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Evaluation of newly insecticides against stem borer *Scirpophaga incertulas* (walker) and leaf folder (*Cnaphalocrosis medinalis*) in rice

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Abstract
A field experiment was conducted during the kharif season of 2018 and 2019 at Crop Research station, Masodha, Ayodhya to evaluate the efficacy of insecticides against rice stem borer and leaf folder. The experiment was comprising five treatments i.e. T1- Dinotefuran @ 200 ml/ha., T2- Rynaxypyr @ 150ml/ha.,T3- Cartap hydrochloride 50% SC@ 200ml/ha., T4- Triflumezopyrim 10% SC @ 48g/ha and T5- Untreated control. The lowest incidence of rice stem borer dead heart % 3.92 (30 DAT), 5.18 (50 DAT) and white ear 2.4% and incidence of leaf folder % 3.99 (30 DAT), 2.74 (50 DAT) were recorded in treatment with T4-Triflumezopyrim 10% SC @48g/ha. In both years. The highest grain yield (4305 kg/ha), yield Increase (45.19%) net return (Rs. 118388/ha) and Incremental Benefit: Cost ratio 2.46%, followed by application of Rynaxypyr @ 150ml/ha. incidence of rice stem borer dead heart % were recorded 5.52 (30 DAT), 9.80 (50 DAT) and white ear 4.11% and incidence of leaf folder % 5.59 (30 DAT), 4.31 (50 DAT) and yield kg/ha was 4104 and percentage increase of yield 38.31.

Keywords: Stem borers, incidence, infestation, leaf folder

Introduction
Rice (*Oryza sativa* L.) is one of the most important crops of the world and provides food to more than 50% global population. More than 90% of the world's rice is grown and consumed in Asia, where 60% of the earth's people live. Rice is a major staple food crop of the state, it is necessary to increase the productivity of rice to meet the food requirement of the population. Not only the productivity has to be increased but it should be sustainable also over the years. There are over 70 pests infesting rice in India and 20 are of regular occurrence (Pathak, 1975) [6]. The pest causes 25-30% damage to rice crop (Lal, 1996) [4]. Among the major pest attacking rice crop the stem borer, *Scirpophaga incertulas* (Walker) is the number one pest, which attack the crop both at vegetative and reproductive stages (Pasalu *et al*., 2002) [5]. Rice stem borer (*Scirpophaga incertulas*.), Leaf folder (*Cnaphalocrosis medinalis*) have been reported from all major rice growing areas and causes severe damage to the rice crop. The young larvae of stem borer primarily enter to the leaf sheath and feed on the green tissue for 2-3 days after which the larvae enter to the basal parts usually 5-10 cm above water level and at heading stage boring usually occurs at the peduncle node and the white ear head formed. The leaf folder larvae cause injury to rice leaves by scrapping folding and webbing them up to 60%. (Prakash and Rao, 1999) [7]. In the field against rice stem borer the insect pest caused 25 to 30 percent yield loss in rice (Agarwala 1995, Sen 1956 and Shukla *et al*, 1986) [13]. The larval stage of stem borers mostly remain concealed inside the stem and it is difficult to control. Rice leaf folder, *Cnaphalocrocis medinalis* (Pyraulidae; Lepidoptera) has attained the status of a major pest in rice growing areas of Eastern Uttar Pradesh.
Hence keeping the above facts in mind the present study was undertake to identified the most suitable insecticide against rice stem borer (*Scirpophaga incertulas*) (Walker) and leaf folder (*Cnaphalocrosis medinalis*) in kharif season of rice crop.

