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Evaluation of Besun 200 SC (Zinc Thiazole 20%) Against Bacterial Wilt (*Ralstonia Solanacearum*) of Ginger (*Zingiber officinale Rosc.*) in Southwestern Ethiopia

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ABSTRACT

Bactericides are one tool for the management of bacterial wilt of ginger caused by Ralstonia solanacearum and other leaf spot disease of ginger in different growing areas of the world. The efficacy of two (2) fungicides viz., Besun- 200 SC at different concentration (1.5,1.75, and 20 litre/ha), and kocide 2000 (2.5 kg/ha) were evaluated against Ralstonia solanacearum and other leaf spot disease. The result of the study showed that the test bactericide (Besun 200 SC) did not differ from check bactericide (kocide 2000) in controlling bacterial wilt disease of ginger and associated leaf spot disease and also provided comparable number finger per rhizome, rhizome length, rhizome width and rhizome yield with check bactericide (kocide 2000). Moreover Besun 200 SC at the rate of 2 litre/hectare reduced bacterial wilt disease incidence to lowest possible level and gave rhizome yield that was almost comparable with check bactericide and advantage better than untreated check. Hence, based on strong positive merits of test bactericide indicated in reducing ginger bacterial wilt disease incidence to the lowest level, Besun 200 SC (Zinc Thiazole 20%) could be used as an alternative in place of kocide 2000 for control of bacterial wilt (Ralstonia solanacearum) of ginger in Ethiopia.

Keywords: *Bacterial wilt, Besun 200, Ginger, Kocide 2000, Leaf spot*

INTRODUCTION

Ginger (*Zingiber officinale* Rosc.), is an important commercial crop grown for its aromatic rhizomes, which are used as both spice and medicine (Sharma *et al.*, 2010). The crop is known to have been introduced to Ethiopia as early as in the 13th century (Jansen, 1981). It is cultivated in south, southwestern and northwestern parts of the country as cash crop, and is among the important spices used in every Ethiopian kitchen (Merga *et al*., 2018).

Ginger grows well in tropical and subtropical climates from sea level to 1600 meter above sea level with an annual rainfall of 1500-3000 mm. It requires temperature ranges of 20 to 30 °C. A friable fertile loam soil with pH of 6-7 is the most suitable for ginger production (Girma *et al.*, 2008). The production of ginger; however, is largely affected by diseases caused by bacteria, fungi, and nematodes. Among these major diseases, bacterial wilt is very important in major ginger producing areas of Ethiopia, including the southwestern parts of the country, where ginger is widely and mainly produced for commercial purposes (Merga *et al.*, 2018).

A wilting and yellowing of the lower leaves, which extends upward until all the leaves appear golden yellow in appearance, is the first recognizable symptom of bacterial wilt in ginger. As the disease progresses, the pseudo stem becomes water soaked and readily breaks away from the underground rhizome. The vascular tissue of the stem darkens to a black color and symptoms progress very rapidly until the ginger plant collapses (Merga *et al.*, 2019).

Ralstonia solanacearum is transmitted by contaminated soil, water and equipment. Transmission can also occur through contaminated public irrigation water system (Kelman *et al.*, 1994). In Ethiopia, bacterial wilt has been reported on potato, tomato, pepper, enset, banana and ornamentals but on ginger it is newly reported (Bekelle *et al*., 2016). The report of Habetewold *et al*. (2015) indicated that bacterial wilt of ginger was found prevalent in all surveyed production areas in Ethiopia.

