International Journal of Engineering Research & Management Technology

ISSN: 2348-4039

March-April- 2018 Volume 5, Issue-2

Email: editor@ijermt.org www.ijermt.org

EFFECTS OF HERBICIDE IN WEED MANAGEMENT IN CHHATTISGARH

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Abstract

In areas such as Chhattisgarh, where agriculture plays a significant role in the economy, weed control is an essential component of agricultural output. This is especially true in locations where agriculture is prevalent. Across a wide range of crops in Chhattisgarh, this study investigates the consequences of pesticide use in weed control strategies from a variety of perspectives. Herbicides, which are chemical agents, have been extensively utilized by farmers in order to control the spread of weeds, which, if left unchecked, can result in considerable output losses. The research investigates the effectiveness of various herbicides, as well as their influence on the health of crops, the quality of soil, and the overall productivity of agricultural production. The research also discusses the environmental repercussions of using herbicides for an extended period of time, such as the possibility of soil deterioration and the emergence of weed species that are resistant to herbicides. According to the findings, integrated weed management (IWM) tactics are extremely important. These strategies incorporate chemical, mechanical, and cultural approaches in order to limit the negative impacts of herbicides while retaining their efficacy. The purpose of this abstract is to highlight the need of using weed control strategies that are both sustainable and balanced in order to maintain the ongoing viability of agriculture in Chhattisgarh.

keywords: *herbicide, weed management,*

Introduction

The competition that weeds have with crops for vital resources like water, nutrients, light, and space is one of the most critical issues that agriculture faces. Weeds are a major problem in agriculture. The successful control of weeds is essential to the preservation and improvement of agricultural yield in Chhattisgarh, a state in which agriculture serves as the major means of subsistence for a significant section of the population. In large-scale farming operations, traditional techniques of weed management, such as human weeding and mechanical tillage, are frequently labor-intensive, time-consuming, and less successful than other alternatives. As a consequence of this, the application of chemical herbicides has become increasingly popular as a viable solution to the problem of weed management. The use of herbicides has a number of benefits, including the capacity to manage a wide variety of weed species, decreased labor costs, and greater efficiency. There are, however, concerns over the long-term consequences of chemical herbicides on the health of soil, the sustainability of the environment, and the development of herbicide-resistant weed species. This is because chemical herbicides are used so often. For the purpose of establishing weed control techniques that are both successful and sustainable, it is vital to have a thorough understanding of the implications of herbicide usage in Chhattisgarh, which is characterized by a wide variety of agricultural systems and distinctive ecological circumstances. A detailed study on the impacts of herbicides in weed management in Chhattisgarh is going to be conducted, and this introduction will lay the groundwork for that study. This study is to investigate the efficacy of herbicides in weed management, analyze the influence that herbicides have on crop production and soil quality, and examine the potential dangers that are connected with the use of herbicides when they are applied. A number of alternative and integrated methods of weed control will also be investigated as part of this project. These methods have the potential to reduce the adverse impacts of herbicides while also preserving agricultural output. By doing so, the research intends to make a contribution to the development of sustainable agricultural practices in Chhattisgarh. This will ensure that weed control tactics are in alignment with both economic and environmental objectives.

