be used as a traditional medicine (*inter alia* to improve blood circulation, after birth treatment), herbal drink, and food spice. Long pepper belongs to family piperaceae and commonly grows as a climbing plant, but it can also grow as terna (short, non climbing) plant from plagiotropic-growth cuttings. Although the success of its technique in a large area is still questioned, terna plant can be cultivated in a household scale. This study was conducted to investigate different methods of fertilizer application. The experiment was conducted in June-December 2009 at IPB experimental station, Darmaga, Bogor. Completely randomized block design was used with single factor i.e. 3 methods of fertilizer application: (1) 500 mL manure liquid from 500 g manure dissolved in 600 mL water, (2) 10 g NPK plant^{-1} every month, and (3) 20 g NPK plant^{-1} every 2 month; 3 replications. A plagiotropic-growth cutting was planted in a mixture of soil, rice husk charcoal, and cow manure (3:1:1, v/v) in a 40 cm x 50 cm polybag. The result showed that at 12 weeks after planting, the application of manure liquid resulted in better plant performances compared to those of other methods.

Keywords: Java long pepper, manure, organic fertilizer, piperaceae, plagiotropic

INTRODUCTION

Long pepper (*Piper retrofractum* Vahl.) is in the group of *Piperaceae* (Heyne, 1987). Fruits of long pepper can be used in traditional culinary but it is more popular as traditional medicine. Long pepper was considered by the National Agency of Drug and Food Control (NA-DFC / BPOM) as one of 9 primary medicinal plants (Anonymous, 2004). The metabolite compounds in fruit of long pepper are piperine, chavicine, palmitic acids, tetrahydropiperic acids, 1-undecylenyl-3,4-methylenedioxy benzene, piperidin, essential oil, isobutyideka-trans-2-trans-4-dienamide, and sesamin. Piperine has properties as antipyretic, analgesic, anti inflammation, and control central nervous system (IPTEK, 2012). *Piper retrofractum* can also be used as botanical pesticide. Zarkani (2008) showed that fruit of *Piper retrofractum* combined with *Tephrosia vogelii* was effective in controlling *Crocidoloia pavonana* and *Plutella xylostella.*

P. retrofractum is a perennial and climbing vine plant. Without pruning, plant height can reach 10 m, but normally people limit the plant height to 2 m

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only. Plant is commonly cultivated with vegetative propagation with stolon, climbing vine, or plagiotropic cuttings. Benefits in using stolon as plant materials are (1) stolon are abundantly and easily available especially in wet season, because farmers do not have plantation area that is especially designated for climbing vine cutting materials ; (2) collection of cuttings from stolon will not damage productive plants; and (3) according to Djauhariya (1992), the viability of cuttings from stolon is higher than those from climbing vines or plagiotropic cuttings.

When *P. retroractum* can be grown as terna (short, non-climbing plant), it is expected that the plants can be planted in limited area of land or in pots as ornamental plants as well as source of family herbal medicine. As herbal medicine, the dried fruit has high value in term of economy.

P. retroractum can be propagated with plagiotropic cuttings. The studies conducted by Djauhariya (1992); Januwati and Effendi (1992); Pujiharti (1998); Suparman and Sopandi (1988) limited the experiments on the viability of cuttings from different plants. Investigation on cultivation technique for *P. retrofractum* is limited, therefore the study can be initiated with the technique in nutrient supply for plant. Wahid (1999) explained that terna *Piper nigrum* has shallow root systems therefore demands high amount of nutrient, i.e. 600 kg NPKMg per plant per year and susceptible to nutrient deficiency.

The objective of the study was to investigate the effect of different application techniques of fertilizer on growth of *Piper retrofractum.*

MATERIALS AND METHODS

The experiment was conducted in June-December 2009 at IPB experimental field, Sawah Baru, Darmaga, Bogor, 250 m asl. The materials used for experiment were: plagiotropic-growth cuttings, collected from Lamongan East Java, cow manure, NPK-compound fertilizer (16:16:16), rice hull charcoal, latosol soil, black-colored plastic bag (*polybag*) with the size of 40 cm x 50 cm, and shading net with 55% shading intensity.

