Original Research Article

"Efficacyofselectedchemicalinsecticidesagainstshootandfruitborer [*Eariasvittella*(Fabricius)]onokra[*Abelmoschusesculentus* (L.)Moench.]"

ABSTRACT

A field trail was conducted at Central Research Farm(CRF),Naini, Prayagraj during *Kharif* from July to November 2021 in Randomized Block Design (RBD) with three replications.Eighttreatmentswereevaluatedagainst*Eariasvittellai.e.*,Flubendiamide@480% SC,Indoxacarb@14.5%SC,Spinosad@45%SC,Chlorantraniliprole18.5%EC,Neemoil@2%, Emamectinbenzoate@5% SG, Cypermethrin@ 25% ECand untreatedControl.Results revealed that, among the different treatments lowest per cent infestation of okra shootand fruitborer was recorded in Chlorantraniliprole 18.5% EC(8.02%,5.15%). Emamectinbenzoate5%SG (9.26%,6.75%) was found to be the next best treatment followed byFlubendiamide@480%SC(10.29%,7.48%),Cypermethrin@25%EC(11.41%,9.24),Indoxacarb@14.5% SC (12.32%,10.00%), Spinosad @ 45% SC (13.13%, 11.53%) whereas Neem oil @ 2% (14.25%,12.70)wasfoundtobeleasteffectiveagainstthispest.Amongthetreatments,Chlorantraniliprole 18.5% EC gave the highestmarketing yield and cost benefit ratio (188 q/ha and 1:8.41)followedbyEmamectinbenzoate5%SG(176q/ha and 1:8.41),Flubendiamide@ 480%SC(152q/ha and1:7.18),Cypermethrin@25% EC(135q/ha and1:6.22),Indoxacarb@14.5%SC(121.2q/ha and1:5.74),Spinosad@45%SC(114.6q/ha and 1:5.29)andNeemoil@2%(102.4q/ha and 1:4.80)ascomparedtocontrolplot(87.2q/ha and 1:4.2).

Keywords:*Abelmoschusesculentas*,Cost-Benefitratio, Chlorantraniliprole,Efficacy,ShootandFruitborer,*Eariasvittella*.

INTRODUCTION

Okra (*Abelmoschus esculentus* L.) is known by various local names in different parts of theworld and is often known as 'Lady's Finger'. Okra is a commercial vegetable crop belongsto family Malvaceae. It originates from Ethiopia and is widely spread all over tropical,subtropicalandwarmtemperateregions oftheworld(**Singh*etal*., 2014).**

Thecompositionofokrapodsper100gedibleportioniswater88.6g,energy144.00kJ(36kcal),protein2.10g,carbohydrate8.20g,fat0.20g,fiber1.70g,Ca84.00mg,P 90.00mg,Fe1.20mg,βcarotene185.00μg,riboflavin0.08mg,thiamin0.04mg,niacin 0.60mg, ascorbic acid 47.00mg. Protein, carbohydrate and vitamin C contains of okra(**Singh *et al*.,2014).** Okra seed oil is reported to contain Linoleic acid which is one of theessentialfattyacid(**NaiduandKumar2019).**
Okra is an important vegetable crop providing a good source of income to farmers. Indiarankedfirstinokraproductioninworld**(Devi*etal*.,2015).**Worldproductionofokraasfreshfruitvegetable isestimated at 6million tones/year. GloballyIndia ranks firstin okraproduction (72% of the total world production) having area of 533 hectares with an annualproduction of 6346 million tons and productivity of 11.9million tons/ha **(Gautam *et al*.,2015).**Major okra producing Indian states are UttarPradesh,Bihar, Odisha, WestBengalAndhraPradesh,KarnatakaandAssamwithaverageproductionofokrainIndiaisaboutto 57.84 lakh tons and productivity 11.6 tons/ha during 2010-11**(Devi *et al*., 2015).** UttarPradeshhasanareaof(22.93ha),production(307.29tones),andproductivity(13.40metrictonnes/ha)ofokra.

