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RESEARCH ARTICLE

COMPARATIVE EFFICACY OF IMIDACLOPRID WITH COMBINATION OF NEEM PRODUCTS AGAINST MAIZE STEM BORER, *CHILO PARTELLUS* (SWINHOE)

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Abstract:A field investigation was carried out in *Kharif*season of 2022-2023 at Cental Research Farm (CRF), Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India. The experiment was laid in Randomized Block Design with eight treatments each replicated thrice *viz*.,Neem oil 2% 20ml/lit, Azadirachtin 0.3% + Imidacloprid17.8% SL 1000ppm/ha + 5ml/lit, Neem oil 2% + Imidacloprid 17.8%SL 20ml/lit + 5ml, Imidacloprid 17.8% SL 5ml/lit, Azadirectin 0.3% 1000ppm/ha, Emamectin benzoate 5 % SC 200gm/ha, NSKE 5% 50ml/litare the treatments used in this experiment.Result revealed that among the botanicals and insecticides lowest percent infestation of maize stem borer was recorded in Azadirachtin 0.3% + Imidacloprid 17.8% SL (7.23%), Neem oil 2% + Imidacloprid 17.8% SL (9.75%) was found to be next best treatment followed by Imidacloprid 17.8% SL (10.75%),Emamectin benzoate 5% SC (11.78%), were found to be effective against Maize stem borer (*Chilopartellus*),nextbettertreatmentinordertosuperioritywereAzadirectin 0.3% (12.76%), Neem oil 2% (13.46%), NSKE 5% (14.98%) and control (26.25%).The highest yield and cost benefit ratio was recorded withAzadirachtin 0.3% + Imidacloprid 17.8% SL (42.72 q/ha),(1:1.70), followed by Neem oil 2% + Imidacloprid 17.8% SL (40.80 q/ha),(1:1.60), Imidacloprid 17.8% SL (37.44 q/ha),(1:1.46)**,** Emamectin benzoate 5% SC (34.79q/ha),(1:1.39), Azadirectin 0.3% (31.68 q/ha),(1:1.28), Neem oil 2% (28.54 q/ha),(1:1.32), NSKE 5% (26.49 q/ha),(1:1.11) and control (23.57 q/ha), (1:0.9).

Keywords*:* Botanicals, *Chilopartellus*, chemicals, Efficacy, Maize

INTRODUCTION

Maize (*Zea mays* L.) is the third major and most important cereal crop of the world after wheat and rice and is grown in tropical, subtropical and temperate regions of the world (Hussain *et al*., 2016). It has been referred as the "Queen of cereals" due to its highest yield potential among all the cereals. Currently, nearly 1147.7 million MT of maize is being produced together by over 170 countries from anareaof193.7millionhawithaverageproductivityof5.7 5t/ha.

India is thefifth largest producer of Maizein the world contributing 3 percent of the global production. At present, out of the total maize produced, 55% is used for food purpose, about 14% for livestock, 18% for poultry feed, 12% for starch and one per cent as seed. (Kumar and Kumar 2017). In India, the average area under maize cultivation is 9.43million hectares with an average production and productivity of 22.23 million tonnes and 2.5 tones per hectare respectively. It is also grown in Andhra Pradesh (20.9%), Maharashtra (9.1%), Karnataka (16.5%), Rajasthan (9.9%), Bihar (8.9%), Uttar Pradesh (6.1%), Madhya Pradesh (5.7%). Maize is the principal cereal crop of Sikkim occupying nearly 37percent of the area under cultivation with annual production of 66,192 tons (Rameash*et al*., 2012).

Among the various insect pests, maize stem borer, *Chilopartellus*is the most dominant contributing 90-95 per cent of the total damage in *Kharif*season (Jalali and Singh, 2002). Maize is most vulnerable to *Chilopartellus*(Lepidoptera: Crambidae) which causes severe losses to it (Songa *et al*., 2001). A loss of 24-75 per cent has been reported by the attack of this pest alone. This pest has been reported to be the most destructive pest of maize at its early growth stage worldwide (Sharma and Sharma 1987, Duale and Nwanze 1999).

