The Use of Biopesticide for Increasing Ginger

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The Use of Biopesticide for Increasing Ginger

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Abstract

The objectives of this research was to study the effect of various biopesticide and their concentration level for increasing ginger yield which were grown under bacterial wilt contaminated soil. This research was conducted at Puspiptek Serpong, Tangerang、Indonesia. Randomized complete block design with two factors and three replications was used in this research. The first factor was biopesticide type i.e. neem (*Azadirachta indica*), guduchi (*Tinospora rumphii*) and garlic (*Allium sativum*). For comparison, synthetic bactericide (Streptomycin sulphate) was used as positive control while water was used as negative control. The second factor was biopesticide concentration (1.5 g/l, 2 g/l and 2.5 g/l). The result showed that biopesticide type and concentration were not significantly affected the whole variable observed. However, the mean showed that the highest ginger yield performed by garlic (28.73 g/plant) then followed byguduchi (24.80 g/plant), neem (13.04 g/plant), synthetic bactericide as positive control (3.31 g/plant) and water as negative control (all died).

Keywords: biopesticide, ginger, bacterial wilt

INTRODUCTION

Ginger (*Zingiber officinale* Roscoe) is one of potential traditional medicinal plants that widely used in the world. It has high economic value and good market. However, ginger agribusiness was not developed well in Indonesia due to its limited cultivation area and low productivity. One of the causes of the low productivity was bacterial wilt attack (*Ralstonia solanacearum).*

The initial symptom of bacterial wilt was the wilt of lower leaves. Next, these leaves will be folded, rolled, yellowed and dried. At the end, the shoots became rotten then the plant died (Haryani 1992). This endemic disease happened in large area in India and could cause yield lost up to 100% under favorable environment (Dohroo 1991; Mathew *et al*. 1979). This will be a problem if ginger is cultured at the same location every year.

Bacterial wilt control had been used by plant rotation using non bacterial wilt host plant, by the use of good quality seed and by synthetic bactericide (Haryani 1992). However, the use of synthetic bactericide was not environmentally friendly. Therefore, biopesticide become an important alternative for bacterial wilt control in ginger. Bio-pesticide has some advantages compared to synthetic pesticide, i.e. non toxic, relatively eco-friendly, naturally available, relatively low cost and easy to produce and applied (Reddy *et al.* 2009).

Therefore, this research was conducted to study the performance of some plant extract i.e. neem (*Azadirachta indica*), guduchi (*Tinospora rumphii*) and garlic (*Allium sativum*) compared to synthetic bactericide for ginger bacterial wilt control. The research was conducted in bacterial wilt contaminated area.

MATERIAL AND METHODS

This research was conducted at Experimental Field of Center for Agricultural Production Technology, Puspiptek, Serpong in 2006. Materials used were ginger rhizome, synthetic bactericide containing streptomycin sulphate 20%, neem leaves, guduchi stem and garlic bulb.

Randomized complete block design with two factors and three replications were used in this experiment. The first factor was pesticide type, i.e.:

T1 : neem leaves extract
T2 : guduchi stem extract
T3 : garlic bulb extract
T4 : synthetic bactericide (Streptomycin sulphate 20%)

The second factor was pesticide concentration, i.e.:

C1 : 1.5 g/l per plant
C2 : 2.0 g/l per plant
C3 : 2.5 g/l per plant

Therefore, twelve pesticide combinations were used in this experiment. As negative control i.e. non pesticide, water was used with the same volume as other treatment. Finally, thirty nine experimental units were tested.

Gingers were cultured in 1 m x 4 m plot area with 60 cm x 40 cm distance. Therefore, twenty plants were used in each plot. Gingers were planted in *Ralstonia solanacearum* contaminated field.

Biopesticide extraction was done by using fresh materials with water as solvent according to Setiawati *et al.* (2008). Biopesticide spraying application used soil drench method. The application was conducted at 3 Month After Planting (MAP) once in two weeks until 7 MAP. Observed variables were rhizome weight (g), root weight (g), root number, root length (cm) and total weight (rhizome and root, g).

RESULT AND DISCUSSION

The results showed that biopesticide type, concentration and their interaction were not significantly affected the whole variable observed (Table 1). Meanwhile, all negative control (water) treated ginger plants were died. This was indicated that the field was contaminated with *Ralstonia solanacearum*.

