Int.J.Curr.Microbiol.App.Sci (2017) *6*(8): 3773-3778

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 6 Number 8 (2017) pp. 3773-3778**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2017.608.456

Effect of Quinchlorac on Grassy Weeds in Transplanted Rice

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Keywords

Weed dry weight, Weed control efficiency, Grain yield, Rice.

Article Info

Accepted:
21 June 2017
Available Online:
10 August 2017

A B S T R A C T

An experiment was conducted during *Kharif* 2015 and 2016, at Agricultural Research Station, Dhadesugur, University of Agricultural Sciences, Raichur, Karnataka, India, to study the effect of Quinchlorac on control of grassy weeds and productivity of transplanted rice in Northern dry zone of Karnataka. Sprays of Quinchlorac 250 g/l SC @ 125 g a.i. /ha, Quinchlorac 250 g/l SC @ 187.5 g a.i. /ha, Quinchlorac 250 g/l SC @ 250 g a.i. /ha, Quinchlorac 250 g/l SC @ 312.5 g a.i. /ha, Cyhalofop butyl 10 % EC @ 100 g a.i. /ha, Penoxsulam 21.7 % SC @ 20 g a.i./ha, Azimsulfuron 50% DF @ 28 g a.i./ha, hand weeding at 15 and 40 days after planting (weed free check) and a weedy check (untreated check) were also maintained. A result revealed that, application of Quinchlorac 250 g/l SC @ 250 g a.i/ha was most effective in controlling the grassy weeds and increases the grain yield of transplanted rice without any phytotoxic effect.

Introduction

Rice has been staple food for more than 60 per cent of the world population, providing energy for about 40% of the world population where every third person on earth consumes rice every day in one form or other (Datta and Khushi, 2002). Therefore, crop paddy (*Oryza sativa* L.) is an important crop which is extensively grown in tropical and subtropical regions of the world. There are several reasons for its low productivity but the losses due to weeds are one of the most important. More than one third of the total loss (33%) is caused by weeds alone (Verma *et al.*, 2015). Weeds are most severe and widespread biological constraints to crop production in India. Weeds are responsible for heavy yield losses in paddy, to the extent of complete crop failure under severe infestation conditions. Irrespective of the method of paddy establishment, weeds are a major impediment to paddy production due to their ability to compete for resources. In general, weeds problem in transplanted paddy is lower than that of direct seeded paddy because of puddling and stagnation of water in transplanted paddy during early growth stage of crop. But in some cases where continuous standing water cannot be maintained

particularly for the first 45 days, weed infestation in transplanted paddy also may be as high as direct seeded paddy. According to Singh *et al.*, (2004) weeds can reduce the grain yield of dry-seeded paddy (DSR) by 75.8%, wet seeded paddy (WSR) by 70.6% and transplanted paddy (TPR) by 62.6%. Weeds by virtue of their high adaptability and faster growth dominate the crop habitat and reduce the yield potential. Therefore, the present investigation was undertaken to study the effect of early post emergent herbicide for control of major grassy weeds in transplanted rice.

Materials and Methods

An experiment was conducted during *Kharif* 2015 and 2016 on effect of Quinchlorac 250 g/l SC on grassy weeds in transplanted rice at Agricultural Research Station, Dhadesugur, Karnataka, India. The soil of the experimental site was deep black and neutral in pH (8.04), EC (0.47 ds/m), medium in organic carbon content (0.41 %), low in nitrogen (224 kg/ha), medium in phosphorus (58.5 kg/ha) and potassium (428.5 kg/ha). The total actual rainfall received during 2015 and 2016 were 642.3 and 655.6 mm, respectively. It was almost good as compared to the average normal rainfall received over the last thirty years. The overall pest and disease incidence was least during this season. There are nine treatments comprising of Quinchlorac at different concentrations, Cyhalofop butyl 10 % EC @ 100 g a.i. /ha, Penoxsulam 21.7 % SC @ 20 g a.i./ha, Azimsulfuron 50% DF @ 28 g a.i./ha, hand weeding at 15 and 40 days after planting (weed free check) and a weedy check (untreated check) and replicated thrice. The randomized block design was adopted for this experiment. Twenty five days old age seedlings were planted and herbicide was sprayed as per the treatments. On pre-spray, 30 and 60 days after transplanting (DAT) and total dry weight of grassy weeds (g/m^2) were taken in both treated and untreated plots. Species wise, weed population were recorded at before spray, 30 and 60 DAT using quadrates of 1.0 m^2. Further, total dry weight grassy weeds were recorded and used for calculating weed control efficiency (WCE). Data on total dry weight of weeds were analysed statistically. Weed control efficiency (WCE) was calculated as follows. WCE=Dry weight of weeds under control plot-Dry weight of weeds under treatments/Dry weight of weeds under control plot X 100. Five plants were randomly selected in each plot of each replication and were tagged for the purpose of recording observations on number of filled grains per panicle.

