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Research Article

Verification of the Efficacy of New Insecticide, Diesel (*Lufenuron+Emamectin Benzoate*) against Onion Thrips (*Thrips Tabaci Lindeman*) in Bale, south-eastern Ethiopia

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Abstract

Onion (*Allium cepa*) is popularly called as "Queen of Kitchen" as it is used as food, salad, spice, condiment and in medicine. Currently, the production is practiced all over the round for its daily uses in food and source of income and for commercial purposes starting from the introduction in the country as planting material from Sudan. However, its productivity is constrained by both biotic and abiotic factors of production. Thrips, thrips tabaci Lindeman (*Thysanoptera: Thripidae*) is the most limiting factor and causes significant yield loses among biotic factors. In this study, the efficacy of the new insecticide (Diesel (*Lufenuron+Emamectin benzoate*) was tested with standard check (CORSA (*Profenofos 40% + Cypermethrin 4%EC*) and unsprayed check included for comparison in three location (*Sinana on station, Goba and Aloshe*) using a plot size of 10m by 10m for each treatment. Accordingly, the result found that, the new insecticide was effective as of the standard check in controlling the infestation of thrips and reducing the yield losses which contributes in increasing both production and productivity of onion. Therefore, Diesel (Lufenuron+Emamectin benzoate) insecticide can be registered and used as management option for control of onion thrips in Ethiopia.

Introduction

Onion (*Allium cepa L.*) is belongs to the genus *alliums* are large, consisting of more than 500 species grown in different parts of the world and one of the most important vegetable crops produced on large scale in Ethiopia. It has a great share in the national economy of the country. According to CSA, 2012 the potential production of onion produced in Ethiopia for local consumption and as exportable item is 10.77 tons per hectare in average every year. Nutritionally fresh onion accounts for 86.8% moisture, 11.6% carbohydrates, 1.2% proteins, 0.2-0.5% calcium, 0.05% phosphorous and traces of iron, thiamine, riboflavin and ascorbic acid as described by Muna yadav, 2018. It has also medicinal role in reducing the risk of anti cancer, cardio vascular and a s antioxidant due to the phytochemical called quercetin found in onion (Smith, 2003). Onion is produced in Bale zone, southeastern part of Ethiopia in most parts of the region both under rain fed and irrigation for local consumption and income generation. Its production is increasing time to time due to its high profitability per unit area and increases in small irrigation in the area.

However, production and productivity of onion is low due to both biotic and abiotic limiting yield factors. Among biotic factors, insect pests are playing a great role in reducing quality, productivity and marketability of the crops in all stage which accounts yield losses of 10 to 25 % world's total production. Of the insect pests (thrips, onion fly, cutworms and tobacco caterpillars etc), thrips is the most serious and which causes a significant yield losses of 90% when the infestation by thrips is at early stage of the crops. The attack is mainly during when the crops are approaching maturity but, may starts at early stage of the crops. Due to Onion thrips directly feed on leaves the ability of the crops in carrying out the photosynthesis

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activity is highly affecting results in about 50% yield losses. It also can be even problematic by transmitting viral disease like *Iris Yellow Spot Virus* (IYSV) [1]. Nymph and adult thrips prefer to feed on young leaves in the inner necks of onion plants (Alston & Drost 2008). They cause damage by puncturing the leaves and sucking the sap resulting in silvering, curling and eventually reduction in bulb size and weight. The bulb yield losses due to thrips ranged between 10 to 85 % as reported by different authors [2-4].

Today, most growers control thrips through application of insecticides several times in the growing season and effective in bringing the pest population down. However, due to a repetition and long period usage with limited number, most insecticides become ineffective because of the development of resistance by thrips to most commonly used insecticide (personal observation). Therefore, verifying the new insecticide for registration is the most important for growers as alteration usage to reduce the resistance development and well management option by integrating with other methods of control. Keeping this in mind, the study was conducting to verify newly introduced insecticides for management of onion thrips.