Table **1**. Analysis of variance result

Variable	Mean Square Error		
	Biopesticide Type (T)	Biopesticide Concentration (C)	T x C
Rhizome Weight	5803.87 ns	14.03 ns	1395.11 ns
Root Weight	135.57 ns	1.88 ns	31.59 ns
Root Number	695.24 ns	36.04 ns	134.44 ns
Root Length	730.16 ns	48.52 ns	86.87 ns
Total Weight	7663.28 ns	26.01 ns	1852.32 ns

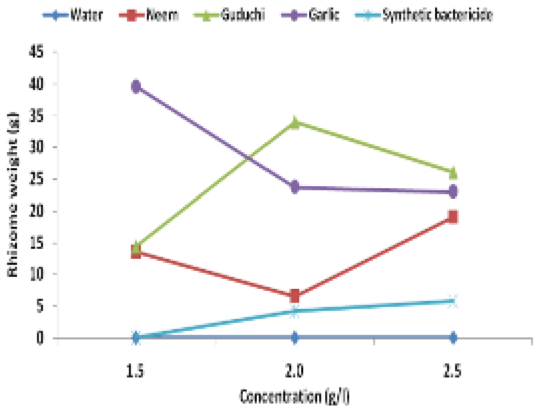

Figure **1**. Effect of biopesticide type and concentration to ginger rhizome weight

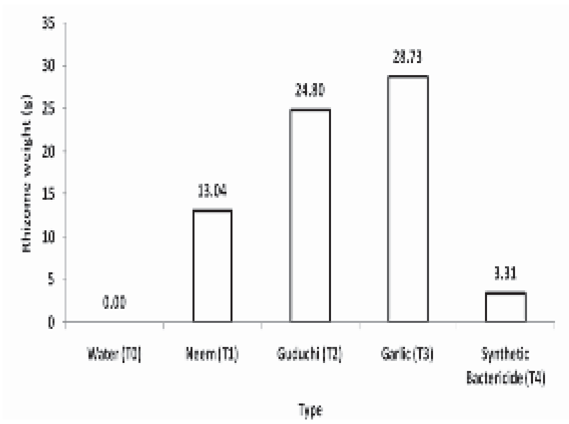

Figure **2**. Effect of biopesticide type to ginger rhizome weight

Root Weight

The highest root weight showed by garlic extract with 1.5 g/l concentration (5.667 g). In general, the highest root weight showed by garlic extract (4.494 g) then followed by guduchi extract, neem extract and synthetic bactericide.

Root Number

The highest root number showed by the interaction between guduchi extract with 2 g/l concentration (Table 2). Secondary metabolite product of guduchi were alkaloid, starch, glycoside, picroretoside, picroetine, harsa, berberine, palmatin, columbine (in root), kokulin (pikrotoksin) (Setiawati *et al*. 2008) However, in general, biopesticide (garlic, guduchi and neem extract) significantly produced higher root number than synthetic bactericide.

Root Length

The highest root length showed by garlic extract with 2.5 g/l concentration (12.867 cm). As single factor, garlic also showed the longest root length compared to synthetic bactericide. Root length represented root ability in penetrating soil layer for water and nutrient uptake.

Total Weight

Statistically total weight was not affected by any treatment and their interaction. However, the highest total weight interactions showed by garlic extract using 1.5 g/l concentration (45.270 g). In general, the highest total weight showed by garlic extract (32.910 g), followed by guduchi, neem and synthetic bactericide.

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Table **2**. Effect of biopesticide types and concentrations to some yield parameters of ginger

Treatment	Rhizome Weight (g)	Root Weight (g)	Root Number	Root Length (cm)	Total Weight (g)
Biopesticide type (T)					
Water (T0,negative control)	0.000	0.000	0.000	0.000	0.000
Neem (T1)	13.040	1.261	6.333	8.300	13.470
Guduchi (T2)	24.800	3.489	8.756	8.722	28.290
Garlic (T3)	28.730	4.494	10.311	11.211	32.910
Synthetic Bactericide (T4, positive control)	3.310	0.556	1.956	3.567	3.640
Concentration (C)					
1.5 g/l (C1)	13.493	1.693	4.227	4.927	14.725
2 g/l (C2)	13.680	2.190	5.893	6.800	15.680
2.5 g/l (C3)	14.760	1.997	6.293	7.353	16.587
Interaction (T x C)					
T0	0.000	0.000	0.000	0.000	0.000
T1C1	13.533	1.400	5.200	8.533	12.620
T1C2	6.533	0.600	3.867	6.133	7.130
T1C3	19.067	1.783	9.933	10.233	20.670
T2C1	14.333	1.400	5.133	6.233	15.730
T2C	34.000	5.333	12.867	11.267	39.330
T2C3	26.067	3.733	8.267	8.667	29.800
T3C1	39.600	5.667	10.800	9.867	45.270
T3C2	23.667	4.017	9.800	10.900	27.400
T3C3	22.933	3.800	10.333	12.867	26.070
T4C1	0.000	0.000	0.000	0.000	0.000
T4C2	4.200	1.000	2.933	5.700	4.530
T4C3	5.733	0.667	2.933	5.000	6.400

