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Journal of
Agricultural Science and Food Research

Research Article

Evaluation of Sowing Date for *Delia arambourgi*/Barely Shoot Fly Based on Today's Environmental Influence

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ABSTRACT

Barely shoot fly is a major problem as aspect of insect pest in Ethiopia. This insect best by nature it prefer dry air condition, and its aggressiveness is very high in dry air conditions. The objective of this experiment was to evaluate the barely shoot fly infestation pressure during sowing date variation due to today's environmental change in Ethiopia; it was done in Holetta Agricultural Research Center. The experimental design was completed by randomized block design within three replications. The varieties during the research used eight food and seven malt barely varieties, these are include, Baleme, Eh1493, Dimtu, Shage, Hb1307, Hb1963, Hb1965, Hb42 and, M-21, Hb1966, Explorer, Holker, Ibon174/03, Traveler, Hb1964 and respectively. The data that were recorded, health plant, damage plant, total tiller, productive tiller and yield. As a result at early set of trial there is high number of health plant (low infestation) and high damage of plant (high infestation) (F_{29}, 6.2 at 0.005=10.8, $p<0.0001$) and (F_{29}, 1.7 at 0.005=6.9, $p<0.0001$) respectively compare with the rest depend variable. Due to today's unconditional environmental changes, the land preparation and sowing date time forced to shift or postponed, so based on metrological forecast, as much as possible need to sowing at early time after the first rain showers.

Keywords: *Delia arambourgi*; Food and malt barley; Sowing date, Relative humidity; Rain fall; Maximum and minimum temperature

INTRODUCTION

In different way world environmental changes, leads insect pressure increment directly or indirectly, this is influence to shift, the sowing date time. Today pesticide side effect is global issue, application pesticide affect our surrounding (ground water, soil organisms, resistant and human health). So, chemical producer companies restricted by international pesticide laws which means to produce chemical pesticides limited by energy money and takes long time to produce effective chemical pesticides which is very expensive, especially for developing countries. To solve insect pest infestation problem and pesticides crises need to develop strategic integrated pest management (IPM). IPM great control option to control insect pests, due to its vital points (safe environment, workers, and keep natural diversity) compare to chemical pesticides. Barely (*Hordeum vulgare*) is one of major crops grown in Ethiopia which is used for food, feed and beverage, in highlands of Ethiopia. By improving of production constraints through research programs and also government give attention to fulfill Beverage Company's interest on malt barely. In Ethiopia yield increasing from 1.17 metric tons per hectare to 1.87 metric tons per hectare in small holders growers and also total production increase from 1million tons in 2005 to 1.9 million tons in 2014 [1,2]. There are different obstacles on the barely production, insect pest problems one of production constraint which affects barely production in Ethiopia, barely shoot fly and Russian wheat aphids are the major. In research activities there are great work on breading program to enhance production through releasing different improved varieties but in crops protection not this much success and yet not search out the durable varieties to resist the major pest. Cultural and agronomical practice (sowing date, weeding, tillage, rotation and fertilizers) are good tools to compromise insect pressure [3]. Thus, the objective of this study was to evaluate the shoot fly infestation variation in sowing date variability under today's environmental changes.

MATERIAL AND METHODS

This experiment was carried out at Holetta Agriculture Research Center, Ethiopian Institute Agriculture Research to evaluate the shoot fly infestation variation in sowing date variability under today's environmental changes. Experimental design was Complete

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Received: August 20, 2018, **Accepted:** September 11, 2019, **Published:** September 17, 2019

Citation: Teferra YK (2019) Evaluation of Sowing Date for *Delia arambourgi*/Barely Shoot Fly Based on Today's Environmental Influence. J Agri Sci Food Res 10:264. doi: 10.35248/2593-9173.19.10.264.

Randomized Block Designee (CRBD) with three replications. The material that was used to collect the data was rural, data sheets and pencil. The five years of metrological data was taken from metrology station of Holeta Agriculture Research Center (2013-2019), these metrological data was include, relative humidity (%), rain fall (ml), minimum and maximum temperature (c_0) as a secondary data. The varieties that was used in experiment (Baleme, Eh1493, Hb1966, Dimtu, M-21, Shage, Hb1964, Hb1307, Hb1963, Hb42, Hb1965, Explorer, Holker, Travler, and Ibon174/03) eights were food barely and the rest were malt barely varieties. On each plot with in raw diagonally 50 cm measured and within 50 cm, at vegetative growth, diagonally after one month four times in every week was taken, health plant and dead heart was taken in each raw by exclude the outer raw. Total tiller and productive tiller after vegetative growth was taken, mother plants, appearance of leaf color (splotch), wilting, and yield was taken. Data analysis was done by using SAS and mean separation by Tukey's student zed in single one way ANOVA ($P \leq 0.05$).

