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EVALUATION OF INSECTICIDES FOR THE MANAGEMENT OF FIELD PEA APHIDS IN ARSI AND WEST ARSI ZONES, SOUTHEASTERN ETHIOPIA

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Abstract

Aphids severely limit the yield of field peas in Ethiopia. Another barrier in the research area is the improper choice and application of pesticides to control pea aphids. To close this knowledge gap, a practical evaluation of registered or available pesticides was conducted at South Eastern part of Ethiopia. Using field pea seeds in an RCBD design with three replications; the experiment included six treatments in total: five registered pesticides and one check/null application. The assessment result showed that the percentage of field pea aphid infestation as well as yield and yield attributes were extremely significant (P>0.05). Based on yield and yield component increase, three insecticides: Dimethoate/ Lifothoate 40EC, Profit72 EC/profenofos, and Hamectin 3.6 EC are suggested for test/equivalent areas among the studied treatments. Therefore, in order to control field pea aphids, I advise using pesticides sparingly and with caution, along with other non-chemical management methods.

Keywords: Aphids, treatments, yield and yield components, Management, Field Pea.

Introduction

Field pea *(Pisum sativum L.)* is most significant pulse crops, which has been grown by smallholder farmers in Ethiopia's high and mid-altitude regions (1800–3000 masl) mostly produced under rain fed conditions Kie *et al.,* 2019). *Pea aphid (Acyrthosiphon pisum)* directly damages the plant and may result in viral infections (Enders and Kandel, 2021). Because fewer seeds are formed when aphids feed on peas during the early pod stage, yields may be reduced. Hence the study targeted with the objective to evaluate best insecticides for the management of field pea aphid.

MATERIALS AND METHODS

Description of the study area

The investigation was carried out throughout the rainy season in 2021 and 2022 at the Kulumsa Agricultural Research Center substations (Kulumsa and Asassa).

Table 1. The experimental sites and their agro ecology

Location	Latitude	Longitude	Altitude/m.a.s.l	RF/Mean	Min temp.	Max.temp.	soil texture	PH
Asassa	07012'N	39020'E	2300	620	5.8	23.6	Clay-loam	6.2
Kulumsa	08005'N	39010'E	2200	820	10.5	22.8	Dark-clay loam	

(Birhan, 2011)

Experimental materials and testing procedures

Field pea seed (Bursa / EH05027and five registered insecticides were utilized in t he experiment.Six (6) treatments were set up in an RCBD design with three replication, each containing one check/null application and five tested insecticides: Lifothoate/Dime thoate, Abema 3% EC, Profit/Profenofos, Helarat 5% EC, Hamectin 3.6%, and null/chec k.3.2 m wide by 4 m long plots with 0.2 m between rows and 5 cm between plants wer e employed. Plots and replications were spaced 1 m apart and 1.5 m apart, respectivel.

The suggested rates for seed, fertilizer (121 kg NPS/ha1), and pesticides were implemented based on the specific location. Using a backpack sprayer and the rates listed in Table 2 below, each insecticide was administered when the pest reached a harmful level.

DATA COLLECTION

Data on stand count was recorded during both the early growth stage and at harvest, along with the number pod, percentage of insect pest infestation, yield in kg/ha, and thousand seed weight.

Grain yield

In the field pea trial, the yield was recorded for the entire plot (grams per plot) and subsequently converted into grain yield per hectare for easier comparison purposes. The weight of the plot yield is first adjusted to a standard moisture level to allow for comparisons of results from the same trials conducted in various locations and years. The standard moisture content adopted for field peas in Ethiopia is 9%.

Number of pod per plant:

Five plants from each plot taken and the overall number of pods is tallied and then divided by the total count of those specific plants.

Number of seed per pod

Each pod contains a certain quantity of seeds. To calculate the number of seeds per pod, the total number of seeds from five plants was tallied and divided by the total number of pods from the same plants. This figure typically falls between 5 and 8 on average for Ethiopian field peas that have recently been released.

Thousand seed weight (gm):

The weight of 1000 seeds adjusted to 9% moisture was used to calculate the grain yield of the entire plot

Field pea Aphid reaction:

Typically, two scoring for breeding materials and multiple scoring for disease management trials are advised. Field pea aphid infestation percentage is calculated using leaves/damaged stem area (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.

DATA ANALYSIS

Using Minitab software version 17, SAS version 9.3 (SAS, 2012), the Tukey test for mean separation (SAS, 2002), and the methods of Gomez and Gomez (1984), analysis of variance and mean separation were carried out.

RESULT AND DISCUSSION

Field performance

The study was carried out in South Eastern Ethiopia during the two production seasons of 2021 and 2022 in Arsi (Kulumsa) and West Arsi (Asassa). The experimental locations were identified as being susceptible to field pea aphid invasion. Five newly released pesticides were purchased from the market, while the Kulumsa Agricultural Research Center's Pulse breeding program provided the recently released Bursa field pea seed.