Material and Methods
Experiment were conducted during WS 2018 and 2019 at Crop Research Station, Masodha,

which is situated at 26.47^{0}N (latitude), 82.12 ^{0}E (longitude) and at 113 m (altitude). The soil is sandy loam low in organic carbon. It is rich in potassium, medium in phosphorus and possesses good water holding capacity. To evaluate the different insecticide to rice stem borer and leaf folder. Experimental material was comprised of four insecticidal formulations and 1 untreated check *viz* T1- Dinotefuran @ 200 ml/ha., T2- Rynaxypyr @ 150ml/ha.,T3-Cartap hydrochloride 50% SC@ 200ml/ha., T4- Triflumezopyrim 10% SC @ 48g/ha and T5- Untreated control. The susceptible rice variety Pusa Basmati-1 was used as test variety. The nursery of Pusa Basmati 1 was sown in raised beds and 23 days old seedling were transplanted keeping 2-3 seedling/hill in the 1st week of July in the be both years of study. Transplanted of randomized block design with three replication in 20m^2 plot size, spacing 20x15 cm. Variety specific agronomic practices were adapted to raise the crop. No plant protection measures were used to create congenial environment for insect pest incidence. Observations were recorded after 30 days of transplanting, on 20-sample (hills) in each plot. Sample (hills) were chosen diagonally. Number of healthy and infested tillers. The data on stem borer and leaf folder infestation was recorded at vegetative stage as dead heart (DH%), damage of leaf/hill and total tillers and percent incidence was worked out. Similarly, white ear (WE%) and panicle bearing tillers were recorded near maturity of crop and percent white ear incidence was worked out. The data on grain yield of each plot were recorded separately by threshing the harvested Pusa Basmati 1. The data so obtain were subjected to statistical analysis after necessary transformation for final statistical analysis (Gomez and Gomez, 1983) [2]. Two season data on pests incidence and grain yield separately recorded the mean value of percentage increase over yield, cost of cultivation, net return and gross income were calculated on the basis of two years data.

Results and Discussion

Incidence of rice stem borer and leaf folder

It is apparent from Table 1 to 6 that the results with various treatments were significantly different from the untreated check. During kharif season 2018 and 2019 insect pest under study, the minimum infestation of borer dead heart % 3.92 (30 DAT), 5.18 (50 DAT) and white ear 2.4% and incidence of leaf folder % 3.99 (30 DAT), 2.74 (50 DAT) were recorded in treatment with T4-Triflumezopyrim 10% SC @48g/ha. in both years. These results are in accordance with (Sontakke *et al*. 2000) who reported chlorpyriphos, ethoprophos, carbofuran, fipronil at 50DAT afforded effective control of stem borer. The other treatment T2-. Rynaxypyr @ 150ml/ha infestation of borer dead heart % 5.52 (30 DAT), 9.80 (50 DAT) and white ear 4.11% and incidence of leaf folder % 5.59 (30 DAT), 4.31 (50 DAT) were recorded. The treatment with T3- Cartap hydrochloride 50% SC@ 150ml/ha infestation of borer dead heart % 7.57 (30 DAT), 11.36 (50 DAT) and white ear 6.87% and incidence of leaf folder % 6.76 (30 DAT), 5.17 (50 DAT) were recorded. The treatment with T1- Dinotefuran @ 200ml/ha. Infestation of borer dead heart % 11.88 (30 DAT), 14.10 (50 DAT) and white ear 9.09% and incidence of leaf folder % 8.70 (30 DAT), 5.94 (50 DAT) were recorded. The untreated control Water spray infestation of borer dead heart % 17.90 (30 DAT), 22.83 (50 DAT) and white ear 15.75% and incidence of leaf folder % 16.34 (30 DAT), 18.85 (50 DAT) were recorded.

Grain yield and economics

The yield data output were collected from treatments plots as well as control plots and finally the extension gap, technology gap, technology index along with the benefits cast ratio were work out (Samui *et al*., 2000) [10]. The lowest yield of rice was recorded untreated control plot 2965 kg/ha. Use of Treatment Triflumezopyrim 10% SC @48g/ha were recorded grain yield kg/ha increased the yield of 45.19% over control The treatment with Triflumezopyrim 10% SC gave higher gross return of Rs. 118388/ha with a benefit cost ratio of 2.46 and additional net return of Rs.70188/ha. use of. Our observation are in comparable with the results of (Gupta, S.P. 2006) [3]. Followed by treatment Rynaxypyr were recorded grain yield 4104 kg/ha. increased the yield of 38.31% over control gross return of Rs. 112860/ha. with benefit cost ratio of 2.34% and additional net return of Rs. 64660/ha are presented in table 7.