Materials and Methods

During the kharif seasons of 2016 and 2017, the experiment was carried out at the IGKV in Raipur (C.G.) in order to investigate the energy requirements and yield of the rice crop in Chhattisgarh under a variety of herbicide weed control strategies. In the experiment, there were ten different treatments, each of which was repeated three times using a randomized block design. The treatments were: pre-emergence application (PE) of pretilachlor 750 g/ha; post-emergence application (PoE) of bispyribac-sodium 25 g/ha, fenoxaprop-p-ethyl 56.25 g/ha PoE; cyhalofop-butyl 80 g/ha PoE; penoxsulam + cyhalofop-butyl (1.02 + 5.1%) (ready-mix) 135 g/ha PoE; penoxsulam 22.5 g/ha PoE; metsulfuron- methyl 20 g/ha PoE; 2,4-D ethyl ester 750 g/ha PoE; weed free by hand weeding thrice at 20, 40 and 60 days after seeding (DAS) and weedy check. A pre-emergence application of pretilachlor was carried out three days before an event. With the exception of penoxsulam, which was sprayed at 16 days after sowing, the post-emergence treatment of herbicides was carried out 22 days after the rice fields were planted. Table 1 (Singh and Mittal, 1992) [10] provides the energy values for the different inputs and outputs that were utilized in the experimental by Singh and Mittal. When calculating the overall energy input for a particular crop, the energy requirements for human labor, diesel, herbicides, seed, and fertilizers were added together in the order that they were included in the calculation. By dividing the total energy created from the main product and by-product by the total energy consumed for cultivating the crop in a unit area, the output: input ratio was calculated. This ratio was then used to determine the output: input ratio. Several alternative formulas were utilized in order to calculate the energy intake and output in Megajoules (MJ). It was determined that the energy efficiency (EE) was calculated in accordance with Dazhong and Pimental (1984).

$$EE = \frac{\text{Energy output (MJ/ha)}}{\text{Energy input (MJ/ha)}}$$

Energy output efficiency (MJ/ha/day) and energy productivity were calculated by:

$$\text{Energy output efficiency} = \frac{\text{Energy output (MJ/ha)}}{\text{Duration of the system (days)}}$$

$$\text{Energy productivity} = \frac{\text{Yield (kg/ha)}}{\text{Energy input (MJ/ha)}}$$

Results and Discussion

Energy input in rice production

The range of energy inputs for rice that were required in the various herbicide-based weed control strategies that were investigated in this study was between 11348.5 and 10547.26 MJ/ha. The fertilizer accounted for the largest proportion of energy input for all herbicide treatments, which was 68%. This was followed by the seed and sowing process, which accounted for 21%, field preparation, which accounted for 9.3%, and harvesting, which accounted for 1.6%. Under the conditions of penoxsulam 22.5 g/ha, the level of energy intake by herbicides was at its lowest (126.8 MJ). The treatment of hand weeding was found to have the highest energy input, followed by the treatment of penoxsulam and cyhalofop-butyl at a rate of 135 grams per hectare.

Table 1: Equations for a number of different types of energy sources

Particulars Inputs (MJ)	Units	Equivalent energy MJ
Human labour	Man-hour	1.96 Mittal *et al*, 1985 [7]
Diesel (3.5 lit/hours)	Litre	56.31 Venturi & Vanturi 2003 [11]
Cultivator	hr-1	220.00 Dagistant *et al*, 2009, Mittal *et al*, 1985 [2, 7]
Seeder	ha-1	338.83
Harvester	hr-1	151.64 MJ/ha Putri R E (2016) [8].
Rice	kg	14.7 Singh and Mittal 1992 [10]
Straw	kg	12.5 Yadav *et al*, 2013 [12]
Chemical fertilizer		
N	Kg	60.60 Baishya & Sharma
P2O5	Kg	11.10 Baishya & Sharma 1990 [1]
K2O	Kg	6.70 Mittal *et al*, 1985 [7]
Irrigation Each 7.5 cm Irrigation requires 10 hr/ha and Irrigation pump is of 15 hp		
(i) Man	Man-hour	1.96
(ii) Electricity	KWh	11.93/hours

(iii) Submersible pump	HP	68.4/hp
Herbicide	kg a.i	288 Kitani 1999

Energy output of rice crop under different herbicide based weed management practices

As a result of the grain yield of various herbicide-based weed control strategies, the total energy output was estimated, and it varied from 136018 to 143074.5 MJ/ha based on the production of two years (Table 4). Based on the average of two years, it was determined that the application of penoxsulam and cyhalofop-butyl at a rate of 135 grams per hectare of PoE resulted in the maximum overall energy yield.