The adult female of okra shoot and fruit borer, *Eariasvittella*lays eggs individually onleaves, floral buds and on tender fruits. Small brown caterpillars bore into the top shoot andfeed inside the shoot before fruit formation. The shoot wilt and dry as a result the damageplantdevelopedbranches.Lateroncaterpillarsboreintothefruitsandfeedinsideasaresultthe infested plant bears smaller and deformed pods. A larva attacks a number of stems andpodsoneafteranother.Damagedplanttissuesserveasentrancefordiseasecausingmicroorganismssuchasfungi**.(Rahman*etal*.,2013).**

It is reported that about 69% losses in marketable yield due to attack of this insect pest. Thedamage due to fruit borer accounts for nearly 22.5% in Uttar Pradesh, 25.93% to 40.91%inMadhya Pradesh 45% in Karnataka which affects the nutritional quality and makes itunsuitableforhuman consumption**(Pacholeetal.,2017).**

OBJECTIVES

1. **Tostudytheefficacyofselectedchemicalinsecticidesandneemoilagainstshootandfruitborer*Eariasvittella*(Fabricius)onokra.**
2. **Tocalculatecostbenefitratio.**

MATERIALSANDMETHODS

TheexperimentwasconductedatSamHigginbottomUniversityofAgriculture,TechnologyandSciences(SHUATS),Prayagraj(U.P)duringthe*Kharif*seasonof2021witha recommended package of practices excluding plant protection. TheOkra seedlings of variety 'Arkaanamika' were seeds sowing at 45cm x 30cm spacing.TheexperimentwaslaiddowninRandomizedBockDesign(RBD)witheighttreatmentsreplicatedthricewitheachplotsizeof2mX2mandproperirrigationwasprovided.Thetreatments comprising of, Flubendiamide480% SC, Indoxocarb 14.5% SC, Spinosad 45% SC, Chlorantraniliprole18.5%SC,Neemoil2%, Emamectin benzoate5SG and Cypermethrin25%EC were applied two times spraying using knapsack sprayer in 15 days ofinterval. From eachplotfiveplantswererandomly selectedandlabelledforrecordingobservations.Theinfestation of pest on shoot was initiated, the observations on total number of shoots and numberofinfestedshootsandfruitinfestationoffiveobservationalplantsfromeachtreatmentreplication wise were recorded at 3rd, 7th and 14th days after imposing treatments. The datarecordedinthedifferenttreatmentsweresubjectedtostatisticalanalysisaftersuitabletransformation by following standard procedures of RBD experiment. After the last picking, totalof all pickings of individual plots produce were calculated to work out the yield of the treatments.Yieldofhealthy fruits was convertedinto quintalperhectare.

The observations on the per cent infestation were recorded visually per plantfromfiverandomlyselectedandtaggedplantsineachplot.Theinsecticidesweresprayedatrecommended doses when larval population reaches its ETL level. whichwasfurtherconverted into per plant population and subsequent observation was recorded at 3rd, 7th and 14thdaysafter sprayingon same plants.

The desired concentration of insecticidal spray solution of desired concentration for eachtreatment was freshly prepared each and every time at the site of experiment, just before thestart of spraying operations. The quantity of spray materials required for crop was graduallyincreasedas thecropadvancedinage.

The healthy marketable yield obtained from different treatments was collected separatelyand weighted. The cost of insecticides used in this experiment was recorded during *Kharif* season.The cost of botanicals used was obtained from nearby market. The total cost of plant protectionconsisted of cost of treatment, sprayer, rent andlabour charges for the spray. There are twosprays throughout the research period and the overall plant protection expenses was calculated.Total income was realized by multiplying the total yield per hectare by the prevailing marketprice, while the net benefit is obtained by subtracting the total cost of plant protection from thetotal income. Benefit over the control for each sprayed treatment was obtained by subtracting theincomeof thecontrol treatmentfromthatofeachsprayed treatment.

