Original Research Article

Effect of Pre and Post Emergence Herbicides on Economics of Turmeric (*Curcuma longa* L.)

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A B S T R A C T

The experiments were conducted at the AICRP, on Weed Management farm, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani (MS), during *Kharif* season of 2012-13 and 2013-14. This study is carried out to evaluate the efficacy of pre and post emergence herbicides on economics in turmeric. The experiment were laid out in Randomized block design with twelve treatments and replicated thrice. The result revealed that pre emergence application of (T_3) Metribuzin 0.7kg ha^{-1} at PE *fb* straw mulch10 t/ha at 9WAP*fb* 1 HW at 12WAP significantly higher gross monitory and net monitory return during 2012-2013 and next year Treatment (T_{11}) Weed free significantly higher gross monitory and net monitory return followed by (T_6) Pendimethalin1.0 kg/ha at PE *fb* straw mulch 10t/ha at 9WAP *fb* 1 HW at 12WAP. Application of Post emergence herbicides during treatments (T_8) Atrazine 0.75 kg ha^{-1} at PE *fb* Fenoxaprop 67 g ha^{-1} + Metsulfuron 4g ha^{-1} at 9 WAP, (T_5) Pendimethalin 1.0 kg ha^{-1} at PE *fb* Fenoxaprop 67 g ha^{-1} + Metsulfuron 4g ha^{-1} at 9 WAP and (T_2) Metribuzin 0.7kg ha^{-1} at PE *fb* Fenoxaprop 67 g ha^{-1} + Metsulfuron 4g ha^{-1} at 9 WAP significantly lower gross monitory and net monitory return at both the year respectively.

Introduction

Turmeric (*Curcuma longa* L.) is one of the most important crop in India and sacred spice of India known as Indian saffron a herbaceous perennial belonging to the family Zingiberaceae (Abdul Rashid *et.al.,* 1992) and order Scitaminae, native of South Asia particularly India. Turmeric contains an conjugated diarylheptanoid (1,7-diaryl-hepta-1,6-dine-3,5diones e.g. (curcumin) The turmeric is used both spice and food colourings agent in pickles, chutneys, curries, curry powder and other culinary preparation, calorific value of turmeric is 34g calories per 100g of edible portion. It also contains appreciable quantity of fats

(5.1%), carbohydrates (69.4%), fiber (2.6%) and protein (6.3%). It is rich in minerals like phosphorous (282 mg per 100g), calcium (150mg per 100g) (Mannikeri, 2006). It is widely used in cosmetics the crop plays an important role in supplying raw materials to agro based industries; it values colouring and pharmaceutical uses. The colour is due to crystalline pigment called 'curcumin'. It is used for medicinally for external application and taken internally as a stimulant 'kum-kum'.

Maharashtra state having 6th rank in turmeric cultivation having area (6.76

thousand ha), production is (8.42 thousand tonnes) and productivity is (1.25 tonnes ha^{-1}) very less as compared to others states.

Materials and Methods

The experiments were conducted at, AICRP, on Weed Management farm, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani (MS), during *Kharif* season of 2012-13 and 2013-14.

Treatment details

The present experiment was laid out in Randomized Block Design with three replications. The details of treatments with their symbols are given T_1. Metribuzin 0.7 kg/ha at PE *fb* 2 hoeing at 9 & 12 WAP, T_2. Metribuzin 0.7kg/ha at PE *fb* fenoxaprop 67g/ha + metsulfuron 4g/ha at 9WAP, T_3. Metribuzin 0.7kg/ha at PE *fb* straw mulch10 t/ha at 9WAP*fb* 1 HW at 12WAP, T_4. Pendimethalin 1.0 kg/ha at PE *fb* 2 hoeing at 9 & 12 WAP, T_5.Pendimethalin 1.0 kg/ ha at PE*fb*fenoxapropat67 g / ha + metsulfuron 4g/ha at 9WAP, T_6. Pendimethalin1.0kg/ha at PE *fb* straw mulch 10 t/ha at 9WAP *fb* 1 HW at 12WAP, T_7. Atrazine 0.75 kg/ha at PE *fb* 2 hoeing at 9 & 12 WAP, T_8. Atrazine 0.75 kg/ha at PE *fb* fenoxaprop at 67g/ha + metsulfuron4g/ha at 9WAP, T_9. Atrazine 0.75 kg/ha at PE *fb* straw mulch 10 t/ha at 9WAP *fb* 1 HW at 12WAP, T_{10}. Glyphosate1.23kg/ha at 10 DAP *fb* 1HW at 12WAP, T_{11}. Weed free, T_{12}. Weedy check. (*fb* - followed by, WAP-Week after planting, HW-hand weeding, PE-pre emergence, DAP-days after planting).

