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Evaluation of Insecticides for the Management of Field Pea Aphids at Arsi and Westarsi Zones, South Eastern Ethiopia

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Abstract:
Aphid is one of a major yield-limiting constraints in field pea production in Ethiopia. Lack of appropriate selection and use of insecticides in controlling pea aphids is also another obstacle and lacking in the study area. Incase to fulfill the gap of information practical evaluation of available or registered insecticides was done in Arsi and West Arsi zones during the 2021 and 2022 Production seasons. Seed of field pea with a total of six treatments; five registered insecticides, one check/null application arranged in RCBD design with three replications were used during the experiment. The analyzed evaluation result showed highly significant($p<0.01$) for both field pea aphid infestation % and yield and yield traits. Considering other factors, among the evaluated treatments three insecticide; Dimethoate/ Lifothoate 40EC, Profit72EC/profenofos and Hamectin 3.6 EC respectively are recommended for the test/equivalent areas on the behalf of yield and yield component increment. Hence, I recommend that appropriate selection and well-advised use of insecticides can manage field pea aphids including other non-chemical control mechanisms.

Keywords: Evaluation, Insecticides, Field pea, Field pea aphids, management, treatments.

INTRODUCTION

Field pea (Pisum *sativum L.*); is one of the most important pulse crops, which is produced for a long time in high and mid altitude areas of Ethiopia (1800-3000masl) by small holder farmers mainly under rain fed condition (Kindie *et al.*,2019). In Ethiopia, pea weevil, *Bronchus pisum L.*, pea aphid, *Acrythosiphon pisum (Harris), African* boll worm, *Helicoverpa armigera (Huber)* and adzuki bean beetle, Callosobruchus *chinensis L.* are reported to be the major insect pests of field pea (Ali *et al.*,2000).

Pea aphid, *Acrythosiphon pisum* directly weakens the plant by sucking its sap and have piercing sucking mouth parts and may vector viral diseases (Enders and Kandel,2021). Aphids feeding on peas in the early pod stage can result in lower yields due to less seed formation and smaller seed size. The economic threshold for pea aphids on the field pea cultivar is two to three aphids per plant tip when 50-75% of the plants are flowering (Jarso *et al.*,2009).

Lack of appropriate insecticides selection and rate determination against pea aphids is also another constraint and most absent in the study areas. Hence, to fulfill the gap of information using recommended insecticides rate for management of pea aphid practical evaluation on available or registered insecticides were done with the following objective.

Objective

Demonstration and recommending effectiveness of selected insecticide for pea aphid management under field condition.

MATERIALS AND METHODS

Description of the Study Area

The study was conducted at Kulumsa Agricultural research center substations (Kulumsa and Asassa) in 2021 and 2022 during the rainy season. The representative agro ecology of Kulumsa and Asassa characterized as water logged vertisols and terminal drought prone respectively (Birhan,2011) .

Table1: The experimental sites and their agro ecological descriptions

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	6

Experimental Materials and Testing Procedures

Five Registered insecticides and field pea seed (Bursa / EH05027-2) were used during the experiment. Six (6) treatments with one check/null application and five tested insecticides i.e., Lifothoate/Dimethoate, Abema 3% EC, Profit/ profenofos, Helarat 5 % EC, Hamectin 3.6% and null/check were arranged in RCBD design with three replications. A plot size of 3.2 m width and 4m length with 0.2 m inter row and 5cm between plants spacing was used and the spacing between plots and replications were 1m and 1.5m wide respectively. Recommended seed rate, fertilizer rates (121kg NPS/ $ha1^{-}$) and insecticides rates were applied as per as that of the particular area. Each insecticides were applied when the pest emerges to damaging level using knapsack sprayer with the rates as indicated in the 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

Data Collection

Stand count both at early growth stage and also during harvesting, number of pods per plant, seeds per pods, insect pest infestation %, Yield kg/ha and Thousand seed weight/TSW were collected.

Grain Yield:

In field pea experiment, yield was measured from the whole plot (gram per plot) and this is later converted into grain yield per ha (kg ha-1) to ease comparisons. First the weight of the plot yield

is adjusted to standard moisture content so that the results from the same trials in different locations and years can be compared. The standard moisture content used for field pea in Ethiopia is 9%.

Number of Pod Per Plant:
It is the number of effective pods on a plant. To determine the average number of pods per plant, five plants are randomly taken from each plot and the total number of pods were counted and divided by the total number of the same plants.

Number of Seed Per Pod:
It is the number of seed in each pod. Total number of seeds of five plants were counted and divided by the total number of pods of same plants to determine number of seeds per pod. In recent released field pea in Ethiopia, this number usually ranges between 5 and 8 on averages.

Thousand Seed Weight (gm):
It was determined from the grain yield of the whole plot as the weight of 1000 seeds adjusted to 9% moisture.