Energy-output efficiency and energy productivity

Among the herbicide treatments, it was found that the application of penoxsulam+ cyhalofop-butyl 135 g/ha PoE resulted in the maximum energy output efficiency (1142.98 & 1091.79MJ/ha/day) for both years. This was the case for both years. On the other hand, when compared to other herbicide-based weed control approaches, the energy output efficiency of cyhalofop butyl 80 g/ha was shown to be less efficient (877.95 & 562.40 MJ/ha/day). With penoxsulam and cyhalofop-butyl at a rate of 135 grams per hectare, the highest energy productivity was achieved. This may be attributed to the greater grain production.

Table 2: How much energy is required to cultivate rice in Chhattisgarh using various herbicide-based weed control methods

Particulars	Unit required	Total energy MJ
Field preparation tractor	per ha	
2 Ploughing	4 hours	880
Diesel consumption	3.5 lit/ha	14
Driver	4 hours	78.4
	Sub total	975.9
Seed and sowing		
Rice	100 kg	147.0
Seed drill	2 hour	377.66
Diesel consumption	3.5 lit/ha	1225.0
Driver	2 hour	39.2
	Sub total	2193.86
Fertilizer		

Nitrogen 80 kg/ha	60.60/kg		6060
P2O5 50 kg/ha	11.10		666
K2O 80 kg/ha	6.7		268
Split application			
Labour	2		98
	Sub total		7092
Harvester 1 hour	151.64 / hours		151.64
Driver	1.96 /hours		19.6
	Sub total		171.24
	Grand total		10429.5
Treatment Herbicide application	2 Labours per application		98
	a.i.	Product	
Pretilachlor	750 g/ha	1500 g/ha	530
Bispyribac sodium	25 g/ha	250 g/ha	170
Fenoxaprop-p-ethyl	56.25 g/ha	600 g/ha	270.8
Cyhalofop Butyl	80 g/ha	800 g/ha	328.4
Penoxsulam + Cyhalofop	235 g/ha	2205 g/ha	733.04
Penoxsulam	22.5 g/ha	100 g/ha	126.8
Metsulfuron methyl	4 g/ha	20 g/ha	103.76
2,4-D Ethyl Ester	750 g/ha	1290 g/ha	469.52
Hand weeding		38 labour	1862

Table 3: Rice crop energy input requirement, straw production, and grain yield in Chhattisgarh under various herbicide-based weed control techniques

Treatment	Grain yield (t/ha)	Straw yield (t/ha)	Input Energy (MJ/ha)

	2016	2017	2016	2017	Treatment	Total
Pretilachlor 750 g ha^{-1} PE	3.83	2.94	4.99	4.45	530.00	10959.50
Bispyribac sodium 25 g ha^{-1} PoE	4.63	4.25	5.84	5.38	170.00	10599.50
Fenoxaprop-p-ethyl 56.25 g ha^{-1} PoE	3.74	2.29	4.95	3.53	270.80	10700.30
Cyhalofop Butyl 80 g ha^{-1} PoE	3.64	2.04	4.85	3.27	328.40	10757.90
Penoxsulam + Cyhalofop 135 g ha^{-1} PoE	5.04	4.63	5.96	5.56	733.40	11162.90
Penoxsulam 22.5 g ha^{-1} PoE	4.65	4.14	5.85	5.31	126.80	10556.30
Metsulfuron methyl 4 g ha^{-1} PoE	3.96	3.56	5.12	4.73	103.76	10533.26
2,4-D Ethyl Ester 750 g ha^{-1} PoE	4.04	4.00	5.15	5.14	469.52	10899.02
hand weeding 38 labour ha^{-1}	5.08	4.98	6.00	5.92	1862.00	12291.50
weedy check	1.78	1.94	2.96	2.13	-	11348.5

Table 4: Rice crop energy output in Chhattisgarh under various herbicide-based weed control strategies