Results and Discussion

Cost of cultivation (₹ ha^{-1})

The data regarding cost of cultivation in turmeric as influenced by different weed control treatments was not statistical analysis and data interpreted in table 1. During both the year of experiments the costs of cultivation values for turmeric were reported numerically maximum with the cultural weed free treatment and minimum in weedy check compared with rest of the treatments during both the years and in mean.

Among herbicidal treatments, application of metribuzine 0.7 kgha^{-1} as PE *fb* paddy straw mulch 10 t ha^{-1} at 9 WAP *fb* 1 HW at 12 WAP reported numerically maximum value for cost of cultivation as compared with rest of the herbicidal treatments during 2012-13, 2013-14 and in two years mean under study.

Gross monetary returns (₹ ha^{-1})

The data pertaining to gross monetary returns of turmeric as influenced by different weed control treatments during both the years and in pooled mean are presented in Table 2. The cultural weed free treatment recorded significantly higher value for gross monetary returns as compared with rest of the treatments during both the years and in pooled mean, except that it was found at par with the application of metribuzine 0.7 kg ha^{-1} as PE *fb* paddy straw mulch 10 t ha^{-1} at 9 WAP *fb* 1 HW at 12 WAP during 2012-13 year of study.

Among the herbicidal treatments, application of metribuzine 0.7 kg ha^{-1} as PE *fb* paddy straw mulch 10 t ha^{-1} at 9 WAP *fb* 1 HW at 12 WAP reported significantly higher value for gross monetary returns as compared with rest of the herbicidal treatments during 2012-13, 2013-14 and in pooled mean. During both the years of study and in pooled mean, the data herein revealed that the weedy check treatment recorded significantly the lowest value for gross monetary returns (₹ ha^{-1}).

Table.1 Cost of cultivation (₹ ha^{-1}) of turmeric at different weed management practices during 2012-13 and 2013-14

Treatments	Cost of cultivation (₹ ha^{-1})		
	2012-13	2013-14	Mean
T$_1$: Metribuzine 0.7 kg ha^{-1} as PE *fb* 2 hoeing at 9 and 12 WAP	92400	94055	93228
T$_2$: Metribuzine 0.7 kg ha^{-1} as PE *fb* Fenoxaprop 67 g ha^{-1} + Metsulfuron 4 g ha^{-1} at 9 WAP	91505	93160	92333
T$_3$: Metribuzine 0.7 kg ha^{-1} as PE *fb* paddy straw mulch 10 t ha^{-1} at 9 WAP *fb* 1 HW at 12 WAP	99600	101255	100428
T$_4$: Pendimethalin 1.0 kg ha^{-1} as PE *fb* 2 hoeing at 9 and 12 WAP	91775	93430	92603
T$_5$: Pendimethalin 1.0 kg ha^{-1} as PE *fb* Fenoxaprop at 67 g ha^{-1} + Metsulfuron 4 g ha^{-1} at 9 WAP	90880	92535	91708
T$_6$: Pendimethalin 1.0 kg ha^{-1} as PE *fb* paddy straw mulch 10 t ha^{-1} at 9 WAP *fb* 1 HW at 12 WAP	98975	100630	99803
T$_7$: Atrazine 0.75 kg ha^{-1} as PE *fb* 2 hoeing at 9 and 12 WAP	91680	93335	92508
T$_8$: Atrazine 0.75 kg ha^{-1} as PE *fb* Fenoxaprop at 67 g ha^{-1} + Metsulfuron 4 g ha^{-1} at 9 WAP	90785	92440	91613
T$_9$: Atrazine 0.75 kg ha^{-1} as PE *fb* paddy straw mulch 10 t ha^{-1} at 9WAP *fb* 1 HW at 12 WAP	98880	100535	99708
T$_{10}$: Glyphosate 1.23 kg ha^{-1} as 10 DAP *fb* 1 HW at 12 WAP	96496	98151	97324
T$_{11}$: Weed free	108065	109720	108893
T$_{12}$: Weedy check	90065	91720	90893
SEm±	--	--	--
CD at 5 %	--	--	--
General Mean	**95092**	**96747**	**95920**