Note: Mean number followed by the same letter at the same column of each factors are not significantly different according to Duncan Multiple Range Test (α=5%)

Overall, biopesticide in this experiment were better than synthetic bactericide. In general, garlic showed best performance on increasing ginger yield grown under bacterial wilt infested area. Jeyaseelan *et al*. (2011) reported that garlic bulb extract has the antibacterial ability toward *Pseudomonas solanacearum* and *Xanthomonas axonopodis* with minimum inhibition ability 12.5 ± 0.5 mm and 18.1 ± 0.8 mm. The antibiotic component of garlic was allicin. It was effective against broad spectrum bacterial in dilution 1:10. Garlic extract was also effective against various fungi and used to protect plant and stored food (Stoll, 1998).

Rubatzky and Yamaguchi (1998) mentioned that garlic aroma dominated by allin (S-allisistein sulfocside). Alin was hydrolyzed by alinase enzyme into allicin (diallil sulfide) after the tissue broken. When allicine was degraded, it took oxygen from the air and changed into high sulphur compound. Seventy organic sulphur were formed in every degradation and some of them were stabile (Roser 1997). These compounds made garlic had the ability to work as insecticide, nematicide, fungicide and antibiotic (Setiawati 2008).

Besides garlic, neem has the capability for bacterial wilt control. Opara and Obani (2009) reported that neem extract 5 g/l has the capability as good as synthetic pesticide such as benomyl (0.1 g/l) in decreasing bacterial spot disease of *Solanum gilo* and *S. torvum* leaves. Secondary metabolites of neem were terpenoid, nimbin, azadirone and azadirachtin. These metabolites were very useful for antimicrobial. Azadirachtin could be extracted from neem leaves and fruits. Neem was also useful for insect repellent and reproduction inhibition (Stoll 2000, Romains and Raemakers, 2001).

CONCLUSION

Some biopesticide extract could be environmentally friendly alternatives for replacing the use of synthetic bactericide in ginger bacterial wilt control. Garlic extract are potential to be used as biopesticide against *Ralstonia solanacearum* in ginger.

REFERENCES

Anonymous. 1992. *Bawang putih dataran tinggi.* Penebar Swadaya. Bogor.

Dohroo NP. 1991. *New Record of Bacterial Wilt of Ginger in Himachal Prades*. IPS North Zone Meet. April 29-30 pp 16 (Abstract).

Haryani. 1992. *Bertanam Jahe*. Trubus No. 266/XXIII. Jakarta.

ISBN No.

Jeyaseelan EC, Pathamanathan HK, Jeyadevan JP. 2011. Inhibitory Effect of Different Solvent Extracts of *Vitex negundo* L. and *Allium sativum* L. on Phytopathogenic Bacteria. *Arch Appl Sci Res* 3 (1) : 1-8.

Mathew J, Koshy A, Indrasenan G. and Marykutty S 1979. A New Record of Bacterial Wilt of Ginger Infected by *Pseudomonas solanacearum* E.F. Smith from India. *Curr. Sci.* 49 : 213-214

Opara EU, Obani FT. 2009. Performance of some plant extracts and pesticides in the control of bacterial spot diseases of Solanum. *Agric. J* 4 (5) : 250 – 253.

Reddy KRN, Reddy CS, Muralidharam K. 2009. Potential of Botanicals and Biocontrol Agents on Growth and Aflatoxin Production by *Aspergillus flavus* Infecting Rice Grains. *Food Control* 20 : 173-178.

Romain IB, Raemakers H. 2001. *Crop Production in Tropical Africa.* Directorate General for International Co-operation, Belgium.

Roser D. 1997. Bawang putih untuk kesehatan. Bumi Aksara. Jakarta.

Rubatzky VE, Yamaguchi M. 1998. *Sayuran Dunia 3.* Edisi Kedua. Penerbit ITB Bandung.

Setiawati W, Murtiningsih R, Gunaeni N, Rubiati T. 2008. Tumbuhan Bahan Pestisida Nabati dan Cara Pembuatannya untuk Pengendalian Organisme Pengganggu Tumbuhan. Balai Penelitian Tanaman dan Sayuran.

Stoll G. 1998. Natural crop protection in the tropics and subtropics. Agrecol. Switzerland.

Stoll G. 2000. Natural Crop Protections in the Tropics. 2nd Edition. Letting Information Come to Life. Margraf Verlag. Pp : 101 - 139

ISBN No.