Bacterial wilt is difficult to manage because it has wide host range, long survival in the soil, spread in many ways (including planting materials, irrigation water, farm implements and

vectors), survives in vegetation as latent infection and genetically diverse strains (APS, 2005). Up to now there is no single control effective measure against the pathogen (Lemessa and Zeller, 2007). However, some level of bacterial wilt control has been possible through use of a combination of diverse methods such as cultural practices, host resistance, biological control, chemical control and integrated disease management schemes. Even if bacterial wilt management using chemicals is a challenge due to localization of the pathogen inside the xylem and its ability to survival in the soil, Ji *et al*. (2005) reported some level of control of bacterial wilt by use of phosphoric acid. In Taiwan The bactericides Terlai has been tested under both greenhouse and field conditions become effective (Hartman and Elphistone, 1994) and other chemical protection through soil fumigation and antibiotics (Penicillin, Ampicillin, Tetracycline and Streptomycin) has shown suppression of the pathogen.

Apart from all attempts to manage bacterial wilt in different parts of the world ginger bacterial wilt is still highly distributed and severe in southwestern areas of the country, and farmers in these areas considered the disease as a major production constraint, which limits the production as well as quality of rhizome. Thus, the use of chemical bactericides was alternative options at the disposal of growers in managing ginger bacterial wilt. However, there is no information and research done so far on the effects of chemical bactericides to manage the disease under field condition in Ethiopia. Therefore, there is a need to investigate the effects of chemical bactericides on ginger bacterial wilt disease epidemic development in ginger production areas of southwestern Ethiopia.

Therefore, the objectives of the present study was:

1. To evaluate the efficacy of bactericides application on the on epidemics of ginger bacterial wilt; and

2. To determine the efficacy of bactericides application on ginger rhizome yield and its components.

Material and Methods

The experiment was conducted at Tepi Agricultural Research Center (on station), Akash and Toli tokali farmers fields, during 2019 main cropping season. The experiment was relied entirely on natural epidemics of bacterial wilt, because all sites are hot spot areas of the disease and the previous history of the field also confirmed it. Local variety of ginger was used for this experiment. Local variety is susceptible to bacterial wilt and showed disease incidence ranging from 42.02 to 80.44% under natural condition without any spray (Merga *et al.*, 2018). The trial was laid out in randomized complete block design with five treatments and three replications. Rhizomes was planted on raised beds of 2.1 × 5 m size at a spacing of 30 × 15 cm between plants and 2m between blocks. No Fertilizers was applied during the experiment. Weeding and other cultural operations was carried out as and when necessary. Test bactericides Besun 200 SC (Zinc Thiazole 20%) and recently registered bactericides kocide 2000 included as standard check along with untreated check (control). Test bactericides was applied manually using knapsack sprayer with a rate of 1.5 lit/ha, 1.75 lit/ha and 2 lit/ha and diluted in 300 lit/ha of water, While standard check or kocide 2000 was sprayed at recommended rate 2.5 kg/ha and untreated check (without spray) was used as control. First spray, of each chemical was started at the first symptoms appeared in the experimental field and continued within 15 days intervals.

Disease Assessment

Disease incidence (number of plants wilted) were visually assessed starting from first symptoms appeared in the exponential fields. Incidence was recorded, in each plot, just one day before each spraying and 15 days before last spraying. Plants that showed either complete or partial wilting were all considered wilted and staked to avoid double counting in subsequent assessments (Merga *et al.*, 2018). Wilt incidence for each treatment was then calculated as percentage of total number of plants emerged. Plant height, number of tiller per plant, rhizome length (cm), rhizome width (cm), number of finger per plant and rhizome yield (kg/ha) were collected from the two central rows.

Data Analysis

Analysis of variance (ANOVA) was performed for disease incidence, growth and yield parameters to determine the effect of treatments. Least significant difference (LSD at 5% probability level) was used for mean separation. All the data analysis was done using

the Statistical Analysis System (SAS) Version 9.3 (SAS Institute, 2014).

Results and Discussion

Disease Epidemics

Bacterial wilt disease pressure was very high on local variety of ginger across all locations during 2019/20 main cropping season. Excellent bacterial wilt disease epidemics was developed to create significance difference among treatments across all testing locations. The test bactericides (Besun 200 SC) and check bactericide (kocide 2000) significantly reduced bacterial wilt disease incidence over untreated check.