Table.2 Gross monetary returns (₹ ha^{-1}) of turmeric at different weed management practices during 2012-13 and 2013-14

| Treatments	Gross monitory returns (₹ ha^{-1})		
	2012-13	2013-14	Pooled mean
T$_1$: Metribuzine 0.7 kg ha^{-1} as PE *fb* 2 hoeing at 9 and 12 WAP	330213	346569	338391
T$_2$: Metribuzine 0.7 kg ha^{-1} as PE *fb* Fenoxaprop 67 g ha^{-1} + Metsulfuron 4 g ha^{-1} at 9 WAP	140622	145642	143132
T$_3$: Metribuzine 0.7 kg ha^{-1} as PE *fb* paddy straw mulch 10 t ha^{-1} at 9 WAP *fb* 1 HW at 12 WAP	402925	415018	408971
T$_4$: Pendimethalin 1.0 kg ha^{-1} as PE *fb* 2 hoeing at 9 and 12 WAP	299492	332203	315848
T$_5$: Pendimethalin 1.0 kg ha^{-1} as PE *fb* Fenoxaprop at 67 g ha^{-1} + Metsulfuron 4 g ha^{-1} at 9 WAP	131784	138192	134988
T$_6$: Pendimethalin 1.0 kg ha^{-1} as PE *fb* paddy straw mulch 10 t ha^{-1} at 9 WAP *fb* 1 HW at 12 WAP	337791	394997	366394
T$_7$: Atrazine 0.75 kg ha^{-1} as PE *fb* 2 hoeing at 9 and 12 WAP	264644	282900	273772
T$_8$: Atrazine 0.75 kg ha^{-1} as PE *fb* Fenoxaprop at 67 g ha^{-1} + Metsulfuron 4 g ha^{-1} at 9 WAP	106592	122049	114320
T$_9$: Atrazine 0.75 kg ha^{-1} as PE *fb* paddy straw mulch 10 t ha^{-1} at 9WAP *fb* 1 HW at 12 WAP	293028	333420	313224
T$_{10}$: Glyphosate 1.23 kg ha^{-1} as 10 DAP *fb* 1 HW at 12 WAP	290284	322781	306532
T$_{11}$: Weed free	405000	427800	416400
T$_{12}$: Weedy check	90439	93790	92114
SEm±	1754	2171	1953
CD at 5 %	5097	6483	5722
General Mean	**257734**	**279613**	**268674**

Table.3 Net monitory returns (₹ ha^{-1}) of turmeric at different weed management practices during 2012-13 and 2013-14

Treatments	Net monitory returns (₹ ha^{-1})		
	2012-13	**2013-14**	**Pooled mean**
T_1 : Metribuzine 0.7 kg ha^{-1} as PE *fb* 2 hoeing at 9 and 12 WAP	237813	252514	245163
T_2 : Metribuzine 0.7 kg ha^{-1} as PE *fb* Fenoxaprop 67 g ha^{-1} + Metsulfuron 4 g ha^{-1} at 9 WAP	49117	52482	50800
T_3 : Metribuzine 0.7 kg ha^{-1} as PE *fb* paddy straw mulch 10 t ha^{-1} at 9 WAP *fb* 1 HW at 12 WAP	303325	313763	308544
T_4 : Pendimethalin 1.0 kg ha^{-1} as PE *fb* 2 hoeing at 9 and 12 WAP	207717	238773	223245
T_5 : Pendimethalin 1.0 kg ha^{-1} as PE *fb* Fenoxaprop at 67 g ha^{-1} + Metsulfuron 4 g ha^{-1} at 9 WAP	40904	45657	43281
T_6 : Pendimethalin 1.0 kg ha^{-1} as PE *fb* paddy straw mulch 10 t ha^{-1} at 9 WAP *fb* 1 HW at 12 WAP	238816	294367	266592
T_7 : Atrazine 0.75 kg ha^{-1} as PE *fb* 2 hoeing at 9 and 12 WAP	172964	189565	181264
T_8 : Atrazine 0.75 kg ha^{-1} as PE *fb* Fenoxaprop at 67 g ha^{-1} + Metsulfuron 4 g ha^{-1} at 9 WAP	15807	29609	22708
T_9 : Atrazine 0.75 kg ha^{-1} as PE *fb* paddy straw mulch 10 t ha^{-1} at 9WAP *fb* 1 HW at 12 WAP	194148	232885	213516
T_{10} : Glyphosate 1.23 kg ha^{-1} as 10 DAP *fb* 1 HW at 12 WAP	193788	224630	209209
T_{11} : Weed free	296935	318080	307508
T_{12} : Weedy check	374	2070	1222
SEm±	1231	1309	1284
CD at 5 %	3646	3860	3762
General Mean	**162642**	**182866**	**172754**