Similarly, grain and straw from each net plot in each replication was harvested and dried. The grains after threshing were weighed and recorded as grain yield per net plot. Further, this net plot grain yield was converted to grain yield per hectare. The data were analyzed as per the procedure of Gomez and Gomez, 1984.

Results and Discussion

Weed flora of experimental site

In the experimental plots, the dominant grassy weeds were *Echinochloa sp, Panicum repens, Cynodon doctylon, Leptochloa chinensis and Bracharia sp. etc.*

Dry weight of grassy weeds

Results revealed that, Hand weeding at 15 and 40 days after transplanting resulted in zero dry weight means weed free was maintained throughout the crop period. Further, significant reduction in dry weight of grassy weeds per square meter was observed under all the doses of Quinchlorac 250 g/l SC application compared to untreated control and other herbicide application treatments.

Table.1 Effect of weed control treatments on dry weight of grassy weeds in transplanted rice

Treatments	Dry weight of grassy weeds (g/m^2)								
	Before spraying			30 DAT			60 DAT		
	2015	2016	Pooled	2015	2016	Pooled	2015	2016	Pooled
T_1: Quinchlorac 250 g/l SC @ 125 g a.i/ha	4.36 (18.0)	4.36 (18.0)	4.36 (18.0)	3.66 (12.4)	3.68 (12.5)	3.67 (12.5)	4.42 (18.5)	4.46 (18.9)	4.44 (18.7)
T_2: Quinchlorac 250 g/l SC @ 187.5 g a.i/ha	4.38 (18.2)	4.34 (17.8)	4.36 (18.0)	3.40 (10.5)	3.40 (10.6)	3.40 (10.6)	3.92 (14.4)	3.97 (14.8)	3.95 (14.6)
T_3: Quinchlorac 250 g/l SC @ 250 g a.i/ha	4.35 (17.9)	4.35 (17.9)	4.35 (17.9)	3.34 (10.1)	3.36 (10.3)	3.35 (10.2)	3.66 (12.4)	3.81 (13.5)	3.73 (13.0)
T_4: Quinchlorac 250 g/l SC @ 312.5 g a.i/ha	4.38 (18.2)	4.41 (18.5)	4.40 (18.4)	3.22 (9.4)	3.36 (10.3)	3.29 (9.8)	3.39 (10.5)	3.44 (10.8)	3.41 (10.7)
T_5: Cyhalofop butyl 10 % EC @ 100 g a. i. /ha	4.39 (18.3)	4.39 (18.3)	4.39 (18.3)	4.04 (15.3)	4.07 (15.6)	4.06 (15.5)	5.10 (25.0)	5.12 (25.2)	5.11 (25.1)
T_6: Penoxsulam 21.7 % SC @ 20 g a.i./ha	4.38 (18.2)	4.38 (18.2)	4.38 (18.2)	3.95 (14.6)	3.95 (14.6)	3.95 (14.6)	4.84 (22.4)	4.90 (23.0)	4.87 (22.7)
T_7: Azimsulfuron 50% DF @ 28 g a.i./ha	4.44 (18.7)	4.44 (18.7)	4.44 (18.7)	4.23 (16.9)	4.24 (17.0)	4.23 (16.9)	5.29 (27.0)	5.31 (27.2)	5.30 (27.1)
T_8: Hand weeding	1.00 (0.0)	1.00 (0.0)	1.00 (0.0)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	1.00 (0.0)	1.00 (0.0)	1.00 (0.0)
T_9: Weedy check	4.49 (19.2)	4.53 (19.5)	4.51 (19.4)	8.23 (66.8)	8.29 (67.8)	8.26 (67.3)	10.3 (105.2)	10.5 (109.2)	10.4 (107.2)
C.D@ 5%	**2.56**	**2.13**	**2.41**	**2.12**	**2.52**	**2.01**	**4.56**	**6.52**	**5.14**

Note: Figures in the parenthesis are square root transformed values (sq. root of x+1), DAT- Days after transplanting, SC- Suspension Concentrates, EC- Emulsifiable Concentrates, DF- Dry Flowable

Table.2 Effect of weed control treatments on Weed control efficiency of grasses in transplanted rice