RESULT AND DISCUSSION

As shown below in the Tables 1 and 2 there is significance difference between early and late set sowing of barely? At early set of trial there is high number of health plant (low infestation) and high damage of plant (high infestation) (F29, 6.2 at 0.005=10.8, p<0.0001) and (F29, 1.7 at 0.005=6.9, p<0.0001) respectively compared with the rest depend variable. This experiment was sown in early Jun, in both years (2017 and 2018), by nature barely shoot fly insect pest at the lower relative humidity its ovipositon capacity is very week and at high rainfall its number of adult shoot fly emergency decreased due to wash away of the eggs from the crop by heavy raining time, this lead to low number of dead heart and high number of healthy plant. As shown in the Table 3, the relative humidity and the rain fall also increased from Jun to August, after mid of august the crop pass the vegetative stage and it can to tolerate. These environmental influence results confide to Kumar and coworkers who are working on sorghum shoot fly [4,5]. In Table 2 indicate, the varieties were used in the experiment barely such like Balem, Explorer, Holker,

Table 1: Dependent variable source of variation in production season in early set production.

Source of variation For all dependent variables	Dependent variable	Mean	CF	DF	Sum square	Mean square	Fv	Pr>f
Variety	MHP	10.8	24.2	29	1296.7	15.9	6.2	<.001
Replication				2	17.48	10.3	1.0	0.35
Variety	MDP	3.1	33.4	29	51.8	1.7	1.7	0.36
Replication				2	6.2	3.1	2.7	0.08
Variety	MTt	10.1	29.7	29	266.5	9.1	1.4	0.0042
Replication				2	398.8	199.4	10.4	0.6
Variety	MPt	6.9	47.3	29	800.1	27.5	1.7	<0.0001
Replication				2	10.89	6.0	1.2	0.0002
Variety	YkY	0.97	94.4	29	27	0.9	1.0	0.24
Replication				2	1.4	0.7	0.87	0.41

Table 2: Mean of each dependent variable SAS analysis of early and late set of barely experiment.

Source of variabilty	Name of cultivar/Varieties (Early sowing date)														
	Baleme	Eh1493	Hb1966	Dimtu	M-21	Shage	Hb1964	Hb1307	Hb1963	Hb42	Hb 1965	Explorer	Holker	Traveler	Ibon 174/03
MHP	15.6 A	14.7A	14.3 A	14.0 AB	13.8 AB	13.5 AB	13.7 AB	11.6 ABCD	13.1 ABCD	12.3 ABCD	14.3 A	15.2 A	14.95 A	11.6 ABCD	12.0 ABCD
MDP	3.6 A	4.0A	3.6AB	3.2 AB	3.0 AB	3.3 AB	2.7 AB	3.3 AB	4.2 A	3.2 AB	3.3 AB	3.2AB	3.3 AB	3.2 AB	3.0 AB
MTt	9.5 A	11.3A	10.1 A	9.8A	8.4 A	8.2 A	10.4 A	10.5 A	11.2 A	10.6 A	9.4 A	9.4 A	10.3 A	10.5 A	9.7 A
MPt	7.1 A	7.9 A	8.6 A	7.5 A	8.0 A	6.6 A	7.8 A	9.6 A	9.0 A	7.8 A	9.0 A	8.8 A	8.9 A	8.0 A	8.8 A
Ygk	1.1	0.62 AB	0.49 B	0.94 AB	0.69 AB	0.73 AB	0.81 AB	0.59 B	0.76 AB	0.7 AB	0.67 AB	0.5 B	0.6 B	0.74 AB	0.64 AB
Source of variablity	**Name of cultivar/ varieties (Late sowing date)**														
	Hb1965	**Ibon174**	**Holker**	**Hb1307**	**Shagae**	**M-21**	**Dimtu**	**Hb1964**	**Hb42**	**Traveler**	**Hb1966**	**Baleme**	**Explorer**	**Hb1963**	**Eh1493**
MHP	9.6BC	8.95 BC	8.75BC	8.4 BC	8 BC	8.5 BC	12.5 ABC	7.7 C	8 BC	7.7 C	6.6 C	6.5C	7.2 C	7.8 C	5.8C
MDP	2.7 AB	3.2 AB	2.6 AB	2.6AB	2.6 AB	2.2 B	2.4 AB	3.7 AB	2.6 AB	3.3 AB	3.1 AB	2.5 AB	3.3 AB	4 A	3 AB
MTt	8.4 A	6.6A	10.7 A	10.7 A	9.6 A	7.8 A	6.7 A	7.1 A	7.9 A	5.8 A	5.8 A	6.5 A	7.8 A	6.5 A	5.8 A
Mpt	8 A	8.6 A	9.2 A	9.2 A	9.3 A	9.4 A	8.0 A	7.6 A	9.3 A	8.2 A	8.6 A	8.3 A	8.4 A	8.4 A	8.1 A
MYgk	0.9 AB	0.82 AB	0.78 AB	0.7 AB	0.73 AB	0.93 AB	1.0 AB	0.76 AB	0.62 B	0.8 AB	0.75 AB	0.74 AB	0.7 AB	0.3B	4.6 A