Conclusion

The results of the present study showed that the insecticide Triflumezopyrim 10% SC @48g/ha. was most effective to control incidence of yellow stem borer and leaf folder. Rice leaf folder, *Cnaphalocrocis medinalis* (Pyraulidae; Lepidoptera) has attained the status of a major pest in rice growing areas of Eastern Uttar Pradesh. In certain cases it has been recorded to cause 63 to 80 percent yield losses in rice. The results of present investigation have reasonably led to conclusion that yellow stem borer and leaf folder can be manage by the use of Triflumezopyrim 10% SC.

Table 1: Effect of different treatment on stem borer (DH) incidence 30 DAT WS 2018 and 2019

S. No.	Trade name	Rate ml/ha	Total tiller 30 DAT (2018) 10 hill	Damage tiller 30 DAT (2018) 10 hill	% DH 30 DAT (2018) 10 hill	Total tiller 30 DAT (2019)	Damage tiller 30 DAT (2019)	% DH 30 DAT (2019)	Mean % DH
T1	Dinotefuran	200	62	8	12.90	61	9	14.75	11.88
T2	Rynaxypyr	150	64	3	4.69	63	4	6.35	5.52
T3	Cartap hydrochloride 50% SC	200	60	4	6.67	59	5	8.47	7.57
T4	Triflumezopyrim 10% SC	480	59	2	3.39	62	3	4.84	3.92
T5	Untreated control (Water Spray)	-	60	12	20.00	57	13	22.81	17.90

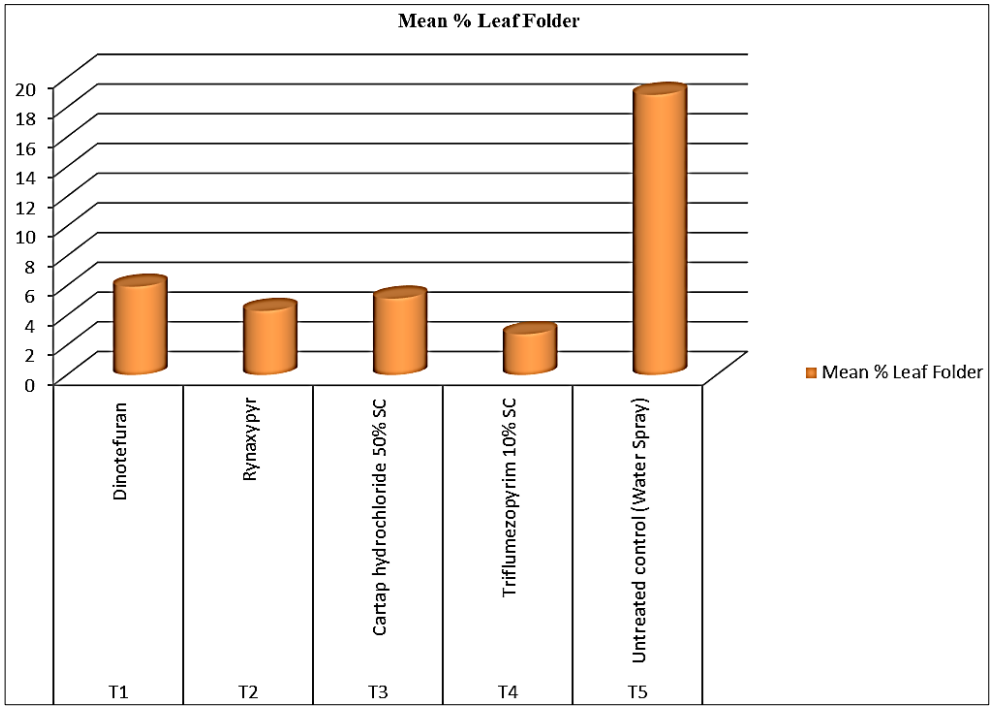

Fig 1: Effect of different treatment on stem borer (DH) incidence 30 DAT

Table 2: Effect of different treatment on stem borer (DH) incidence 50 DAT WS 2018 and 2019

