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Impact of Crop Insecticides on Rice Yield and Income of Farmers in Mandya District of Karnataka

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Abstract **– The pest incidence and its damage to the agricultural crops is causing huge yield loss to the farmers, where in, the damage was to the extent of per cent in severe cases and the farmers lost whole crop! The degree of damage varied depending upon the agro-climatic conditions, adaphic factors, genetic make-up of the crop varieties and its population multiplication. One such pest in case of rice being yellow stem borer (Scipophaga incertula) and leaf folder (Cnaphlocrosis medinalis) in southern dry zone of Karnataka causing heavy crop damage. To manage the this pest the scientists of University of Agricultural sciences, Bengaluru (UASB), through its Zonal Agricultural Research Station, VC Farm Mandya have released and recommended the Flubendiamide insecticide (FAME) during 2010 to the farmers to adopt and to manage the pest. Since then, many Rice growers had adopted the variety. After lapse of 6 years of its release, the UASB was interested in to find out the performance of the technology on the farmers' field and their opinion in gaining economic returns when compared to other insecticides. From this backdrop the study was conducted during 2016 in Mandya district, where there is large area under the rice crop. The district has 7 taluks, from each taluk 2 rice growing villages were selected. From 14 villages, 210 respondents who have adopted both Flubendiamide and Chlorpyriphos insecticides (Before) were selected randomly and interviewed and information was sought. 'Before and After' research design was adopted to compare the results. The findings of the study reveal that, the Flubediamide effectively controlled the pest both at rice nursery and main field when compared to Cloropyriphos indicating more effectiveness quotient (0.94). The respondents obtained relatively more additional yield from the Flubendiamide than that of Cloropyriphos. However the difference was non-significant. In case of additional net income obtained, the Cloropyriphos had given more than that of Flubendiamide because of its low market price.**

Keywords **– Insecticides, Grain Yield, Net Income, Rice Pest, Flubendiamide, Diffusion.**

I. INTRODUCTION

The University of Agricultural Sciences, Bengaluru (UASB) is one of the premiere Universities of India, engaged in evolving location specific, farmer need based technologies through its Zonal Agricultural Research Stations (ZARS) spread over in Southern Karnataka. One such ZARS (Southern dry zone-6) is located in VC Farm, Campus Mandya district Karnataka (Anonymous 2015) [3]. The ZARS V.C Farm, Mandya has initiated many research programs on zonal major crops (rice, ragi, sugarcane, maize, sugarcane, fodder and other major crops) and has come out with many novel technologies, among them the application of Flubendiamide insecticide to control the yellow stem borer and leaf folder was one, which was released during 2010 to manage the pest in rice crop (Anonymous 2015) [3].

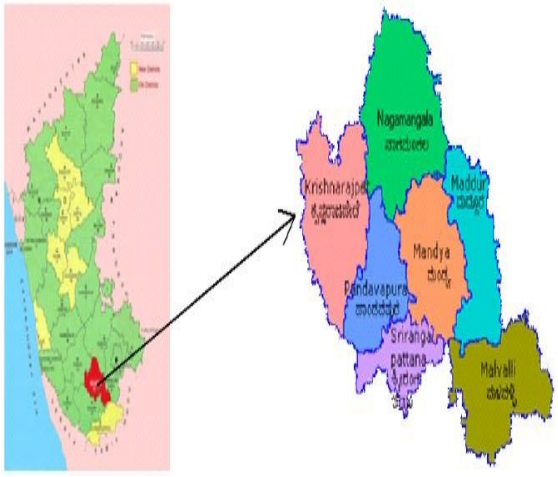
Technology Impact on Farmers Income

The present study was conducted to assess the impact of Flubendiamide insecticide which was released during 2010 from ZARS and recommended for farmers to adopt to control the yellow stem borer and leaf folder to obtain better yield and income (Anonymous 2015) [4]. The UASB has funded this project to find out the impact of the released and recommended technologies from ZARS, on the crop yields and income of the farmers and the extent of area covered under the technologies as to know its impact (Anonymous, 2017) [1]. Keeping the above background in view the study was conducted in the year 2016-2017 with the following objectives. To find out the extent of control of recommended insecticides in controlling the rice pest and to find out the impact of recommended insecticides on yield and income from rice.