Randomized complete block design was used with single factor 3 replications. The treatment was methods of fertilizer application consisted 500 g cow manure dissolved in 600 mL water, NPK fertilizer with the rate of 10 g plant^{-1} applied every month, and NPK fertilizer with the rate of 20 g plant^{-1} applied every 2 months.

Composition of the plant growth substrate was soil, rice hull charcoal, and cow manure (3:1:1, v/v). Cuttings were pre-planted in the nursery (smaller polybag) before transplanted into the 40 cm x 50 cm plastic bags. One seedling of *Tagetes erecta* was planted next to seedling of *P. retrofractum* to protect plants from nematode infestation. All units were laid on land surface that was covered with plastic mulch to prevent roots insertion into the soil.

The first treatment i.e. 500 mL manure liquid was made from 500 g cow manure dissolved in 600 mL water for 30 minutes, the liquid was then poured into the media. The application was done every week. The 2nd treatment was 10 g NPK plant^{-1} dissolved in 600 mL water and applied every month. The 3rd treatment was 20 g NPK plant^{-1} and applied every 2 month, in a gully surrounding the plant and watered with 600 mL water. The nutrient content of NPK and manure was considered in determining different frequencies of fertilizer application. Cow

manure contents low nutrient, therefore rate of application was much higher than that of chemical fertilizer and it must be applied in more frequent application (once a week).

Sixteen (16) weeks after transplanting, plants with no manure grew very slowly, therefore all treatments were then added with manure liquid. The treatments became: manure liquid (control), manure liquid + 10 g NPK plant^{-1}, and manure liquid + 20 g NPK plant^{-1}.

Climbing vines and stolon were removed regularly. Flowers and fruits were removed at 4-16 weeks after transplanting to reduce the sinks and prolong vegetative phase of plant.

RESULTS AND DISCUSSION

In general, variables were significantly different since 12 weeks after transplanting (Table 1 and 2). Manure liquid resulted in the best plant growth compared to those with other treatments.

Big differences occurred in leaf number and shoot diameter (Table 1). Plant growth was dominated with lateral rather than vertical growth therefore the value of shoot diameter was higher than plant height.

Table 1. Plant characteristics with 3 fertilizer treatments

Plant age (WAT)	T test	Treatment per plant			
		500 mL manure liquid	10 g NPK	20 g NPK	Means
			Leaf numbers		
0	ns	17.6	14.9	18.7	17.1
4	ns	18.1	15.7	18.7	17.5
8	*	32.5a	22.4b	22.5b	25.8
12	**	65.7a	25.6b	29.8b	40.3
16	**	123.2a	26.2b	29.0b	59.5
20	*	100.6a	23.8b	17.5b	17.1
24	cn	42.5a	20.8ab	15.2b	17.5
28	ns	31.5	12.5	14.9	19.6
			Shoot diameters (cm)		
4	ns	34.42	26.94	33.57	31.64
8	ns	41.31	33.65	37.54	37.50
12	cn	59.53a	36.65b	40.39ab	45.52
16	*	71.47a	36.75b	44.04b	50.75
20	*	75.38a	38.42b	41.67b	51.82
24	*	64.70a	40.17b	36.00b	46.96
28	*	59.42a	36.25b	34.86b	43.51
			Plant height (cm)		
0	ns	19.78	19.30	20.33	19.80
4	ns	22.36	21.57	22.48	22.14
8	ns	25.04	22.77	25.90	24.57
12	cn	33.10a	25.86b	28.98ab	29.31
16	*	38.50a	28.19b	30.09b	32.26
20	*	45.34a	30.08b	29.66b	35.03
24	*	43.91a	31.53b	29.11b	34.85
28	ns	37.14	29.13	27.28	31.18

Notes: WAT = weeks after transplanting. Numbers at the same row followed by different letters mean significantly different with DMRT. ** = significant at α=0.01, *= significant at α=0.05, cn = significant at α=0.1. ns=non significant.