S. No.	Trade name	Rate ml/ha	Total tiller 50 DAT (2018)	Damage tiller 50 DAT (2018)	% DH 50 DAT (2018)	Total tiller 50 DAT (2019)	Damage tiller 50 DAT (2019)	% DH 50 DAT (2019)	Mean % DH
T1	Dinotefuran	200	69	9	13.04	66	10	15.15	14.10
T2	Rynaxypyr	150	68	6	8.82	65	7	10.77	9.80
T3	Cartap hydrochloride 50% SC	200	65	7	10.77	67	8	11.94	11.36
T4	Triflumezopyrim 10% SC	480	67	3	4.48	68	4	5.88	5.18
T5	Untreated control (Water spray)	-	63	14	22.22	64	15	23.44	22.83

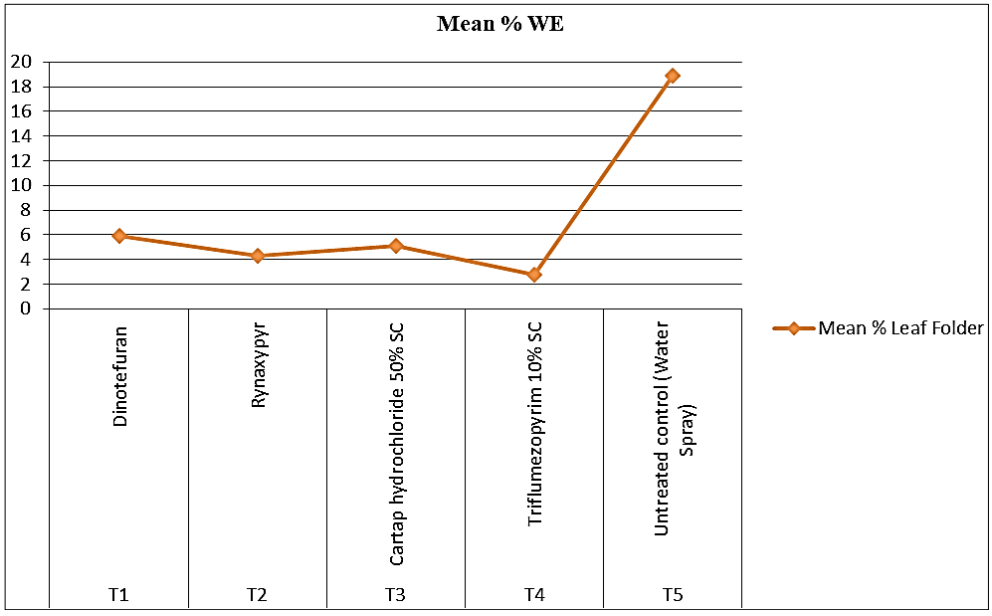

Fig 2: Effect of different treatment on stem borer (DH) incidence 50 DAT

Table 3: Effect of different treatment on stem borer (WE) incidence DAT WS 2018 and 2019

S. No.	Trade name	Rate ml/ha	Total tiller (2018)	WE (2018)	% WE (2018)	Total tiller (2019)	WE (2019)	% WE (2019)	Mean % WE
T1	Dinotefuran	200	82	7	8.54	83	8	9.64	9.09
T2	Rynaxypyr	150	84	3	3.57	86	4	4.65	4.11
T3	Cartap hydrochloride 50% SC	200	79	5	6.33	81	6	7.41	6.87
T4	Triflumezopyrim 10% SC	480	77	1	1.30	84	3	3.57	2.4
T5	Untreated control (Water Spray)	-	72	11	15.28	74	12	16.22	15.75