Materials and methodology

Description of the study areas

The experiment was conducted at three locations (Sinana Agricultural Research on station, Sinja and Aloshe) since, 2019/2020 G.C.The locations represent the potential area of onion production and area of which the damage due to insect is frequently occurred in Bale zone, south-eastern Ethiopia. Bale zone is characterized by bimodal pattern of annual rain fall. The first rainy season occurs from March to June "*Ganna (Belg)*" and the second from August to December *"Bona (Meher)"*. The two seasons are locally termed after the time of crop harvest. Sinana Agricultural Research Center (SARC) is located at 7º7' N (latitude) and 40º10' E (longitude) at about 2400 m.a.s.l and receives 750–1000 mm mean annual rain fall and a mean annual temperature of 9–21 ºC (Nefo, et al. 2008). The dominant soil type is pellic vertisoil and slightly acidic (Dagne, et al. 2016).

Experimental materials and treatments

Locally available variety of onion which is susceptible for the downy mildew of onion that enhances the thrips damage as well was bought from local market and used as planting materials (bulbs). The crop was planted on plot size of 10mx10m using the spacing of 20cm and 10cm between rows and plants respectively, during the main cropping season "Bona" of 2019/20G.C.The plots were fertilized with 100kg/ha of both Urea and NPS as blanket recommendation. Two different insecticides, the newly () sent to Sinana Agricultural research center by Hamlin Trading P.L.C for verification ,CORSA as standard check and unsprayed plot were used as experimental treatment. The three described locations represent replication of the treatments. The spray treatment was started when the economic threshold level (ETL) for the thrips is exceeds five thrips per plant as described by Shiberu T, et al. 2015). During the onset of infestation at threshold level, the two test insecticides, Diesel (Lufenuron+Emamectin benzoate) was sprayed on one of the experimental plot at the rate of 1L/ha. The standard check,CORSA (Profenofos 40% + Cypermethrin 4%EC) was also sprayed on one of the rest two plots as per recommendation rate among the two insecticides. Spraying was continued three times in the interval of 15(fifteen) days for both two insecticides. The third plot (unsprayed plot) was included as control. Each plot was replicated three times as locations, (Sinana on station, Sinja and Aloshe). All agronomic practices required was applied during the growth cycle of the plant.

Data collection and analysis

The dynamic population of the pest was assessed to observe the effect of insecticides as compared to unsprayed plot. Data on Pre and post spray population of thrips populations was collected from 10 randomly selected plants from each three treatments. The post spray population was recorded after 24 an hour at interval of fifteen days and the numbers of thrips were counted visually. The collected data were analyzed using GenStat 15th Edition statistical Software. Analysis of variance (ANOVA) was used to test for significant differences between the variables.

Efficacy of the insecticide: - The efficacy of the insecticide was calculated using the following formula described by Shiberu and Negeri, (2014).

$$\text{Efficacy }(\%) = \frac{\text{Pre spray count} - \text{Post spray count}}{\text{Pre spray count}} * 100$$

Intensity of the damage level: - the degree of infestation by thrips was calculated using the formula of R=Σ (n. b)/N described by Diaz-Montano, et al. 2011. Where, N=-numbers of plants in sample, n=-number of plants damaged at the same level, and b=-level of damage (according to 0.5 point scale)

Plant height (cm): Average height of 10 bulbs per plot

Weight of the bulbs (g): Average weight of 10 bulbs per plot

Total weight of the bulbs (Qt/ha): Total weight of the bulbs harvested from the middle rows and transformed to quintals per hectare.

Results and discussion

The analyzed data indicated that the average number of onion thrips per plant and percent mortality caused by insecticides (both standard check and newly introduced insecticides) after 24 hours were significantly different from untreated plot. The highest mean number of thrips per plant recoded from untreated plot were 136.2 while, the lowest number of thrips of 7.8 and 12.3 were recorded from the standard check and the new introduced insecticides per plant respectively. This result confirmed with the work of Amna Sadozai, et al. [5] who has been recorded the highest mean number of thrips per plant and highest mortality rate from tested insecticides and while, the lowest from unsprayed plot. The dynamic thrips population of onion crops is decreasing as the number of frequency of insecticides increases. The lowest

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dynamic populations of thrips were recorded from tested insecticides of Diesel and Corsa while the highest numbers of thrips per plant was obtained from check plot in the third application of the insecticides (Figure 1) Table 1.

