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Original Research Article

Management of barley shoot fly using seed treating insecticides at Arsi, South Eastern Ethiopia

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Abstract

Barley (Hordeum vulgare L.) used in food and malt production in Ethiopia. Besides its importance, one of the major insect pests of barley; barely shoo fly; Delia spp., prominently affects barley production and productivity in the highlands of Ethiopia. The current study was conducted from July, 2019 to March, 2020 in the main cropping seasons in Arsi, south Eastern Ethiopia across three experimental sites (Meraro on station, Bekoji on station and Bekoji on farm). Nine treatments were applied across three locations with three replications, that is, one untreated check, one seed of malt barley dressed with Centrino and one of malt barley seeds treated with apron star used per location to verify the choice and verification of effectiveness of seed treatment insecticide (Centrino) for barley shoot fly management to ensure food security. During the study 13.5kg traveler seed weighted for the three test locations, for one site 4.5kg per three plots, that is, 1.5kg of seed per 10mx10m area, nine milliners of Centrino per 4.5 kg of traveler i.e. 200ml of Centrino/100kg of seed, untreated 4.5kg per three location used, i.e.1.5 kg/one plot/10mx10m area. Nine milliliters apron star per 4.5 kg of traveler seeds were used as standard check, that is, 200g of apron star/100kg of seeds.24ml of water used per 4.5 kg of seed. NPS and Urea were used in recommended to the area 10mx10m. Therefore, management of this important insect pest using different tactics promotes barley production and productivity.

Keywords: *Barley shoot fly, Centrino, infestation, management, insect pest, and seed treating insecticides.*

Introduction

Barley (*Hordeum vulgare L.*) is a self-pollinating diploid species (2n = 14) and a descendant of wild barley (*Hordeum spontaneum* C Koch). It ranks fourth among cereals after wheat, maize, and rice worldwide. According to report by FAOSTAT (2020), in 2019/20 crop year, global barley production was approximately 156.4 million metric tons. In the 2019/2020 growing season, 950,742.01 hectares of land covered by barley in peasants' farms in Ethiopia with a total harvest of 2,378, 0102.92 tons (Abebe, 2022). Its productivity (2.66 t/ha) is lower compared to that barley producing countries such as United Arab Emirates, Belgium and the Netherlands 8,7.59 and 7.0t/ha respectively (Muhe and Assefa, 2011). Traditionally, barley a very important food crop plant in the semi-arid regions of Africa (Morocco, Algeria, Libya and Tunisia), Middle East (Saudi Arabia, Iran, Iraq and Syria), highlands of Nepal, Ethiopia and Tibet, Andean countries of South America (Peru and Chile) and in some Asian counties (China, North Korea and Himalaya)(*Kumar et al,2014*).In Ethiopia barley is cultivated from 1400 to over 4000 meter above sea level (Abtew,2015).Although barley is cultivated in almost all parts of the country, Arsi, Bale, Shewa, Gojam, Gonder, Welo and Tigray are the most important barley producing regions accounting for more than 85% of the country's total production(*Rashi et al.,2019*).Demand and production of barley are growing for various reasons: genetic diversity wide adaptability, model crop for molecular research and a wide range of uses, such as food, beer and feed. It is used as food, feed and beverage in more than twenty different ways in the country. Even though the importance and production of barley in East and West Arsi, South Eastern Ethiopia is unquotable the new threat in barley production is barley shoot fly *Delia spp*., which is the biotic factor limiting quality, production and productivity of the crop. Therefore, the study mainly trusted with the objective on the

choice of testing effective insecticides (Centrino) against barley shoot fly at Arsi, South Eastern Ethiopia to increase quality production and productivity.

Materials and methods

Description of the study area

The study conducted at three test locations; Kulumsa Agricultural research center sub stations, that is, Meraro research station, Bekoji research station and Bekoji farmers' farm land from July, 2019 up to March 2020.The agro ecological descriptions of the trial sites are presented as in Table (1) below.

Table (1): describes the major agro ecology of the experimental sites

Location	Latitude	Altitude	Tº	RF	Longitude.	Soil type	Agro Ecology
Bekoji	07032'37''N	2780	7.9-18.6	1020	39015'21''E	Clay soil (Nit sols)	Highland & high rainfall
Meraro	07024'27''N	2990	5.7-18.1	1196	39014'56''E	Clay soil (Nit sols)	Extreme highland & frost

Source Birhan A, 2011

Planting materials

During the experiment; 4.5kg barley seed for untreated check per three test locations, treated seed with Centrino 9ml per 4.5kg seed for three locations and treated seed with apron star 9ml per 4.5kg seed for three locations were used as testing materials. The treatments were placed or planted as untreated check (1.5kg), Centrino treated (1.5kg) and Apron star treated seed (1.5kg) per Location.