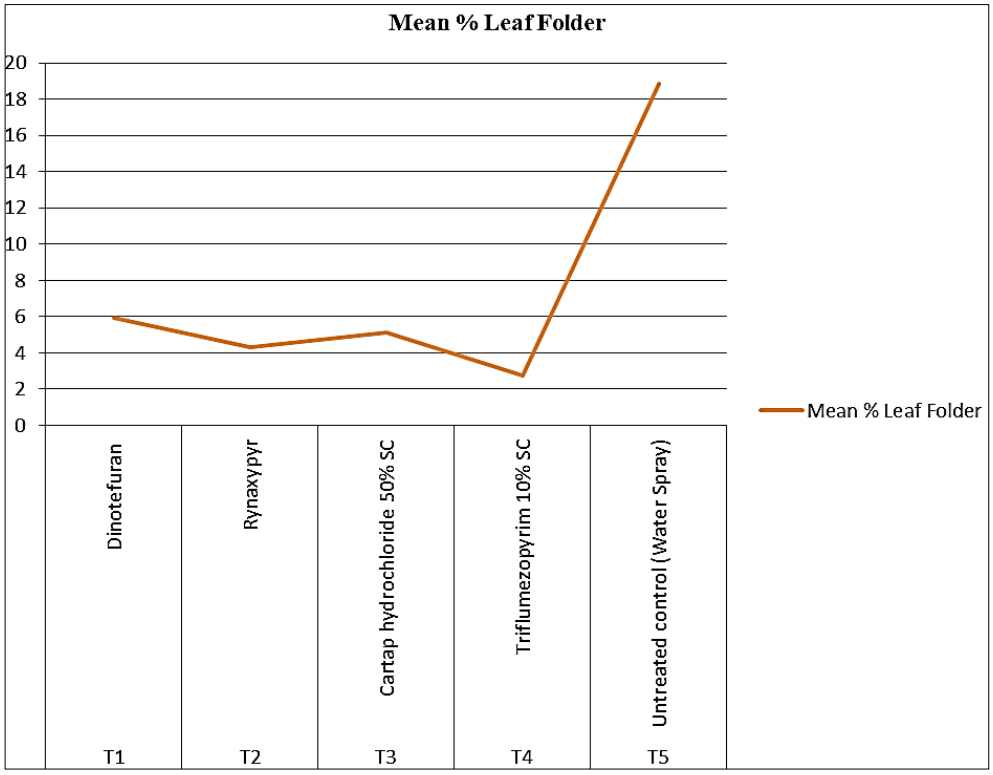

Fig 3: Effect of different treatment on stem borer (WE) incidence

Table 4: Effect of different treatment on leaf folder incidence 30 dat ws. 2018 and 2019

S. No.	Trade name	Rate ml/ha	Total leaf 50 DAT (2018)	Damage leaf 50 DAT (2018)	% Leaf folder (2018)	Total leaf 50 DAT (2019)	Damage leaf 50 DAT (2019)	% Leaf folder 50 DAT (2019)	Mean % leaf folder
T1	Dinotefuran	200	232	19	8.19	239	22	9.21	8.70
T2	Rynaxypyr	150	241	12	4.98	242	15	6.20	5.59
T3	Cartap hydrochloride 50% SC	200	236	15	6.36	237	17	7.17	6.76
T4	Triflumezopyrim 10% SC	480	222	9	4.05	254	10	3.94	3.99
T5	Untreated control (Water Spray)	-	239	37	15.48	244	42	17.21	16.34