Table.4 Benefit cost ratio of turmeric at different weed management practices during 2012-13 and 2013-14

Treatments	Benefit cost ratio		
	2012-13	**2013-14**	**Pooled mean**
T_1 : Metribuzine 0.7 kg ha^{-1} as PE *fb* 2 hoeing at 9 and 12 WAP	3.57	3.68	3.63
T_2 : Metribuzine 0.7 kg ha^{-1} as PE *fb* Fenoxaprop 67 g ha^{-1} + Metsulfuron 4 g ha^{-1} at 9 WAP	1.54	1.56	1.55
T_3 : Metribuzine 0.7 kg ha^{-1} as PE *fb* paddy straw mulch 10 t ha^{-1} at 9 WAP *fb* 1 HW at 12 WAP	4.05	4.10	4.07
T_4 : Pendimethalin 1.0 kg ha^{-1} as PE *fb* 2 hoeing at 9 and 12 WAP	3.26	3.56	3.41
T_5 : Pendimethalin 1.0 kg ha^{-1} as PE *fb* Fenoxaprop at 67 g ha^{-1} + Metsulfuron 4 g ha^{-1} at 9 WAP	1.45	1.49	1.47
T_6 : Pendimethalin 1.0 kg ha^{-1} as PE *fb* paddy straw mulch 10 t ha^{-1} at 9 WAP *fb* 1 HW at 12 WAP	3.41	3.93	3.67
T_7 : Atrazine 0.75 kg ha^{-1} as PE *fb* 2 hoeing at 9 and 12 WAP	2.89	3.03	2.96
T_8 : Atrazine 0.75 kg ha^{-1} as PE *fb* Fenoxaprop at 67 g ha^{-1} + Metsulfuron 4 g ha^{-1} at 9 WAP	1.17	1.32	1.25
T_9 : Atrazine 0.75 kg ha^{-1} as PE *fb* paddy straw mulch 10 t ha^{-1} at 9WAP *fb* 1 HW at 12 WAP	2.96	3.32	3.14
T_{10} : Glyphosate 1.23 kg ha^{-1} as 10 DAP *fb* 1 HW at 12 WAP	3.01	3.29	3.15
T_{11} : Weed free	3.75	3.90	3.82
T_{12} : Weedy check	1.00	1.02	1.01
SEm±	0.05	0.07	0.08
CD at 5 %	0.15	0.21	0.23
General Mean	**2.67**	**2.85**	**2.76**