Cost benefits of treatment

Costeffectivenessofeachtreatmentassessedbasedonnetreturns.Netreturnofeachtreatmentshould be worked out by deducting total cost of the treatment from gross returns. Total cost ofproductionincludesbothcultivationaswellasplantprotectioncharges.

RESULTSANDDISCUSSION

Okra (*Abelmoschus esculentus* L.) is known by various local names in different parts of theworld and is often known as 'Lady's Finger'. Okra is a commercial vegetable crop belongs tofamilyMalvaceae.Okracropsuffersheavydamagebyanumberofinsectpestviz.,thejassid,*Amrescabiguttullabigutulla*(Ishida),aphid,*Aphisgossypii*(Glover),Okrafruitborers,*Eariasspp*., whitefly, *Bemisiatabaci*(Genn.). Among these pests shoot and fruit borer *Eariasvitella*(Fab.)is themostdestructivepest of okraas thelarvabores in to youngshoots andfruits.
Theadultfemaleofokrashootandfruitborer,*Eariasvittella*layseggsindividuallyonleaves,floral buds and on tender fruits. Small brown caterpillars bore into the top shoot and feedsinside the shoot before fruit formation. The shoot wilt and dry as a result the damaged plantdeveloped branches. Later caterpillars bore into the fruits and feed inside as a result theinfested plant bears smaller and deformed pods. A larva attacks a number of stems and podsoneafteranother.Damagedplanttissuesserveasentrancefordiseasecausingmicroorganismssuch as fungi**.** It is reported that about 69% losses in marketable yield due to attack of thisinsect pest. A number of chemical insecticides have been found effective against this pest indifferentpartsofthecountry.

Thefirst spray was given 30 days of transplanting. The percent infestation of shoot and fruit borer in okra after first spray (shoot) revealed that all the chemical treatments were significantly superior over control.Among all the treatments lowest population of okra shoot and fruit borer was recorded inChlorantraniliprole 18.5% EC (6.585%). Emamectin benzoate 5% SG (8.005%) was found tobethenextbesttreatmentfollowedbyFlubendiamide@480%SC(8.885%),Cypermethrin@25%EC(10.325%),Indoxacarb@14.5%SC(11.160%),Spinosad@45%SC(12.330%)andNeemoil@2%(13.475%)wasfoundtobeleasteffectiveagainstthis pest. (Table 1)

The second spray was applied after 15 days of first spray and data on percent fruit damage was recorded. The pooled data for second spray shows minimum percent fruit damage inChlorantraniliprole18.5%EC(5.15%),Emamectinbenzoate5%SG(6.75%)andFlubendiamide @ 480% SC (7.48%) recorded lowest population of *Eariasvittella*which wassignificantly superior over control followed by Cypermethrin @ 25% EC (9.24%), Indoxacarb@ 14.5% SC (10%), Spinosad @ 45% SC (11.53%) and Neem oil @ 2%(12.70%) showed theleasteffectivenessamong alltreatments. (Table1)

Between the various treatments, there were notable yields. Chlorantraniliprole 18.5% EC (188 q/ha) produced the maximum yield. **Reddy *et al*., (2019)** first supported these findings, and then **Dash *et al*., (2019)** supported them for Emamectin benzoate 5% SG (176 q/ha).After Cypermethrin @ 25% EC (135 q/ha), which is consistent with the same results of **Padwal and Kumar (2013),** the next-best therapy was Flubendiamide @ 480% SC (152 q/ha). These findings were corroborated by **Deepak *et al*., (2017).**According to studies by **Patra *et al*.,(2007)** was similar finding to the Indoxacarb @ 14.5% SC (121.2 q/ha). **Pachole*et al*.,(2017)** validated the comparable conclusion that Spinosad @ 45% SC (114.6 q/ha) was effective, and the lowest yield was Neem oil @ 2% (102.4 q/ha), which is in line with findings by **Archunan and Pazhanisamy (2020)** and the control plot (92.6 q/ha).(Table 1)