Treatment	**Output energy (MJ/ha)**					
	Grain yield		**Straw yield**		**Total output**	
	2016	**2017**	**2016**	**2017**	**2016**	**2017**
Pretilachlor 750 g ha^{-1} PE	56301	43218	62375	55625	118676	98843
Bispyribac sodium 25 g ha^{-1} PoE	68061	62475	73000	67250	141061	129725
Fenoxaprop-p-ethyl 56.25 g ha^{-1} PoE	54978	33663	61875	44125	116853	77788
Cyhalofop Butyl 80 g ha^{-1} PoE	53508	29988	60625	40875	114133	70863
Penoxsulam + Cyhalofop 135 g ha^{-1} PoE	74088	68061	74500	69500	148588	137561
Penoxsulam 22.5 g ha^{-1} PoE	68355	60858	73125	66375	141480	127233

Metsulfuron methyl 4 g ha^{-1} PoE	58212	52332	64000	59125	122212	111457
2,4-D Ethyl Ester 750 g ha^{-1} PoE	59388	58800	64375	64250	123763	123050
hand weeding 38 labour ha^{-1}	74676	73206	75000	74000	149676	147206
weedy check	26166	13818	37000	26625	63166	40443
Note - Equivalent Energy (MJ) for rice grain = 14.7 /kg and straw = 12.5/kg						

Table 5: Energy efficiency, energy output efficiency, and energy productivity of rice crops in Chhattisgarh when managed using various herbicide-based weed control methods

Treatment	Energy efficiency (MJ/ha/day)		Energy output efficiency (MJ/ha/day)		Energy productivity (Kg/MJ)	
	2016	2017	2016	2017	2016	2017
Pretilachlor 750 g ha^{-1} PE	10.83	9.02	912.89	784.47	0.35	0.27
Bispyribac sodium 25 g ha^{-1} PoE	13.31	12.24	1085.08	1029.56	0.44	0.40
Fenoxaprop-p-ethyl 56.25 g ha^{-1} PoE	10.92	7.27	898.87	617.37	0.35	0.21
Cyhalofop Butyl 80 g ha^{-1} PoE	10.61	6.59	877.95	562.40	0.34	0.19
Penoxsulam + Cyhalofop 135 g ha^{-1} PoE	13.31	12.32	1142.98	1091.75	0.45	0.41
Penoxsulam 22.5 g ha^{-1} PoE	13.40	12.05	1088.31	1009.79	0.44	0.39
Metsulfuron methyl 4 g ha^{-1} PoE	11.60	10.58	940.09	884.58	0.38	0.34
2,4-D Ethyl Ester 750 g ha^{-1} PoE	11.36	11.29	952.02	976.59	0.37	0.37
hand weeding 38 labour ha^{-1}	12.18	11.98	1151.35	1168.30	0.41	0.41
weedy check	5.57	3.56	485.89	320.98	0.16	0.17

Conclusion:

Herbicides have become an integral part of contemporary agriculture in Chhattisgarh as a whole, providing farmers with a practical and economical way to control weeds and increase crop yields. Chemical herbicides are replacing more labor-intensive manual weeding methods, which mirrors regional tendencies toward agricultural intensification and the pursuit of greater output. But there are serious worries about the extensive and perhaps careless use of herbicides as well. The sustainability of agricultural operations is threatened by issues such as the emergence of herbicide-resistant weed species, the possible deterioration of soil health, and the detrimental effects on local biodiversity. A well-rounded strategy for weed control is essential in light of these difficulties. Integrated weed management (IWM) strategies must be promoted if Chhattisgarh's agriculture is to remain sustainable in the long run. Industrial weed management (IWM) provides a more comprehensive and long-term solution by integrating chemical, mechanical, and cultural weed control strategies. To ensure the continued success of agriculture in the region, it is crucial to teach farmers to use herbicides wisely and to promote the use of other methods of controlling weeds. To sum up, herbicides are an essential tool for contemporary weed control, but they need to be used with caution and in tandem with other methods to lessen their bad effects on the environment and guarantee that agriculture in Chhattisgarh may continue in the future.

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