II. METHODOLOGIES

The study was conducted in Mandya district. It has 7 taluks, from each of the taluk, 2 villages were selected (Anonymous, 2015) [2].

Research Project Study Area



Karnataka State Mandya District

Sample size: The farmers who adopted the selected technologies were identified. A list such adopters was obtained from ZARS, KVK and KSDA Mandya. Through cluster sampling method 210 respondents were selected randomly.

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Selection of Villages: Sample Size

Sl. No.	Taluk	Villages	Respondents
1	Mandya	Holalu	15
		Modachakanahalli	15
2	Maddur	Doddarasinakere	15
		Kesthur	15
3	Srirangapatna	Arakere	15
		Kodiyala	15
4	Pandavapura	Kythanahalli	15
		Dodda byadarahalli	15
5	K.R.pet	Bandihole	15
		Beriya	15
6	Nagamangala	Devalapura	15
		Bindenahalli	15
7	Malavalli	Kirgavalu	15
		Hittanahalli koppalu	15
Total			**210**

The Instruments used for data collection were; pre-tested and standardised Interview schedule, 'Participatory rural appraisal' tools and Focus group discussions. The data were collected during November 2016 to February 2017. The research design adopted was 'Before and After'. The farmers who have adopted both technologies were identified and selected randomly by adopting stratified sampling procedure. The respondents were selected randomly who had adopted both insecticides Flubendiamide and Chlorphyriphos (before), their opinion was recorded by their memory lane of recollection. Measurement of insecticide effectiveness in controlling the pest was measured on the 4 point opinion continuum 'least, less, effective and more effectiveness' scale. Nominal score of 1, 2, 3, and 4 were awarded respectively. The total score for 210 respondents were calculated the maximum score would be 840. The Rice yield and income definition and measurement: The additional grain and straw yield were defined as, the yield obtained over and above the normal yield when insecticides were not used by the respondents. The quantification of grain was measured quintals/ac and straw tons/ac. Similarly the additional income mean, net income obtained over and above the normal net income when the insecticides were not used. Alternate hypotheses, there would be a significant difference between Flubendiamide and Chlorphyriphos insecticides with respect to grain and straw yield and there would be a significant difference between Flubendiamide and Chlorphyriphos insecticides with respect to net-income earned. The data analysis was done by using simple statistical tools such as frequency and per cent, were used to analyse the data and to draw the inferences.

III. Result and Discussion

A. The Rice Yield Levels in Mandya District (Normal, without using Insecticides)

About 34 per cent respondents obtained wide range of grain yields in seven taluks of Mandya district Karnataka. Many of the respondents obtained grain yields ranging from 14 to 17.9 q/ac (Table 1). The lowest yield range was less than 1.0q/ac was observed among 8 per cent of respondents and the highest yield was more than 23 q/ac was observed among 7.62 per cent of the respondents (Anonymous 2014) [5]. (The actual total grain yield obtained as per the farmers practice is given in the Table-1 & Fig.1).

Table 1. Rice grain yield obtained by the respondents in Mandya district (without using insecticides)
n = 210

SN	Rice Yield range (q/ac)	Pandavapura	Maddur	Mandya	S.R. Patna	K.R.Pet	Nagamangala	Malavalli	Total	%
1	<10	5	3	1	2	1	2	3	17	8.09
2	10.1 to 13.9	3	8	2	5	9	12	13	52	24.76
3	14 to 17.9	12	10	7	13	11	7	11	71	33.81
4	18 to 22.9	7	6	17	8	7	7	2	54	25.72
5	>23	3	3	3	2	2	2	1	16	7.62
	Total	**30**	**30**	**30**	**30**	**30**	**30**	**30**	**210**	**100.0**