Treatments	Weed control efficiency (%)								
	Before spraying			30 DAT			60 DAT		
	2015	2016	Pooled	2015	2016	Pooled	2015	2016	Pooled
T_1: Quinchlorac 250 g/l SC @ 125 g a.i/ha	6.25	7.64	6.95	81.4	81.5	81.5	82.4	82.7	82.6
T_2: Quinchlorac 250 g/l SC @ 187.5 g a.i/ha	5.36	8.56	6.96	84.2	84.4	84.3	86.3	86.4	86.4
T_3: Quinchlorac 250 g/l SC @ 250 g a.i/ha	6.61	8.00	7.31	84.8	84.8	84.8	88.2	87.7	87.9
T_4: Quinchlorac 250 g/l SC @ 312.5 g a.i/ha	5.10	5.23	5.17	86.0	84.9	85.4	90.0	90.1	90.1
T_5: Cyhalofop butyl 10 % EC @ 100 g a. i. /ha	4.69	6.41	5.55	77.1	77.0	77.0	76.2	76.9	76.6
T_6: Penoxsulam 21.7 % SC @ 20 g a.i./ha	5.21	6.67	5.94	78.2	78.4	78.3	78.7	78.9	78.8
T_7: Azimsulfuron 50% DF @ 28 g a.i./ha	2.55	3.90	3.22	74.7	75.0	74.8	74.3	75.1	74.7
T_8: Hand weeding	100	100	100	100	100	100	100	100	100
T_9: Weedy check	-	-	-	-	-	-	-	-	-
C.D@ 5%	**5.12**	**4.12**	**4.25**	**1.05**	**1.06**	**1.02**	**3.10**	**3.24**	**3.21**

Note: Figures in the parenthesis are square root transformed values (sq. root of x+1), DAT- Days after transplanting, SC- Suspension Concentrates, EC- Emulsifiable Concentrates, DF- Dry Flowable

Table.3 Effect of weed control treatments on productivity of transplanted rice

Treatments	Number of filled grains per panicle			Grain yield (kg/ha)			Straw yield (kg/ha)		
	2015	2016	Pooled	2015	2016	Pooled	2015	2016	Pooled
T_1: Quinchlorac 250 g/l SC @ 125 g a.i/ha	173	175	174	4340	4620	4480	4690	5082	4886
T_2: Quinchlorac 250 g/l SC @ 187.5 g a.i/ha	175	176	175	5208	5421	5315	5655	5963	5809
T_3: Quinchlorac 250 g/l SC @ 250 g a.i/ha	179	181	180	5324	5524	5424	5895	6076	5986
T_4: Quinchlorac 250 g/l SC @ 312.5 g a.i/ha	185	186	186	5440	5623	5531	5924	6185	6055
T_5: Cyhalofop butyl 10 % EC @ 100 g a. i. /ha	174	176	175	4803	4985	4894	5209	5484	5346
T_6: Penoxsulam 21.7 % SC @ 20 g a.i./ha	172	174	173	5093	5124	5108	5649	5636	5643
T_7: Azimsulfuron 50% DF @ 28 g a.i./ha	172	175	174	4688	4765	4726	5072	5242	5157
T_8: Hand weeding	187	189	188	5903	5988	5945	6407	6587	6497
T_9: Weedy check	172	174	173	3472	3456	3464	3759	3802	3780
C.D@ 5%	**5.82**	**6.25**	**7.26**	**562.3**	**462.1**	**526.2**	**652.1**	**504.0**	**505.2**

Note: Figures in the parenthesis are square root transformed values (sq. root of x+1), DAT- Days after transplanting, SC- Suspension Concentrates, EC- Emulsifiable Concentrates, DF- Dry Flowable

Table.4 Economics of transplanted rice as influenced by weed control treatments (Mean data 2015 and 2016)

Treatments	Cost of cultivation (Rs/ha)	Gross returns (Rs/ha)	Net returns (Rs/ha)	B:C ratio
T_1: Quinchlorac 250 g/l SC @ 125 g a.i/ha	30635	80852	50217	2.64
T_2: Quinchlorac 250 g/l SC @ 187.5 g a.i/ha	30735	96004	65269	3.12
T_3: Quinchlorac 250 g/l SC @ 250 g a.i/ha	30835	98104	67269	3.18
T_4: Quinchlorac 250 g/l SC @ 312.5 g a.i/ha	30935	99958	69023	3.23
T_5: Cyhalofop butyl 10 % EC @ 100 g a. i. /ha	31935	88409	56474	2.77
T_6: Penoxsulam 21.7 % SC @ 20 g a.i./ha	32147	92491	60343	2.87
T_7: Azimsulfuron 50% DF @ 28 g a.i./ha	30547	85418	54871	2.80
T_8: Hand weeding	35435	107478	72043	3.03
T_9: Weedy check	30435	62649	32214	2.06
C.D@ 5%	**NA**	**NA**	**4652.2**	**0.18**

Note: NA: Not Analyzed, SC- Suspension Concentrates, EC- Emulsifiable Concentrates, DF- Dry Flowable,Urea @Rs. 5.00 kg^{-1}, DAP @Rs. 20.00 kg^{-1}, MoP @Rs. 15.00 kg^{-1}, Quinchlorac 250 g/l SC @ Rs.400 l^{-1}, Penoxsulum 21.7 % SC @ Rs.1712 ha^{-1}, Clincher 10 % EC @ Rs.1500 ha^{-1},Azimsulfuron 50 % DF @ Rs.2000 ha^{-1}, Grain @ Rs 17.0 kg^{-1} and Straw @ Rs 1.0 kg^{-1}.