Several approaches have been adopted to management insect pest of maize crop, among these methods of pest control, chemical control have largely been used for the control of insect pest. There is a need to use the chemicals and botanicals in

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combination against *Chilopartellus* such as neonicotinoids, organophosphates, phenyl pyrazoles and botanicals etc. groups of insecticides. Maize stem borer progeny build up resistance against the normally sprayed organophosphate groups of insecticides. If the maize stem borer population surpassed through action threshold or natural enemies unable to cope with rapid intensify larval population, the different insecticides treatments are mandatory for effective control.

MATERIALS AND METHODS

The experiment was conducted at the experimental research plot of the Department of Entomology, Central Research Farm, Sam Higginbottom University of Agriculture Technology And Sciences, during the *kharif* season of 2022, in a Randomized Block Design with eight treatments replicated thrice using variety 'Shivam' seeds @20-25 kg/ha in a plot size of 2m×1m at a spacing of 60cm×20cm with a recommended package of practices excluding plant protection. The soil of the experimental site was well drained and medium high. Research farm situated at 25^0 27" North Latitude 80^0 05" East Longitudes and at an Altitude of 98 meter above sea level the maximum temperature reaches upto 42^0C in summer and crops down to 4^0C in winter. The treatments used in experiment are *viz.* Neem oil 2% (20ml/lit), Azadirachtin 0.3% + Imidacloprid 17.8% SL (1000ppm/ha + 5ml/lit), Neem oil 2% + Imidacloprid 17.8% SL (20ml/lit + 5ml), Imidacloprid 17.8% SL (5ml/lit), Azadirectin 0.3% (1000ppm/ha), Emamectin benzoate 5 % SC (200gm/ha), NSKE 5% (50ml/lit) and control.

Observations on larval population of stem borer per plant before and after treatment application. Pre-count larval population was taken one day before spraying on five randomly selected plants in each plot. Post count was taken 3rd, 7th, 14th days after treatment application for two sprayings. The insecticides sprayed at recommended doses when *Chiloparetellus* reaches its ETL level of 10%. Dead heart formation by *Chilopartellus* was recordedat25DAS, 40 DAS, 55 DAS before and after spraying.

The healthy marketable yield obtained from different treatments were collected separately and 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 protection consisted of cost of the treatments, sprayer, rent and labour charges for the spray. There are two sprays throughout the research period and the overall plant protection expenses were calculated. Total income was obtained by multiplying the total yield per hectare by the prevailing market price, while the net benefit is obtained by subtracting the total cost of plant protection from the total income. Benefit over the control for each sprayed treatment was obtained by subtracting the income of the control treatment from that of each sprayed treatment.

RESULTS AND DISCUSSION

The findings of the current investigation demonstrated that after insecticidal applications against maize stem borer *Chiloparetellus* were found significantly superior over control plot. Azadirectin 0.3% + Imidacloprid 17.8 SL (14.81%) was found significantly superior in percent infestation of maize stem borer followed by Neem oil @2% + Imidacloprid 1.7.8% SL (10.77%), Imidacloprid 17.8% SL (11.78%), Emamectin benzoate 5% SC (12.79%), Azadirectin 0.3% (13.80%), Neem oil @2% (14.81%), NSKE 5% (15.82%) as compared to control (24.91%) at 3, 10 and 15 days after spray as shown in (Table 1).

As in second spray among the insecticides treated against maize stem borer was found significantly superior on percent of infestationin Azadirectin + Imidacloprid (6.39%) followed by Neem oil @2% + Imidacloprid 1.7.8% SL (8.74%), Imidacloprid 17.8% SL (9.73%), Emamectin benzoate 5% SC (10.77%), Azadirectin 0.3% (11.73%), Neem oil @2% (12.12%), NSKE 5% (14.14%) as compared to control (27.60%) at 3rd, 10th and 15th days after spray as shown in (Table 1).

All insecticides were significantly superior over control in reducing the infestation percent of Stem borer recorded at 3rd,7th and 14th DAS after insecticidal applications. Among all these treatments Azadirectin 0.3% + Imidacloprid 17.8 SL(7.23%) was found significantly superior followed by Neem oil @2% + Imidacloprid 1.7.8% SL (9.75%). Imidacloprid17.8%SL(10.75%),Emamectinbenzoate 5%SC(11.78%),Azadirectin0.3%(12.765%),Neemoil @ 2%(13.43%),NSKE5%(14.98%)ascomparedtocont rol (18.20%)at3,10 and15daysafter spray.