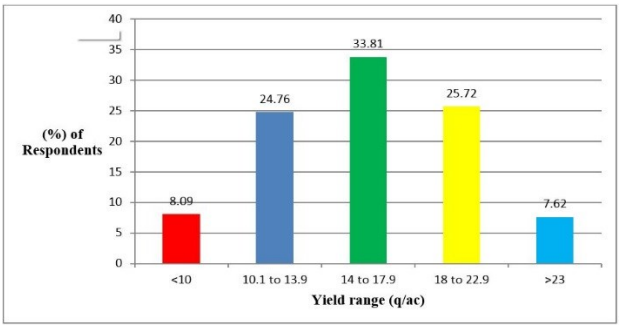

Fig. 1. Rice grain yield obtained by the respondents in Mandya district (without using insecticides)

From this back drop, the impact of Flubendiamide insecticide on additional yield obtained by the respondents was calculated. Accordingly the result of the objectives are presented.

B. The Extent of Control of Rice Yellow Stem Borer and Leaf Folder by using Flubendiamide and Chlorpyriphos Insecticides

The Table 2 & Fig. 2 reveals that, 83 per cent respondents opined that the Flubendiamide insecticide had controlled the yellow stem borer and leaf folder in Rice more effectively. Similarly, in case of Chlorpyriphos also 62.5% per cent majority of them opined that it had controlled the above pest more effectively. To draw an inference that both insecticides were more effective in controlling the yellow stem borer and leaf folder in Rice in Mandya district. None of the respondents opined that the both insecticides were least effective. Further, the table-2, indicates that the degree

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of effectiveness of insecticides with respect to control of stem borer and leaf folder in rice in mainland. The effectiveness quotient value of Flubendiamide was 0.94 as compared to the Chlorpyriphos it was 0.88. This implies that Flubendiamide was relatively more effective compared to that of Chlorpyriphos. The findings are in tune with proceedings of zonal workshop. (anonymous 2010) [6].

Table 2. Extent of control of Rice yellow stem borer & leaf folder by using insecticides Flubendiamide and Chlorpyriphos insecticides
n=210

SN	Taluk	Extent of control (%) by Flubendiamide				Extent of control(%) by Chlorpyriphos				Total
		Least effective (<24)	Less effective (25 to50)	Effective (51 to 75)	More effective (>76)	Least effective (<24)	Less effective (25 to 50)	Effective (51 to 75)	More effective (>76)	
1	Pandavapura	0	3	3	24	0	1	7	22	30
2	Maddur	0	1	2	27	0	3	8	19	30
3	Mandya	0	2	5	23	0	1	8	21	30
4	S.R.Patna	0	3	1	26	0	3	9	18	30
5	K.R.Pet	0	2	4	24	0	4	10	16	30
6	Nagamangala	0	2	3	25	0	3	10	17	30
7	Malavalli	0	2	2	26	0	4	8	18	30
Total		0	15	20	175	0	19	60	131	210
%		0	8.0	9.0	83.0	0	9.0	28.5	62.5	100.0
Score obtained		0	30	60	700	0	38	180	524	
Total score obtained		**790**				**742**				
Effective quotient		**0.94**				**0.88**				

(Score 4, 3, 2 &1 was given for response more effectiveness, effectiveness, less effectiveness and least effectiveness respectively. Maximum score possible-840)

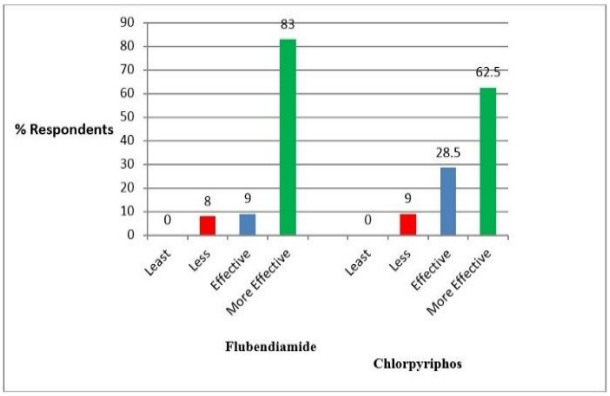

Fig. 2. Extent of control of Rice yellow stem borer & leaf folder by using insecticides Flubendiamide and Chlorpyriphos insecticides