Physiological and field pea aphid infestation data scoring was done for each plot across the test locations during the trial, along with field preparation, layout, seed sowing, fertilizer applications, weeding, and test insecticide applications. Using the suggested rates, each herbicide was sprayed on each plot for seven to ten days (table 2).

Table 2: Rates of insecticides, water and frequency of application used during the experiment

Insecticides name	Rate of chem.	Rate of water	spray Frequency /days
Dimethoate/Lifothoate 40EC	1li/ha	150 lit/ha	7-10 days
Profit 72EC/profenofos	0.7 -1.4 lit/ha	150 lit/ha	7-10 days
Abema 3% EC	1 lit/ha	150-200Lit	7-10 days
Hamectin 3.6 EC	1 lit/ha	150-200 lit	7-10 days
Helarat 5%EC	325-400 ml	150-400 lit /ha	7-10 days

Analysis of variance/ANOVA

The six investigated treatments varied significantly, according to the combined ANOVA of pea aphid and agronomic factors. As shown in table (3), the analysis of variance revealed a highly significant difference at ($P<0.05$).

Table 3: Summary of ANOVA table for yield and yield traits

SV	Df	Aphid inf.%	height /cm	#pod/plant	#seed/pod	TSW/gm	Yield/kgha-1
Rp	2	4.33	6.36	1.19	0.03	188.02	29.8
Trt	5	108.86**	135.51**	24.91**	5.29**	187.31**	493.45**
2Loc	1	2.78	69.44*	13.44**	3.36*	172.21	41.52
Trt:Loc	5	7.58	13.11	2.51	0.36	185.9**	14.71
MSE	22	8.36	16.54	1.78	0.53	10.78	12.04
Mean		4.9	9.74	1.85	0.2	180.12	35.66
CV%		2.04	2.04	2.04	2.04	2.04	2.04
LSD(<0.05)		3.41	4.8	1.57	0.86	3.41	4.09

Key words: * = significant at $P < 0.05$, ** = significant at $P < 0.01$, ns (non-significant) at $P>0.05$, SV = source of variation, DF = degree freedom, MSE = mean square of error, SW = thousand seed weight, Rp = replication, Trt = treatment, Loc = location, CV = coefficient of variations.

Yield and yield components

The mean yield, measured in kilograms per hectare, varies between 17.11 to 39.02 for each treatment. Similar ranges were found for pods per plant, seeds per

plant, and thousand seed weight (table 4). These were 7-12, 5-7, and 170-188.02, respectively.

The three mean yields among the six treatments are higher than the average, whereas the remaining three mean yields, which are 35.66 kg/ha1, were lower than the average (table 4). However, the outcomes of the unapplied/check treatment are lower than those of the five tested insecticides. As a result, using the right insecticides to combat field pea aphids can boost output. Applying Dimethoate /Lifothoate 40EC, Profit 72EC/profenofos, and Hamectin 3.6 EC for field pea aphid management can raise field pea production from 19.53 kg/acre to 22.09 kg/acre in comparison to the check/unapplied, as shown in the table (4) below.

Table 4: Mean yield and yield attribute for field pea genotype/ EH05027-2 tested over 2 test locations during (2021-2022) cropping season

Treatments	Aphid inf%	height /cm	#pod/plant	#seed/pod	TSW/gm	Yield/kgha-1
Dimethoate/Lifothoate 40EC	10.17d	177a	12a	7a	188.02a	39.02a
Profit 72EC/profenofos	12.67cd	174.33ab	11a	7ab	187.31a	37.11a
Abema 3% EC	18.17ab	168.33bc	8b	6bc	172.21c	21.98c
Hamectin 3.6 EC	12.17cd	173ab	11a	6ab	185.9a	36.64a
Helarat 5%EC	16.33bc	169.17bc	8b	6bc	178.14ab	27.86b
Null application/check	21.5a	163.83c	7b	4c	170.01bc	17.11c
Mean	4.9	9.74	1.85	0.2	180.12	35.66
Cv	2.04	2.04	2.04	2.04	2.04	2.04

Note that: Treatments with the same letter are not significantly different

CONCLUSION AND RECOMMENDATION

The recommended application rate for field aphid management across and/or with equivalent test locations is higher for Dimethoate/Lifothoate40EC, Profit 72EC/profenofos, and Hamectin 3.6EC, respectively, among the evaluated insecticides against field pea aphid in this study. The study's findings so indicate that, in addition to time, the use of plant protection equipment (PPE), and recommended rate considerations, choosing pesticides to combat field pea aphids is a crucial factor. Various important considerations include the development of an integrated pest management (IPM) plan, the use of resistant or tolerant varieties, various agronomic techniques, and the prudent application of pesticides.

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Notes on Author: Based at the Holota Agricultural Research Center of the Ethiopian Institute of Agricultural Research institute, Shumi Regassa is a researcher specializing in plant protection. He has worked as a researcher in plant pathology, agricultural entomology, and seed health.

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