From the above results it is discussed that the highest yeild, percent infestation, and b:c ratio among the insecticides treated are Azadirachtin 0.3% + Imidacloprid 17.8% SL (42.72 q/ha), (7.23%),(1:1.70), followed by Neem oil @2% + Imidacloprid 17.8% SL (40.80 q/ha), (9.75%), (1:1.60), Imidacloprid 17.8% SL (37.44 q/ha), (10.75%), (1:1.46), Emamectin benzoate 5% SC (34.79q/ha), (11.78%), (1:1.39), Azadirectin 0.3% (31.68 q/ha), (12.76%),(1:1.28), Neem oil @2% (28.54 q/ha), (14.98%), (1:1.32) and NSKE 5% (26.49 q/ha),(1:1.11).

Same result of Azadirectin 0.3% + Imidacloprid 17.8 SL (7.23%) was reported by Amjad*et al.*, (2001),Neupane *et al.*, (2016).The Neem oil 2% + Imidacloprid 1.7.8% SL (9.75%) was found to be the next effective treatment and its results were supported by Neupane *et al.*, (2016).In the present findings reported Imidacloprid 17.8% SL (10.75%)

infestation and it is supported by Reddy and Walker (2021), Aher *et al.*, (2022).

The yield and benefit cost ratio with the greatest value was found in Azadirectin 0.3%+ Imidacloprid 17.8 SL (42.72 q/haand1:1.70), findings were validated and followed by Neem oil 2% + Imidacloprid1.7.8% SL (40.80 q/ha and 1:1.60). and Imidacloprid 17.8% SL(37.44 q/ha and 1:1.46)the observations was supported by Aher *et al.*, (2022).

Table 1. Efficacy of imidacloprid with combination of neem products against maize stem borer, *Chilopartellus* (Swinhoe).

S.No.	Treatments	Mean percent infestation (%)							Overallmean %	Yield(q/ha)	C:B ratio
		Firstspray				Secondspray					
		1DBS	3DAS	7DAS	14DAS	3DAS	7DAS	14DAS			
T_1	Neem oil 2%	20.02	18.18^{abc}	11.11^{bc}	15.15^{b}	18.18^{b}	14.14^{b}	10.10^{bc}	13.46^{bc}	34.79	1:1.15
T_2	Neem oil 2% + Imidacloprid 1.7.8% SL	18.18	13.13^{de}	9.09^{bca}	10.10^{bc}	14.14^{bc}	12.08^{bc}	8.08c	9.75^{de}	40.80	1:1.60
T_3	Azadirectin 0.3%+Imidacloprid 17.8 % SL	22.22	11.11^{e}	6.06^{c}	7.07^{c}	9.77^{c}	8.08^{c}	7.07^{c}	7.23^{e}	42.72	1:1.70
T_4	Imidacloprid 17.8% SL	17.17	14.14^{cde}	9.09^{bc}	12.12^{bc}	15.15^{bc}	12.12^{bc}	9.09^{bc}	10.75^{cd}	37.44	1:1.46
T_5	Azadirectin 0.3%	19.119	16.16^{bcd}	11.11^{bc}	14.14^{bc}	17.17^{b}	14.14^{b}	10.10^{bc}	12.76^{bc}	31.68	1:1.28
T_6	Emamectin benzoate5% SG	18.18	16.16^{bcd}	10.10^{bc}	12.12^{bc}	16.16^{b}	13.13^{b}	10.10^{bc}	11.78^{cd}	28.54	1:1.39
T_7	NSKE5%	23.23	20.20^{ab}	13.13^{b}	15.15^{b}	20.20^{b}	16.16^{b}	13.13^{b}	14.98^{b}	26.49	1:1.07
T_0	Control	17.17	22.22^{a}	24.24^{a}	28.28^{a}	29.09^{a}	28.28^{a}	26.26^{a}	26.25^{a}	23.57	1:0.9
	F-test	NS	S	S	S	S	S	S	S		
	S.Ed(±)		1.370	1.713	1.74	1.61	1.82	1.96			
	C.D.(P = 0.05%)		3.90	5.09	5.29	4.9	4.5	4.75	0.47		

DAS=Day after spray
DBS=Day before spray

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