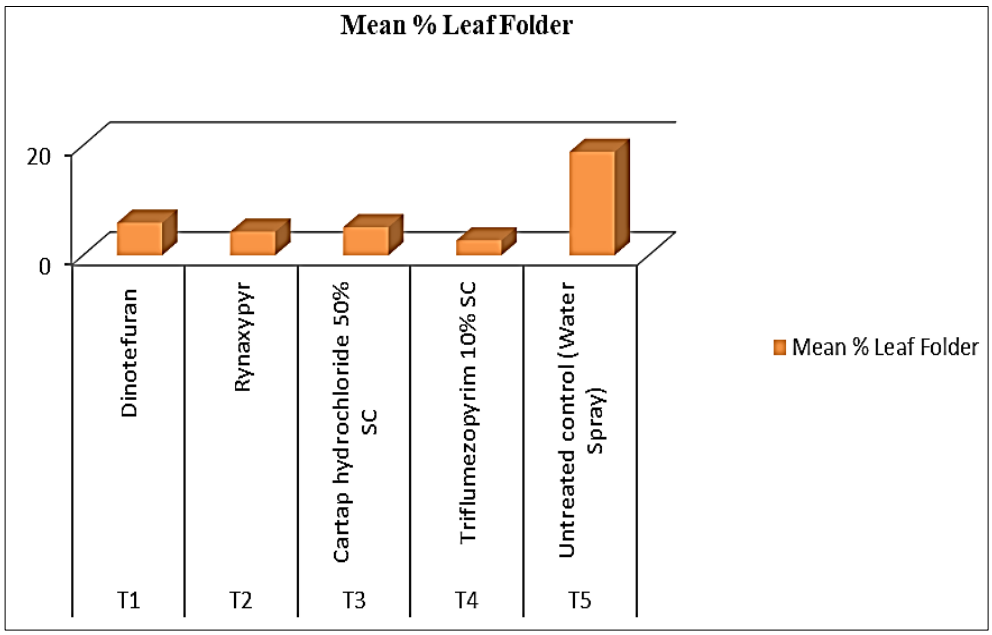

Fig 4: Effect of different treatment on leaf folder incidence 30 DAT

Table 5: Effect of different treatment on leaf folder incidence 50 DAT WS. 2018 and 2019

S. No.	Trade name	Rate ml/ha	Total leaf 50 DAT (2018)	Damage leaf 50 DAT (2018)	% Leaf folder (2018)	Total leaf 50 DAT (2019)	Damage leaf 50 DAT (2019)	% Leaf folder 50 DAT (2019)	Mean % leaf folder
T1	Dinotefuran	200	263	15	5.70	275	17	6.18	5.94
T2	Rynaxypyr	150	266	11	4.14	268	12	4.48	4.31
T3	Cartap hydrochloride 50% SC	200	268	13	4.85	276	15	5.43	5.14
T4	Triflumezopyrim 10% SC	480	273	7	2.56	266	8	3.01	2.74
T5	Untreated control (Water Spray)	-	261	42	16.09	259	56	21.62	18.85