Among weed control treatments, application of Quinchlorac 250 g/l SC @ 312.5 g a.i./ha recorded significantly lower dry weight of grassy weeds at 30 and 60 days after transplanting and which was onpar with the application of Quinchlorac 250 g/l SC @ 250g a.i./ha and Quinchlorac 250 g/l SC @ 187.5g a.i./ha compared to other weed control treatments in both the years.

These results are conformity with the findings of Abeysekera (1999) stated that, application of tank mixture of quichlorac @ 50 g/ha + propanil @ 1.08 kg/ha controlled effectively the grassy weeds and recorded lower dry weight in wet seeded rice in mid country region of Srilanka. Whereas, higher dry weight of grassy weeds was observed in weedy check treatment. This might be due high weed infestation (Table 1).

Weed control efficiency

In both the years, Cent per cent weed control efficiency was noticed in hand weeding treatment because weed free maintained in throughout the crop period. Further, significantly higher weed control efficiency was observed under all the doses of Quinchlorac 250 g/l SC application treatments compared to untreated control and other herbicide application treatments. Among weed control treatments, application of Quinchlorac 250 g/l SC @ 312.5 g a.i./ha recorded significantly higher weed control efficiency at 30 and 60 days after transplanting and which was onpar with the application of Quinchlorac 250 g/l SC @ 250g a.i./ha and Quinchlorac 250 g/l SC @ 187.5g a.i./ha compared to other weed control treatments. These results are conformity with the findings of Amarasinghe *et al.*, (1999) stated that, application of quichlorac @ 500 g/ha recorded higher weed control efficiency in wet seeded rice in mid country region of Srilanka.

Similarly, lower weed control efficiency was noticed in weedy check treatment (Table 2).

Yield components and yield of rice

The number of filled grains per panicle was significantly higher in hand weeded treatment and lower in un-weeded treatment in both the years. Similarly, significantly higher grain and straw yield were observed in weed free treatment and which was on par with the application of Quinchlorac 250 g/l SC @ 312.5

g a.i./ha, Quinchlorac 250 g/l SC @ 250g a.i./ha and Quinchlorac 250 g/l SC @ 187.5g a.i./ha compared to other weed control treatments. These results are conformity with the findings of Abeysekera (1999) stated that, application of tank mixture of quichlorac @ 50 g/ha + propanil @ 1.08 kg/ha controlled effectively the grassy weeds in wet seeded rice and resulted in higher grain yield in mid country region of Srilanka. Similar results also reported by Amarasinghe *et al.*, (1999). Whereas, lower grain and straw yield were recorded in weedy check plot. This is due to the higher infestation of weeds Seema *et al.*, (2015) also stated that, higher grain yield of aerobic rice was recorded in weed control treatments over the un-weeded treatment (Table 3).

Effect of weed control treatments on economics

Mean data of 2015 and 2016 showed that, application of Quinchlorac 250 g/l SC @ 312.5 g a.i./ha recorded significantly higher benefit cost ratio and which was on par with the application of Quinchlorac 250 g/l SC @ 250g a.i./ha and Quinchlorac 250 g/l SC @ 187.5g a.i./ha compared to other weed control treatments. This might be due higher grain and straw yield and less cost of establishment. Further, lower benefit cost ratio was noticed in weedy check treatment where weed infestation was more and resulting in lower grain and straw yield (Table 4). Similar finding were also reported by Amarasinghe and Marambe (1998).

The results indicated that, application of Quinchlorac 250 g/l SC @ 187.5g a.i/ha or 250 g.a.i/ha was found to be more effective in control of grassy weeds over other weed control treatments without showing any phytotoxic symptoms to the rice plants.

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How to cite this article:

Ramesha, Y. M., Manjunatha Bhanuvally, Ashok Kumar Gaddi, D. Krishamurthy and Umesh, M.R. 2017. Effect of Quinchlorac on Grassy Weeds in Transplanted Rice. *Int.J.Curr.Microbiol.App.Sci.* 6(8): 3773-3778. doi: https://doi.org/10.20546/ijcmas.2017.608.456