Field Pea Aphid Reaction:
Field pea aphid's infestation % recorded based on the percentage of infected leaves/ stem area damaged (Perring *et.al.*,2015). Foliar diseases are best scored when most susceptible entry in the trial receives about 75% infection by the disease based on foliage coverage. Most of the time, two scoring for breeding materials and several scoring for disease management trials are recommended (Jarso *et al.*,2009).

Data Analysis
Analysis of variance and mean separation were performed following the procedures of Gomez and Gomez (1984) and using SAS version 9.3 (SAS, 2012) and Tukey test for mean separation (SAS, 2002) and Minitab software version 17.

RESULT AND DISCUSSION

Field Performance
The study was conducted for two production seasons (2021 and 2022) at Arsi (Kulumsa) and West Arsi (Asassa), South Eastern Ethiopia. The experimental sites suggested as prone for the field pea aphid infestation. Released five insecticides were bought from market and the recent released Field pea seed (Bursa) was obtained from Kulumsa Agricultural Research Center, Pulse breeding program. During the experiment field preparation, layout, seed sowing, fertilizer applications, weeding, test insecticides applications and physiological and field pea aphid infestation data scoring were undertaken for each plot across the test locations. Each pesticides were sprayed between 7-10 days on each plot using the recommended rates(table 2).

Analysis of Variance/ANOVA
Combined ANOVA of pea aphid and agronomic parameters showed significant variation among evaluated six treatments. The analysis of variance showed highly significance difference at ($P<0.01$) as illustrated in table (1) below.

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

SV	Df	Aphid inf%	height /cm	#pod/plant	#seed/pod	TSW/gm	Yield/kgha-1
Rp	2.00	4.33	6.36	1.00	1.00	4.14	29.80
Trt	5.00	108.86**	135.51**	25**	5 **	142.23**	43.34**
Loc	1.00	2.78	69.44*	13**	3*	1.29	41.52
Trt: Loc	5.00	7.58	13.11	3.00	1.00	7.58	14.71***
MSE		8.36	16.54	2.00	0.53	14.00	12.04
CV%		19.06	2.38	13.00	11.00	1.47	11.58
LSD(<0.05)		3.41	4.80	2.00	1.00	6.37	4.09

Key 'SV=Source of variation, Df=Degree freedom, MSE=Mean square of Error, TSW=Thousand seed weight, RP= replication, Trt=treatment, Loc= Location, CV= Coefficient of variations, *= Significant at P < 0.05 and **= significant at P< 0.01, ns(non-significant) at P>0.05.

Yield and Yield Components

Mean of yield obtained in kilogram per hectare ranges from 17.11 to 39.02 among treatments. Similarly pods per plants, seeds per plants, thousand seed weight ranged from 7-12,5-7,170-188.02 respectively (table). Among the six treatments the three mean yield exceeds the average mean and the other left three mean yield result showed below the average mean i.e. ,35.66kg/ha1-(table). On the other hand, the un applied/check treatment yield results below the five tested insecticides. Therefore, application of appropriate insecticides against field pea aphid can increase productivity.

As indicated in the table () below, application of Dimethoate/Lifothoate 40EC, Profit 72EC/ profenofos and Hamectin 3.6 EC for field pea aphid management can increase field pea yield from 19.53kg/acre upto 22.09 kg/acre as compared to the check/un applied, i.e 17.11kg/acre.

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

Treatments	Aphid infn%	height /cm	#pod/plant	#seed/pod	TSW/gm	Yield/kgha-1
Dimethoate/Lifothoate 40EC	10.17d	177a	12.33a	7.33a	188.02a	39.02a
Profit 72EC/profenofos	12.67cd	174.33ab	11.17a	7.16ab	187.31a	37.11a
Abema 3% EC	18.17ab	168.33bc	8.83b	6.00bc	172.21c	21.98c
Hamectin 3.6 EC	12.17cd	173ab	11.50a	6.83ab	185.9a	36.64a
Helarat 5%EC	16.33bc	169.17bc	8.83b	6,00bc	178.14ab	27.86b
Null application/check	21.5a	163.83c	7.00b	4.83c	170.01bc	17.11c
MSE	8.36	16.54	2.00	0.53	14.00	12.04
CV%	19.06	2.38	13.00	11.00	1.47	11.58
LSD(<0.05)	3.41	4.80	2.00	1.00	6.37	4.09

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

CONCLUSION AND RECOMMENDATION

In the present study; among evaluated insecticides against field pea aphid, I recommend that Dimethoate/Lifothoate 40EC, Profit 72EC/ profenofos and Hamectin 3.6 EC applied field pea yields higher respectively with the recommended application rate(table) for field aphid management across and/or with equivalent test locations. Therefore, the study result signifies selections of insecticides against field pea aphids is an important aspect in addition to time, use of plant protections Equipment/ PPE and recommended rate considerations. Developing Integrated pest management (IPM) strategy, use of resistance/tolerant varieties, other agronomic practices and wise use of pesticides are also crucial points to be taken into account.

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