An intriguing outcome was obtained after calculating the cost-benefit ratio. The most effective and affordable treatment of all those examined was chlorantraniliprole 18.5% EC (1:8.59). **Shrivastava *et al.*, (2017)** followed by Emamectin benzoate5% SG (1:8.41), which are in agreement with **Birah and Raghuraman's (2011)** findings, made comparable findingsFollowing Flubendiamide @ 480% SC (1:7.18), which was obtained in a manner similar to that of **Deepak *et al.*, (2017)**, Cypermethrin @ 25% EC (1:6.22), which was obtained in a manner similar to that of **Javed*et al.*, (2018).**The following treatment, Indoxacarb @ 14.5% SC (1:5.74), was similar to the results of **Bajad*et al.*, (2014).** Spinosad @ 45% SC (1:5.29) was the following course of treatment, which is consistent with **Sarkar *et al.*,(2015)**Additionally, Neem oil at 2% showed the lowest benefit-cost ratio (1:4.80), which is similar to the findings from **Subbireddy*et al.*, (2018)**and the control plot (1:4.2).(Table 1)

Table no.1 To evaluate the selected chemical insecticides and neem oil on percent infestation of shoot and fruit borer, *E. vittella* of okra

S.No.	Treatments	% Infestation of okra shoot and fruit borer							Yield (q/ha)	C:B ratio
		First spray				Second spray				
		1DBS	3DAS	7DAS	14DAS	3DAS	7DAS	14DAS		
T_1	Flubendiamide@480%SC	14.63	10.58^{a}	06.75^{a}	09.16^{a}	07.070^{a}	04.29^{a}	09.38^{a}	152	**1:7.18**
T_2	Indoxacarb@14.5%SC	15.25	12.31^{b}	09.48^{b}	12.34^{b}	09.24^{b}	07.40^{b}	11.01^{b}	121.2	**1:5.74**
T_3	Spinosad@45%SC	15.39	13.24^{c}	10.39^{bc}	13.50^{bc}	10.82^{bs}	08.96^{bc}	12.82^{bc}	114.6	**1:5.29**
T_4	Chlorantraniliprole18.5% EC	13.23	08.13^{d}	03.37^{c}	07.33^{bc}	04.35^{bcd}	02.68^{bcd}	06.25^{bcd}	188	**1:8.59**
T_5	Neemoil@2%	15.58	14.07^{e}	12.63^{cd}	14.69^{cd}	11.49^{cd}	09.90^{bcd}	14.69^{bcd}	102.4	**1:4.80**
T_6	Emamectinbenzoate@5% SG	14.47	09.09^{e}	05.18^{de}	08.30^{de}	06.67^{de}	03.57^{cd}	08.46^{cde}	176	**1:8.41**
T_7	Cypermethrin@25%EC	14.86	11.25^{f}	08.37^{ef}	11.15^{de}	08.05^{de}	06.84^{d}	10.89^{de}	135	**1:6.22**
T_8	Control	15.84	17.03^{g}	19.77^{f}	20.97^{e}	22.89^{e}	24.12^{d}	26.96^{e}	87.2	**1:4.2**
	F-test	NS	S	S	S	S	S	S		
	S.Ed(±)	00.91	00.33	01.13	01.42	01.55	02.43	01.84		
	C.D.(P = 0.5)	-	00.72	02.42	03.05	03.32	05.21	03.45		

CONCLUSION

From the analysis of the present findings, it can be concluded that Chlorantraniliprole 18.5%ECismoreeffectiveincontrollingpopulationofokrashootandfruitborer and also give the highest cost benefit ratio and marketable yield i.e. (135q/ha and 1:6.22),followedby Emamectin benzoate 5% SG was found to be the next best treatment followed Flubendiamide@480%SC,Cypermethrin@25%EC, Indoxacarb @ 14.5% SC, Spinosad @ 45% SCand Neem oil @ 2% was found to be least effective against this pest.Futurestudymaybe conductedtovalidatethefindings.Botanicalsare the part of integrated pest management in order to avoid indiscriminate use of pesticidescausingpollutionintheenvironment andnotmuch harmfultobeneficialinsects.

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