Table 2. Numbers of node and branches with 3 fertilizer treatments

Plant age (WAT)	T test	Treatment per plant			
		500 mL manure liquid	10 g NPK	20 g NPK	Means
			Nodes		
0	ns	8.5	9.2	9.6	9.1
4	ns	25.7	21.7	25.6	24.3
8	ns	39.1	30.3	31.4	33.6
12	*	79.5a	38.1b	43.5b	53.7
16	**	145.2a	44.9b	54.1b	81.4
20	*	142.5a	49.1b	41.7b	77.8
24	*	126.9a	52.5b	45.3b	74.9
28	*	104.6a	40.5b	43.9b	62.9
			Primary branches		
4	ns	3.8	2.9	3.6	3.4
8	ns	5.2	5.6	4.5	5.1
12	*	7.6a	3.9b	4.1b	5.2
16	*	8.1a	4b	4.2b	5.5
20	*	7.2a	4.1b	3.9b	5.1
24	*	6.7a	4.2b	3.6b	4.8
28	ns	5.5	3.3	3.3	4.1
			Secondary branches		
4	ns	3.1	3.2	4.1	3.5
8	ns	5.8	4.9	4.8	5.1
12	*	12.6a	5.8b	7.1b	8.5
16	*	22.6a	7.4b	7.5b	12.5
20	*	23.1a	8.1b	6.3b	12.5
24	*	20.9a	9.8b	7.0b	12.6
28	ns	13.4	7	4.9	8.4

Notes: WAT = weeks after transplanting. Numbers at the same row followed by different letters mean significantly different with DMRT. ** = significant at α=0.01, *= significant at α=0.05, cn = significant at α=0.1. ns=non significant.

Different effect of treatments is probably caused (1) by important role of cow manure in supporting plant growth through its role in improving soil biological and physical properties which then indirectly improve soil chemical properties; and (2) by the different rates of nutrient availability from different types of fertilizer. Nutrient from cow manure liquid is available faster than from NPK which is in the form of granules; although water was added after NPK fertilizer application. Soil applied with fertilizer in the form of liquid was also benefited from reduced soil temperature. Unlike grown in the field, plant experiencing temperature stress when it is grown in pot. Markham *et al.* (2011) explained that higher temperature stress will occur in media with black colored pot because of its nature that dark color absorb heat more than the light one. Furthermore, Huett and Gogel (2000) mentioned that increasing temperature of

the plant media will affect rates of nutrient availability and the study of Hartz *et al.* (2010) showed that soil temperature affect nitrogen availability in the soil. Those previous studies might be in line the result of current experiment of *P. retrofractum*. Plants with application of granular NPK fertilizer might experience more temperature stress than those with liquid manure, because of less frequent watering. Water was added after the application of NPK fertilizer and occasionally when the soil was dry, while plants with manure liquid treatment were watered regularly every week, regardless of the soil moisture condition. Therefore, the benefit of applying manure liquid was not only from dissolved nutrient but also from reduction of substrate temperature. Nuraini (2007) also presumed that slow growth of *P. retrofractum* due to slow availability of nutrient in NPK-granule fertilizer.

In general, the climax of plant growth was reached at 16 weeks after transplanting. Since plant growth without manure application was very slow, manure liquid was added to all treatments. It was expected that the addition of manure liquid would improve plant growths of NPK-fertilizer treatments. However, plant did not grow well after that because almost all plants were infected with *Phytophtora capsici*, fungi that caused foot rot disease. Disease infestation increased due to high rainfall intensity (415.8 mm month^{-1}) and resulted in high air humidity (82%). High moisture of plant media in this experiment might be also caused by canopy structure of terna long pepper that covered intensely the media surface. *Piper retrofractum* is susceptible to this foot rot disease also shown in the studies of Ferdiansyah (2009) and Arifiyanti (2009). They showed that plants infected by *P. capsici* lost their leaves and plant heights as the result of broken nodes.

Frequent application of fertilizer in the form of liquid increased the risk of plants to be infected by *P. capsici*, because the media became too wet especially when it was raining. Therefore, the frequency of manure liquid application reduced to once a month with the consequence of reducing fertilizer rate. To overcome the possible lack of nutrient addition from manure application, further study is needed to obtain the optimum rate of fertilizer without burdening the plant with the risk of pest and disease infestation.

CONCLUSION

The best growth of terna *Piper retrofractum* was obtained with the weekly application 500 mL manure liquid plant^{-1} from 500 g manure dissolved in 600 mL water. This cultivation technique must be conducted with care especially to control the moisture of plant growth media.

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