C. Impact of Flubendiamide and Chlorpyriphos on Additional Grain Yield Obtained in Rice:

The respondents had used both insecticides the Flubendiamide and Chlorpyriphos (before) during 2011 to 2016 to control Rice yellow stem borer and leaf folder in the main field. They had obtained an average additional grain yield of rice 0.89 q/ac., by spraying Flubendiamide from the normal practice of without Spray and in case of Chlorpyriphos they obtained 0.87q/ac., (before). The effect of Flubendiamide was better in getting increased marginal yield (0.02q/ac) compared to that of Chlorpyriphos (Table 3). To infer that both chemicals had almost equal effect in obtaining the rice grain yield. The 't' test indicated non-significant difference (t=0.13) between them. Thus, the null hypothesis is accepted.

Table 3. Additional Rice grain yield obtained by using Flubendiamide and Chlorpyriphos insecticides
n=210

Sl.No	Taluk	After (Flubendiamide)	Before (Chlorpyriphos)	Yield difference (q/ac)	Paired 't' test
		Grain yield (q/ac)	Grain yield (q/ac)		
1	Pandavapura	1.12	0.87	0.25	**0.13 NS**
2	Maddur	1.20	0.45	0.75	
3	Mandya	1.00	1.50	-0.5	
4	S.R.patna	0.75	0.80	-0.05	
5	K.R.Pete	0.87	0.70	0.17	
6	Nagamangala	0.25	0.62	-0.37	
7	Malavalli	1.06	1.18	-0.12	
	Average	**0.89**	**0.87**	**0.02**	

NS-Non significant (Popular var: Jaya, BR-2655, MTU-1001, IR-64)

D. Impact of Flubendiamide and Chlorpyriphos Additional Straw Yield Obtained in Rice

The respondents had used both insecticides the Flubendiamide and Chlorpyriphos (before) during 2011 to 2016 to control Rice yellow stem borer and leaf folder in the main field. They had obtained an average additional rice straw yield 0.075t/ac by using Flubendiamide spray and in case of Chlorpyriphos it was 0.060 t/ac. (before.) The effect of Flubendiamide was better in getting increased marginal yield (0.015t/ac) compared to that of Chlorpyriphos (Table-4 & Fig.4). To infer that both chemicals had almost equal effect in obtaining the rice straw yield. The 't' test indicated non-significant difference (t=0.028) between them. Thus, the null hypothesis is accepted. The strategies for communication and diffusion of technologies by the agencies make a difference (Supe. 1987) [9].

Table 4. Additional Rice straw yield obtained by using Flubendiamide and Chlorpyriphos insecticides
n=210

Sl.No.	Taluk	After (Flubendiamide) strae yield(t/ac)	Before (Chlorpyriphos) Straw yield (t/ac)	Yield difference (t/ac)	Paired 't' test
1	Pandavapura	0.081	0.069	0.012	0.028NS
2	Maddur	0.089	0.071	0.018	
3	Mandya	0.099	0.079	0.02	
4	S.R.patna	0.087	0.064	0.023	
5	K.R.Pete	0.091	0.078	0.013	
6	Nagamangala	0.021	0.011	0.01	
7	Malavalli	0.061	0.048	0.013	
	Average	**0.075**	**0.060**	**0.015**	

NS-Non significant (Popular var: Jaya, BR-2655, MTU-1001, IR-64)
(Flubendiamide cost Rs.800/ac, Chlorpyriphos Rs. 200/ac)

E. Additional Income Obtained by Using Flubendiamid and Chlorpyriphos Insecticides

The respondents obtained net income of Rs.1147/ac from the spray (Table 5). They obtained additional grain and straw because of spray effect in controlling the yellow stem borer and leaf folder in the transplanted main field. The net income varied from taluk to taluk might be because of variations in application of prescribed dosage by the farmers in their field also matters in extent of control of infestation caused by the yellow stem borer and leaf folder, which has direct association with yield and income to the farmers. In case of **Chlorpyriphos** the respondents obtained net income of Rs.1217/ac from the spray (Table-5 Fig.5). This net income is slightly more than that of Flubendaimide. One of the reasons could be that the cost of the chemical required for one acre in case of of Flubendiamide was (Rs.800/ac) lower than that of the retail price of chlorpyriphos (Rs.650 per 500ml/ acre). The net income varied from taluk to taluk might be because of variations in application of prescribed dosage by the farmers in their field also matters in extent of control of infestation, which has direct association with yield and income of the farmers (Ryan and Gross 1943) [7]. The 't' test indicated non-significant difference (t=0.093) between them. Thus, the null hypothesis is accepted.