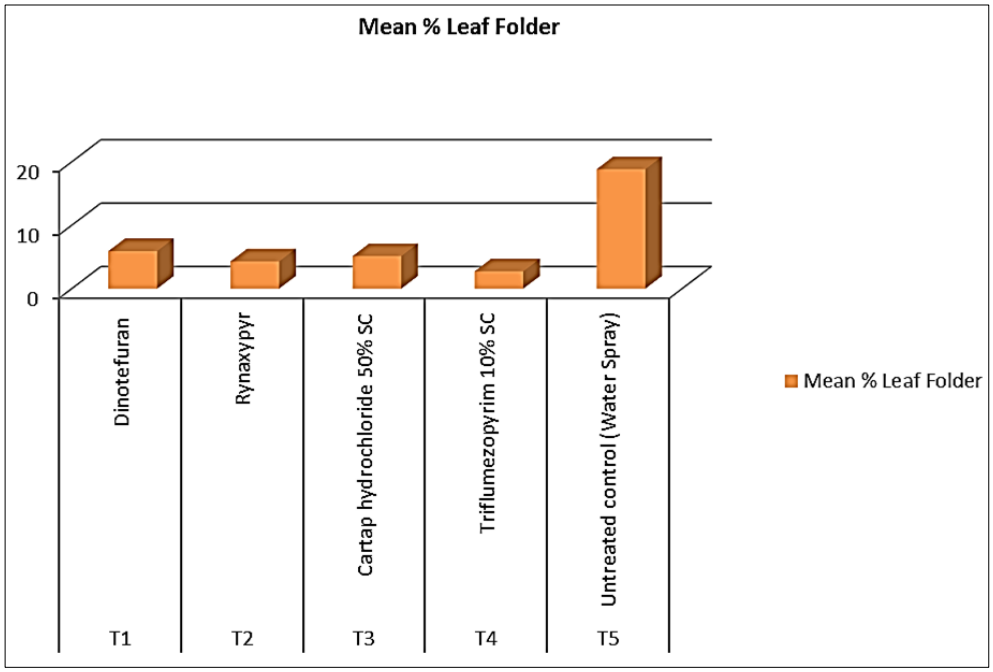

Fig 5: Effect of different treatment on leaf folder incidence 50 DAT

Table 6: Effect of different treatment on yield kg/ha WS. 2018 and 2019

S. No.	Trade name	Rate ml/ha	Yield Kg/ha (2018)	Yield kg/ha (2019)	Mean	Yield increase (%)
T1	Dinotefuran	200	3750	3911	3831	22.60
T2	Rynaxypyr	150	4040	4167	4104	38.31
T3	Cartap hydrochloride 50% SC	200	3910	4090	4000	34.90
T4	Triflumezopyrim 10% SC	48	4260	4350	4305	45.19
T5	Untreated control (Water Spray)	-	2890	3039	2965	-

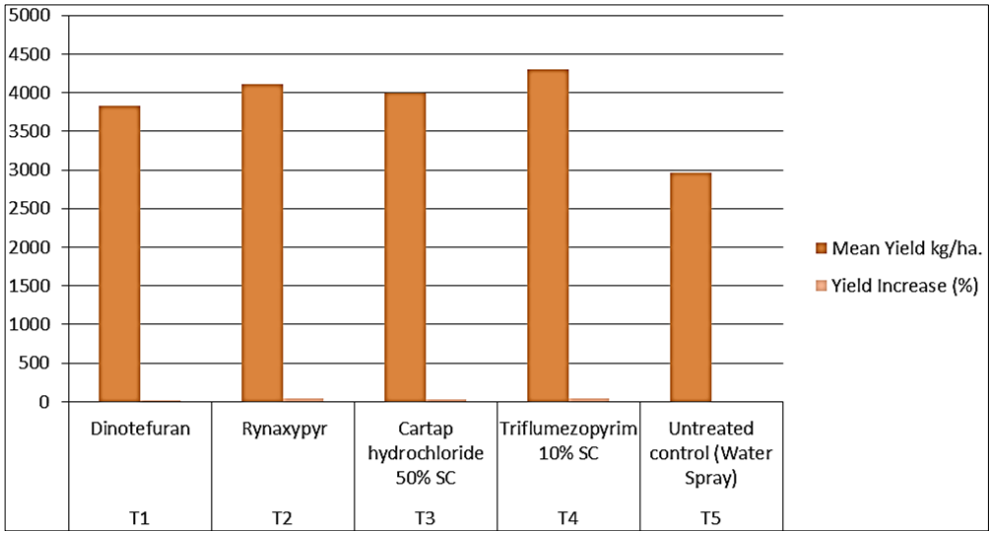

Fig 6: Effect of different treatment on yield kg/ha

Table 7: Economic analysis of different treatment on WS 2018 & 2019

S. No.	Trade name	Rate ml/ha	Cost of cash input	Sale price of grain (MSP) (Rs./qt)	Yield q/ha	Total returns (ha)	Extra returns /ha	Incremental benefit: cost ratio
T1	Dinotefuran	200	48200	2750	34.31	94353	46153	1.96
T2	Rynaxypyr	150	48200	2750	41.04	112860	64660	2.34
T3	Cartap hydrochloride 50% SC	200	48200	2750	40.00	110000	61800	2.28
T4	Triflumezopyrim 10% SC	48	48200	2750	43.05	118388	70188	2.46
T5	Untreated control (Water Spray)	-	48200	2750	29.65	81538	33338	1.69

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