Fig.1 Effect of herbicides on gross and net monetary returns during 2012-13 and 2013-14
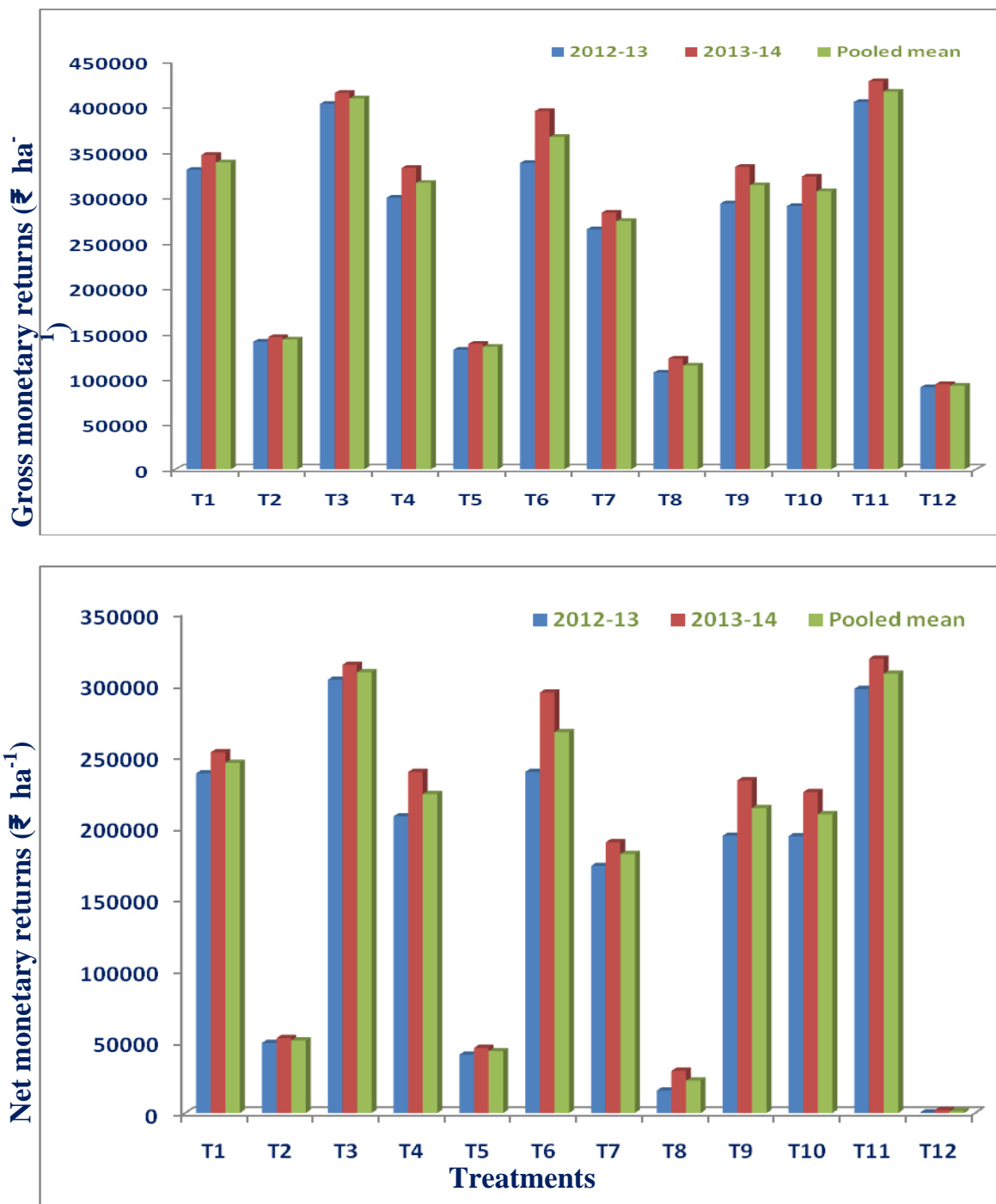
Net monetary returns (₹ ha^{-1})

The data on net monetary returns of turmeric was significantly influenced due to different weed control treatments during both the years and in pooled mean are presented in

Table 3. Application of metribuzine 0.7 kg ha^{-1} as PE *fb* paddy straw mulch 10 t ha^{-1} at 9 WAP *fb* 1 HW at 12 WAP reported significantly higher net monetary returns as compared with rest of the treatments during both the years and in pooled mean, however,

it was found at par with the cultural weed free treatment during both the years and in pooled mean. Significantly the lowest value for net monetary returns (₹ ha[-1]) was reported with the weedy check treatment during both the years and in pooled mean.

Benefit cost ratio

The benefit cost ratio of turmeric was significantly influenced due to different weed control treatments during both the years and in pooled mean. The data pertaining to benefit cost ratio of turmeric as influenced by different weed control treatments during both the years and in pooled mean are presented in Table 4.

The cost of cultivation values for turmeric were reported numerically maximum with the cultural weed free treatment and among herbicidal treatments, application of metribuzin 0.7 kg ha^{-1} as PE *fb* paddy straw mulch 10 t ha^{-1} at 9 WAP *fb* 1 HW at 12 WAP reported numerically maximum value for cost of cultivation as compared with rest of the herbicidal treatments during 2012-13, 2013-14 and in two years mean under study.

The cultural weed free treatment recorded significantly higher magnitude for gross monetary returns during both the years and in pooled mean. While, among the herbicidal treatments, application of metribuzin 0.7 kg ha^{-1} as PE *fb* paddy straw mulch10 t ha^{-1} at 9 WAP *fb* 1 HW at 12 WAP reported significantly higher net monetary returns and benefit cost ratio in turmeric as compared with rest of the treatments, however, it was found at par with the use of pendimethalin 1.0 kg ha^{-1} as PE *fb* paddy straw mulch 10 t ha^{-1} at 9 WAP *fb* 1 HW at 12 WAP and cultural weed free treatment during both the years and in pooled mean. Kiranjit Kaur *et al.,* (2008)

also reported that integrated use of paddy straw with either of metribuzin, pendimethalin or atrazine was adjudged very effectively for weed control and for attaining the highest productivity and profitability in turmeric.

Numerically minimum cost of cultivation and the significantly the lowest value for gross monetary returns (₹ ha[-1]), net monetary returns (₹ ha[-1]) and benefit cost ration was observed with the weedy check treatment during both the years and in pooled mean.

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