Table 5: Additional income obtained by using Flubendiamide and Chlorpyriphos insecticides
n=210

Sl. N.	Taluk	Flubendiamide net income(Rs)	Chlorpyriphos net income (Rs)	Difference (Rs)	Paired 't' test
1	Pandavapura	1484.39	1180.36	304.03	0.093NS
2	Maddur	1863.72	691.21	1172.51	
3	Mandya	1497.92	2096.32	-598.4	
4	S.R.patna	861.28	835.76	25.52	
5	K.R.Pete	1233.51	1036.46	197.05	
6	Nagamangala	239.59	279.31	-39.72	
7	Malavalli	1332.54	1542.42	-209.88	
	Average	**1147.68**	**1217.12**	**-69.44**	

NS-Non significant (Popular var: Jaya, BR-2655, MTU-1001, IR-64)

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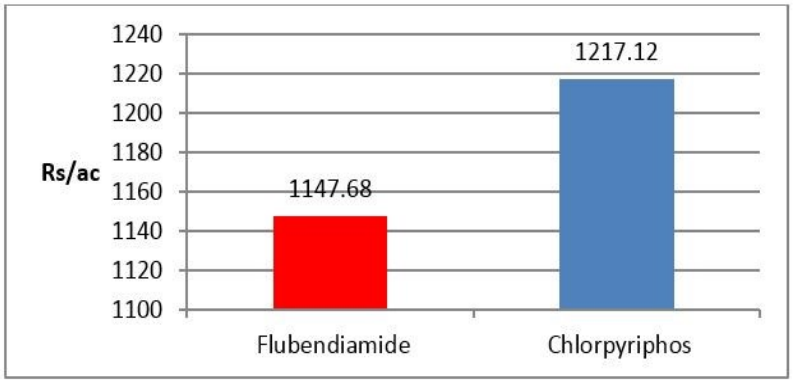

Fig. 5. Additional income obtained by using Flubendiamide and Chlorpyriphos insecticides

IV. CONCLUSION

The study findings indicated that, the effectiveness quotient value of Flubendiamide was 0.94 and in case of Chlorpyriphos it was 0.88. This implies that Flubendiamide was relatively more effective compared to Clorpyriphos in controlling the rice yellow stem borer and leaf folder insects. The impact of these insecticides in obtaining an average additional grain yield of rice by using Flubendiamide spray was 0.89 q/ac. and in case of Chlorpyriphos it was 0.87q/ac., (before). The effect of Flubendiamide was better in obtaining increased marginal yield (0.02q/ac) compared to that of Chlorpyriphos. However, there was no significant difference in obtaining the additional grain yield. In case of obtaining additional rice straw yield; the effect of Flubendiamide was better in obtaining increased marginal yield (0.015t/ac) compared to that of Chlorpyriphos. Thus, both chemicals had almost equal effect in obtaining the rice grain and straw yield. However, the difference was non-significant. The respondents had obtained relatively more additional net income from Chlorpyriphos than that of Flubendiamide insecticide as the cost of the latter was more. However, there was no significant difference in obtaining the additional net income to the respondents. The implications being both Flubendiamide and Chlorpyriphos insecticides were effective in managing the rice pest Yellow Stem Borer and Leaf Folder as a consequence of which, the respondents obtained additional yield and income, such insecticides should be made available to the extension personnel of Agriculture Department, Indian Council of Agriculture Research, State Agricultural Universities and Private agencies timely so as to make them available to the farmers. Further, suitable institutional arrangements are to be made for farm advisory services in such a way that farmers use right chemical, right dosage and at right time considering the novel method of 'integrated pest management' approach of managing the insects eco-friendly way in rice crop.

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