Experimental design and testing procedures

The experiment was performed with a plot size of 10m width and 10m length with 0.2m inter row spacing and drilling between plants across three locations. Centrino and apron star were used as seed dressing insecticides against barley shoot flies as recommended per plot prior to planting. Nine treatments across three locations with three replications, that is, one untreated check, one of malt barley seed dressed with Centrino and one of malt barley seed treated with apron star were used per location. The treatments were planted across three locations (Meraro research station, Bekoji research station and Bekoji farmer land). Recommended seed rate and fertilizer used rates for that particular location.

Collected data

Stand counts both at the early growth stage of infected plants barley shoot fly per plots across three locations using quadrants and agronomic and quality parameters were taken, that is, Tillers number, shoot fly infected barley, height, yield, thousand seed weight (TKW) and Hectoliter weight (HLW): listed as listed in Table 2.

Table 2: shows evaluated ANOVA across test locations

Test locations	Sh./fly inf.%	tillers	Height	TKW	Yield	HLW
Bekoji on farm	5.02	134	78	47.32	16.7	2820
Bekoji on station	13.22	130	69	47.21	16.45	2908
Meraro	39.51	241	112	40.18	21.92	2615
Mean	8.32	168	86	44,9	18.36	2781

Number of tillers: data on the number of shoot flies per 20 randomly selected tillers per plot taken in a crossed diagonal line at weekly intervals.

Shoofly infestation percentage: infestation percentage (%) was recorded based on the percentage of infected leaves or stem area damaged **(Perring *et.al.* 2015**). Foliar diseases are best scored when the most susceptible entry in the trial receives approximately 75% infection by the disease based on foliage coverage.

Height; Plant length and Plant length including the stem, ear and awn were measured. The length measured from the base of the plant to the tip of the highest awn with a range of short (< 92 cm), medium (≥ 92 < 107 cm), and tall (≥ 107 cm).

Yield: Grain yield in g/plot at 12.5% moisture content was recorded and converted to kilogram per hectare (kg/ha).

Thousand seed weight/TKW; It was determined from the grain yield of the whole plot as the weight of 1000 seeds adjusted to standard storage moisture.

Hectoliter weight (HLW): - Grain weight of one-litter volume (random sample) was estimated for each experimental unit by following standard procedure (**Ayele, 2019**) and the result was converted to ghl-1.

Data analysis

Analysis of variance and mean separation were performed following the procedures of Gomez and Gomez (1984) and using SAS version 9.3 and Tukey test for mean separation (SAS, 2002) and Minitab software version 17.

Result discussion

Field performance

The study was conducted in 2019/2020 main cropping season at three locations of barley shoot fly- prone areas; Meraro station, Bekoji farm and Bekoji stations. The Traveler variety was used as a test cultivar. For one site experiments; treatments were placed as Untreated, Centrino treated, and apron star(check) treated laid on a plot size of 10m width, and 10m length with 0.2m inter row spacing and drilling between plants across three locations. During the experiment, the field preparation, layout, seed sowing, fertilizer applications, weeding, and physiological and barley shoot fly infestation data were scored across each plots and locations. Shoot fly infestation data were five times with ten days intervals starting from the pest symptom start up seen.

Tactics/protocols followed

During the experiment, the following procedures were considered as areas for a plot = 10mx10m.For each site treatments put as Untreated (plot1) plus Centrino treated (plot2) plus standard check/apron star treated (plot3), and the amount of seed used for one plot (10mx10m) is equals to 1.5 kg, on the other hand the amount of seed used for one location =1.5 kgx3=4.5 kg of seed. Hence, the total seed used for the three locations=4.5 kgx3=13.5 kg. The amount of Centrino and apron star used for seed treating calculated from 200 ml/100 kg for the recommended area, i.e. 9 ml of Centrino/apron star used per 4.5 kg of traveler seed. The seed and fertilizer used calculated as per as recommended to the area, the amount of water used for the recommended area also calculated from 533.3 ml of water/100 kg of seed. Finally, all other agronomic techniques, from site selection to post harvest performed well.

Analysis of variance/ANOVA

The Combined ANOVA of barley shoot fly infestation and agronomic parameters showed significant variations among the evaluated treatments. The analysis of variance showed a highly significant difference at ($P<0.05$) as shown in table3., which showed evaluated and combined ANOVA across test locations respectively.