However, there was statistically significant difference observed between test bactericides and check bactericides in controlling disease incidence (Table 1). Even though, there was no statistically significant difference observed between test bactericides and check bactericides, relatively check bactericides had comparable efficacy in reduced bacterial wilt disease incidence to the minimum possible level with test bactericide. While based on visual field observation test bactericides (Besun 200 SC) showed similar efficacy in controlling bacterial wilt disease incidence with check bactericide (kocide 2000). Test bactericides (Besun 200 SC) reduced bacterial wilt disease incidence by 21.9% as compared to untreated plot. While check bactericides (kocide 2000) reduced bacterial wilt disease incidence by 28.4% compared to untreated plot. Based on visual field observation and analyzed data the test bactericide (Besun 200 SC) showed similar level of efficacy in controlling ginger bacterial wilt disease incidence with check bactericide (kocide 2000). Thus test bactericide can be used for control bacterial wilt disease of ginger.

Yield and Yield Components

The statistical analysis showed that there is no significant difference observed between the test bactericide (Besun 200 SC) and check bactericide (kocide 2000) and untreated control on number of tiller per plant. While there was significance difference on number of finger per rhizome, rhizome length, rhizome width and yield between bactericides treatments (test and check bactericide) and un treated plot (without spray) (Table 1). Test and check bactericide showed 37% (2.2 t/ha) and 57.4% (3.1 t/ha) yield advantage over untreated check respectively (Table1). Therefore, test bactericide (Besun 200 SC) and check bactericide (kocide 2000) controlled bacterial wilt compared untreated check on local variety of ginger (Table 1).

Table1. *Efficacy of Besun 200 SC (Zinc Thiazole 20%) against bacterial wilt disease incidence, yield and yield components of ginger in Tepi at Ethiopia.*

Treatment	NTPP	RL (cm)	RW (cm)	NFPR	YLD (t/ha)	DI (%)
Besun 200 SC (1.5 lit/ha)	5.6^{a}	9.9^{bc}	3.3^{bc}	4.2^{ab}	6.1^{cd}	43.7^{b}
Besun 200 SC (1.75 lit/ha)	5.8^{a}	9.7^{cd}	3.7^{ab}	4.0^{b}	7.0^{bc}	38.3^{c}
Besun 200 SC (2 lit/ha)	5.9^{a}	10.7^{ab}	3.4^{b}	4.8^{a}	7.6^{ab}	37.3^{cd}
Check (Kocide 2000 (2.5 kg/ha)	6.0^{a}	10.9^{a}	3.9^{a}	4.9^{a}	8.5^{a}	34.2^{d}
Control	4.9^{a}	9.0^{d}	3.0^{c}	3.1^{c}	5.4^{d}	47.8^{a}
LSD (0.05)	NS	0.91	0.43	0.67	1.13	3.69
CV (%)	25	9.4	12.9	16.6	17.08	9.61

NTPP= number of tiller per plant, RL= rhizome length, RW= rhizome width, NFPR= number of finger per rhizome, YLD= yield ton per hectare, FDI= disease incidence, LSD= least significant difference among treatment means ($p \leq 5\%$), CV= coefficient of variation, means with the same letter with in the column are not significantly different.

Summary and Conclusion

Test bactericide (Besun 200 SC) did not differ from check bactericide (kocide 2000) in controlling bacterial wilt disease of ginger and provided comparable number finger per rhizome, rhizome length, rhizome width and rhizome yield with check bactericide (kocide 2000). Moreover Besun 200 SC at the rate of 2 lit/ha reduced bacterial wilt disease incidence to lowest possible level and gave rhizome yield that was almost comparable with check bactericide and advantage better than untreated check. Hence, based on strong positive merits of test bactericide indicated in reducing ginger bacterial wilt disease incidence to the lowest level, thus, Besun 200 SC (Zinc Thiazole 20%) could be used as an alternative in place of kocide 2000 for control of bacterial wilt (*Ralstonia solanacearum*) of ginger in Ethiopia.

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