Note :- Across a column similar letters are have not significance difference
MHP=Mean of health plant, MDP mean of dead plant
MTt=Mean of total tiller, MPt= mean of productive tiller, ykg=Yield in kilo gram

Table 3: The year of 2013-2018 (winter time) environmental conditions during planting time and crop vegetative period (Jun, July and August).

Year	Month	Relative Humidity (%)	Rain fall (ml)	Minimum Temperature (c_0)	Maximum Temperature (c_0)
2013	Jun	56	120.7	10.6	25.8
2013	July	66	81.8	10.6	19.8
2013	August	80	201.9	9.8	22.6
2014	Jun	56	68.4	7.2	24.9
2014	July	59	137.3	9	21.4
2014	August	71	222.4	8.4	20.9
2015	Jun	67	78.2	3.4	25
2015	July	74	27.2	4.4	24.1
2015	August	76	73.5	3.2	24.3
2016	Jun	77	38.4	7.1	24.6
2016	July	83	31.6	7.8	23
2016	August	82	164.9	8.2	21
2017	Jun	77	74.6	8.8	22.1
2017	July	83	172.8	8.8	21.7
2017	August	76	311.4	10.4	22.6
2018	Jun	75.5	204.1	9.1	20.6
2018	July	74.2	225.2	11.4	20.2
2018	August	73.2	234.1	10	19.5

Table 4: The min relative humidity, rain fall and Temperature of Holetta Agriculture research Centre from the Year of 2013-2018.

Year	Relative humidity (%)	Rain fall (ml)	Minimum temperature (c_0)	Maximum temperature (c_0)
2013	60.08	63.48	6.4	24.37
2014	63.4	52.8	6.8	21.7
2015	46	38	2.9	19.9
2016	59.6	53.2	6.2	23.9
2017	53.4	97.6	6.5	23.8
2018	52.2	115.4	7.7	22.9

Traveler, Eh1493, Hb1966 and dimtu have a good performance in the early set trial (have low infestation). Generally almost all selected variety have good performance in all dependent variability (high health plant, high productive tiller, high total tiller and low infestation), even they are good in yield at early sowing date compare to the late date. Wetted land also affects the shoot fly pupa servile, if the sowing time is at early time, after the first rain showers, the land become sufficiently wetted and the shout fly pupa become disturbed and it is difficult to survive and emerge to adult form, the raining is continue, the regeneration and the infestation level of shoot fly become to decreased, but when we sow in late season the winter period become too ended, but the crops still vegetative, the air condition's also become hot, the shoot fly re infestation is restarted, so due to this complexity, the crop could not escape and tolerate, even its maturity stage is delay, the end point of yield is very affected. So as a recommendation in order to reduced barely shoot fly infestation, if the sowing date acts up on, one up to two week before on time sawing date based on new metrology forecast. Today's climate conditions varied, time to time, year to year, month to month, as showmen in Tables 3 and 4.

CONCLUSION

In Ethiopian production season (winter), the rains temperature, and relative humidity very varied year to year, as shown on that metrological data's on recorded area. So every farmer and any customers before decide to sowing, need to follow, weather forecasting, the starting time of the rain, the warm (minimum and maximum temperature, relative humidity, soil moisture and Temperature) and insect assessment year to year is also very important before planning to sow the coming production season. So as a recommendation in order to reduced barely shoot fly infestation, if the sowing date act up on, one up to two week before on time sowing date, the shoot fly risk would be reduced rather than late sowing date.

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