There was a significant (p>0.05) difference among bulb weight, plant height, and total yield between sprayed and unsprayed plants. This show the thrips has effect on the plant height, bulb weight and total bulbs (yield) of the crops. This is due to the thrips feed the leaves directly which reduces the capacity to carry out photosynthesis in result affecting the bulb size and total weight of onions. The highest average total yield of 73.5 and 70.95 Qt/ha were recorded from the plot treated with standard check and the new test insecticide respectively, While the lowest was recorded from the control one (31.5Qt/ha). This result is line with the reports of Amna Sadozai, et al. 2009 and S.D. Patil, et al. 2009 [5,6] which they record the higher bulb weight , total yield and plant height from treated plot with the insecticides while , the lowest bulb weight , total yield and plant height from the check plot. The average weight of bulbs and plant height treated with the new test insecticides, Diesel (Lufenuron+Emamectin benzoate) was approaching to the standard check (CORSA (Profenofos 40% Cypermethrin 4%) [7-10]. The lower average bulbs weight and height of the plant was recorded from the control one (Table 2).

Summary and recommendations

Full yield potential of onion crop is reduced by a number of constraints. Among them, insect pests like thrips, cutworm, and onion shoot fly and tobacco caterpillars. Thrips (*Thrips tabaci* Lindeman) is the most important insect pest which causes significant yield losses of onion. The experiment was conducted to evaluate the efficacy of Diesel (Lufenuron+Emamectin benzoate) insecticide against onion thrips at three locations, Sinana on station (Sinana agricultural research center) and Sinja and Aloshe on farm. Corsa (Profenofos 40% Cypermethrin 4% EC) was used as standard check. Accordingly, the new test insecticide was effective as of the standard check in controlling the infestation of thrips and reducing the yield losses. Therefore, Diesel (Lufenuron+Emamectin benzoate) insecticide can be registered and used for the management of onion thrips in Ethiopia.

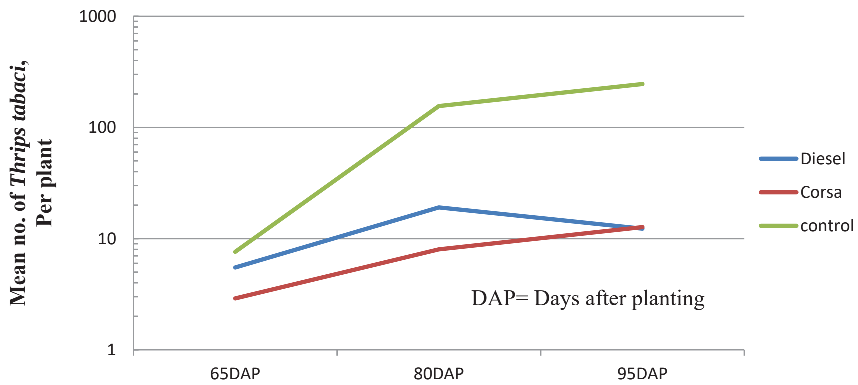

Figure 1: Population dynamics of onion thrips, *Thrips tabaci* in onion crop.

Table 1: The control efficacy of tested insecticides.

Insecticides	24hrs after first spray		24hrs after second spray		24hrs after third spray	
	Number of live thrips	Efficacy (%)	Number of live thrips	Efficacy (%)	Number of live thrips	Efficacy (%)
Diesel (Lufenuron+Emamectin benzoate)	5.5	72.5	19.1	85.2	12.3	84.4
Corsa (Profenofos Infestation 40% + Cypermethrin 4% EC)	2.9	75.3	8	84.6	12.7	87.8
Control	7.6		155.6		245.5	
Mean	6.9		70		102	
CV (%)	39.2		31.7		26	
LSD (0.05)	NS		95.62		113.9	

Table 2: Effect of insecticides on plant height, bulb weight and total yield.

Insecticides	Days to maturity (in days)	Plant height(cm	Bulbs weight(g)	Number of bulbs per plant	Total Yield (Qt/ha)
Corsa (Profenofos 40% + Cypermethrin 4% EC)	110	35.3	151.1	8.8	73.5
Diesel (Lufenuron+Emamectin benzoate)	100.5	31.7	140	8.5	70.95
Control	51.5	12.95	46	8.7	31.5
Mean	87.3	26.65	112	8.67	58.92
CV (%)	7.5	4.8	33	27.4	1.8
LSD (0.05)	28.27	5.5	159.3	NS	4.57

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