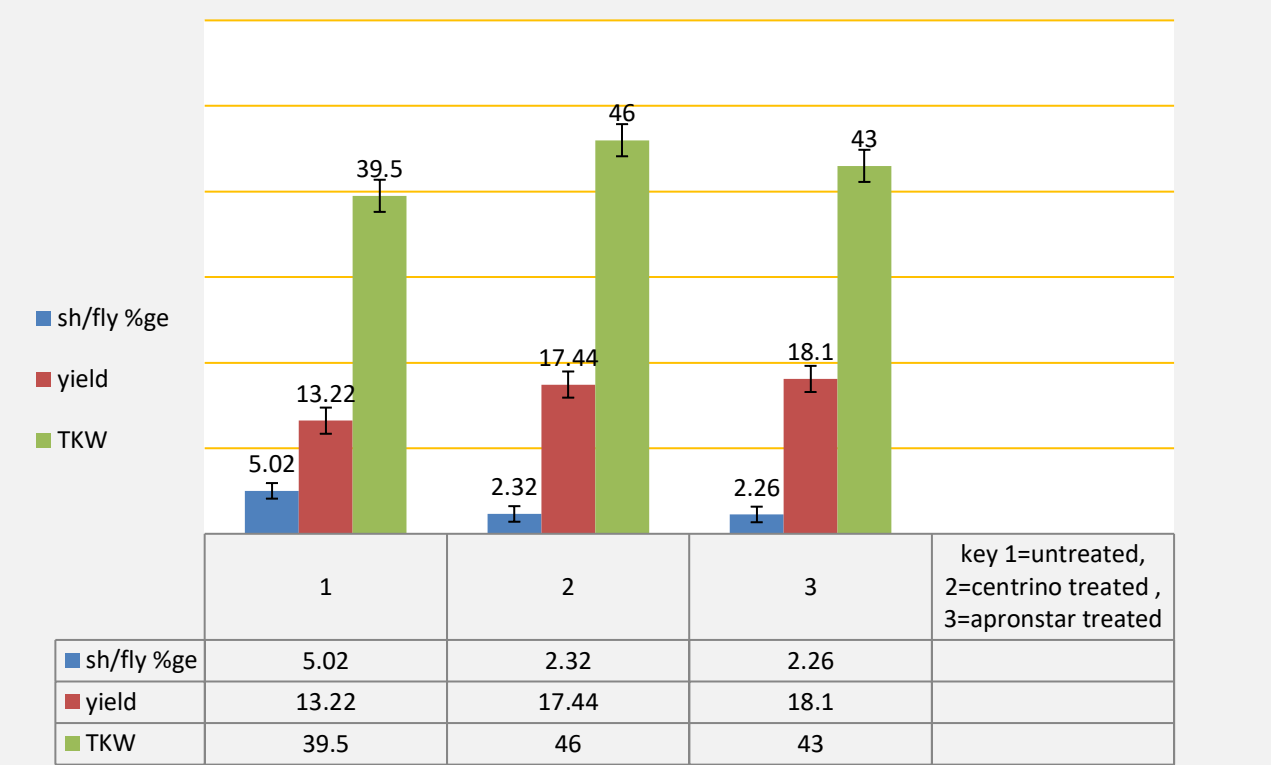
Table 3. Combined ANOVA results for each tested traits

plots	germinated	tillers no	Shoot fly infest %	height/cm	TKW/g	Yield kg/ha-1	HLW/lit
1a	70	125	8.7	70	37.74	10.84	2726
2a	96	134	2.6	78	50.04	13.96	2820
3a	63	139	2.9	82	46.48	16.7	2627
1b	61	122	4.37	72	42.5	12.5	3045
2b	63	130	3.1	68	47.2	16.45	2908
3b	75	175	2.8	65	43.38	16.32	3038
1c	70	232	2	176	38.12	16.54	2616
2c	75	245	1.25	161	40.18	21.92	2615
3c	81	380	1.1	176	38.7	21.21	2620

Key: 1. =untreated, 2=Centrino treated and 3=apron star treated, a =Bekoji on farm, b=Bekoji on station =Meraro on station

Comparison of shoot fly infestation, Yield and thousand seed weight

As indicated in the graph1.below , the average shoot fly infestation percentage across the three locations showns; in untreated(5.02%ge),Centrino treated (2.32%ge), and apron star(check) treated (2.26%ge).Even though the average yield obtained is below the national level, Centrino treated plots are higher than untreated and more or less approaches apron star treated ones i.e. 13.22qt./ha for untreated plots ,17.44 quintals/ha for Centrino treated plots and 18.1 qt. /ha for apron star treated(check).on the other hand the thousand kernel weight (TKW) shows greater in Centrino treated than untreated and apron star treated checks ; i.e. 39.5 (for untreated), 46(for Centrino treated) and 43 (apron star treated).



	1	2	3	key 1=untreated, 2=centrino treated , 3=apronstar treated
sh/fly %ge	5.02	2.32	2.26	
yield	13.22	17.44	18.1	
TKW	39.5	46	43	

Graph1. Shows relationships of shoot fly infection%, yield and TKW across three location and treatments

Conclusion and recommendation

The Barley Shoot fly infection record and ANOVA results for the three experimental locations and treatments showed that treating seeds of barley prior to sowing by dressing with 9ml of Centrino plays a vital role in increasing production and productivity including to other agronomic practices.

Disclosure statement; No potential conflict of interest in this regard.

Data availability statement; Data that support the findings of this study are available from the corresponding author upon reasonable request.

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