

## ISSUES RELATED TO WEED CONTROL FACED BY PADDY FARMERS IN HAMBANTOTA DISTRICT OF SRI LANKA

J.H.D Chamara<sup>1</sup>, C.S De Silva<sup>2</sup>

### ABSTRACT

*Rice is the most important staple crop in Sri Lanka but farmers face several problems in cultivating their crop and achieving a profitable yield. Weeds are a major problem in paddy cultivation since time immemorial. Farmers use many weed control methods in their rice cultivation- herbicides are the main factor for weed control. However, poor weed control, newly emerging weeds, herbicide-resistant biotypes of weeds, environmental and human health issues related to herbicide use, have become major drawbacks to rice cultivation in Sri Lanka.*

*This study was conducted to examine the problems faced by farmers in paddy cultivation in Beliatta, Walasmulla and Okewela Agrarian Service Divisions in the Hambantota District of Sri Lanka. In total, 300 farmers were used to complete the questionnaire and field experiments to study weed abundance and types. According to the results, even though majority of the farmers (52%) were under major irrigation schemes, they have not used water for weed control. Majority of the farmers were using Rotary plough for land preparation even though Mould board plough is the most effective equipment to control weed during land preparation.*

*Only 50% of the farmers keep a 5-14 day gap between the 1<sup>st</sup> and 2<sup>nd</sup> land preparation which is important to control weeds. Most of the farmers have used self-seed paddy and broadcasting methods for sowing the seeds which makes effective weed control difficult. Majority of the farmers use chemical weed control and used Clomazone 200g/l+Propanil 400g/l EC (23.3%) and Pretilachlor300g/l EC (32.3%) in higher percentages. Farmers used to tank mix Carfentrazone-ethyl 240g/l EC (43.3%) with another herbicide without proper knowledge on active ingredients and mode of action which may lead to health hazards.*

*Therefore, this study recommends that awareness programmes need to be introduced to Agricultural officers and farmers before the commencement of cultivation on effective weed control from land preparation stage and effective usage of herbicides.*

**Key words:** Rice, weeds, cultural practices, herbicides

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<sup>1</sup>Rice Research Station, Ambalanthota

<sup>2</sup>Department of Agricultural and Plantation Engineering, OUSL

## INTRODUCTION

Rice (*Oryza sativa* L) is a major staple food in Sri Lanka. It is also an important food in Asia and the world, where approximately 90% of the rice is produced and consumed and where 60% of the Earth's people live (Khush, 2004). Rice accounts for over 70% of the daily calorie intake in countries such as Bangladesh, Cambodia, Laos and Myanmar (Anchal *et al*, 2017) which consists of three billion Asians.

Rice is planted in about 148 million hectares annually, or 11% of the world's cultivated land. Rice is the only major cereal crop that is consumed almost exclusively by humans. The world's rice production was 728 million tons in 2018. China, the largest producer, produced 203 million tons followed by India (163 million tons).

Weed is considered as one of the biotic factors and it is a major problem in rice cultivation. Weed cause serious yield losses in rice production in the range of 30% - 40% (Ratnasekara, 2015). Rice yield loss due to weed, depends on the weed species and dominant nature.

There are few dominant weed species found in rice fields in Sri

Lanka such as, *Echinochloa crusgalli*, *Ischaemum rugosum*, *Isachne globose*, *Cyperus iria*, *Cyperus difformis* and *Cyperus rotundus*. Weed distribution is the result of a compound influence of ecological and human factors. The composition of the weed flora may differ depending on location (Shannon, 1998), water supply cultural practices (Peng *et al*, 2004), the inherent weed flora in the area and the type of crop grown.

Weed management strategies can be categorized into cultural, mechanical, biological and chemical practices. Weed control using herbicide is the most popular method among farmers. Globally, herbicides have become dominant in the market where they contribute to 60% of total agro chemical imports (Ampon and De Datta, 1990). However, dependence on herbicide increases the cost of production, enhances environmental pollution and accelerates the process of evolution of herbicide resistant weeds.

Especially, in direct seeded rice cultivation, effective weed control requires proper herbicide application techniques which are often not met, resulting in poor weed control. Most farmers were using this method for controlling weeds in rice cultivation. Rice cultivation in Sri Lanka mainly

depends on major, minor and rainfall irrigation systems.

In a herbicide dominant system, overall weed control efficacy could be improved by selecting suitable herbicides with a combination of proper usage practices. Some grasses are resistance to some herbicides.

As an example, low land rice cultivation in Sri Lanka was reported to have developed a resistance to propanil (Herath, 2017). However, information on herbicide use and herbicide resistance is limited and awareness on such is not satisfactory in Sri Lanka. More attention is required for proper herbicide usage in rice to achieve effective weed control while minimizing the development of herbicide resistant weeds.

Most farmers do not have sufficient knowledge about herbicides. Most of the time, the choice of herbicides are made by Agrochemical retailers in the area who run chemical shops. Thus, farmers usually don't pay much attention in reading the label regarding modes of action and recommendations of the herbicides. Therefore, it is important to examine the level of understanding and the current knowledge of farmers in the practices of herbicide usage and

weed diversity pattern.

This information is very important for effective weed management in rice eco systems. Further, it is important for directing future research and educational priorities. Thus, a survey was conducted to study the current problems faced by farmers in rice cultivation such as practices on herbicide usage, their awareness on herbicide usage and recommendations, land preparation, sowing and water management methods to control weeds.

In addition, field surveys were conducted to identify the weed diversity pattern of farmer's fields such as the most abundant weed variety. It was noted that they mostly used herbicide for controlling weeds. Based on the findings, the most important aspects for future research were the health issues faced by humans. Further, recommendations for farmers will also be developed.

## METHODOLOGY

### Location

The study was conducted in three agrarian service divisions (ASDs) namely Beliatta, Okewela and Walasmulla from Hambantota District. The ASDs have major, minor and rain-fed water systems for the cultivation of paddy. The

paddy land extent in Beliatta ASD is 1581ha, Okewela is 771.4ha and Walasmulla is 1191ha (Department of Census and Statistics, 2019). This area was located in the IL1B agro ecological region.

## Sampling

The survey was divided into two parts, in the first part a primary survey was conducted among farmers on herbicide usage in these three ASDs and in the second part, it was to quantify the weed diversity in rice fields.

The primary survey was conducted using 300 randomly selected farmers during the 2019 *yala* season. 100 farmers were selected in one Agrarian Division for the questionnaire survey.

The secondary survey was to quantify the weed diversity of farmer's fields. For that, 10 farmers were randomly selected from the above 100 farmers in one agrarian division. This was done in all three agrarian divisions.

## Data sources and method of data collection

Primary data was collected using a questionnaire, this questionnaire contained structured and semi-structured questions and pre-tested

to achieve the set objectives. Data was collected through a farmer survey by face to face interviews. Collected data included date of application, herbicides in use, type of herbicides, information on application of two or more herbicides together and their combinations, dose and frequency of herbicides applied, type of equipment used for application, most problematic weed flora in the system, remaining weed species after herbicide application and finally, weed control efficacy of herbicides.

The secondary survey was in farmer fields during the 2019 *yala* season. For these, 100 farmers in one agrarian division were randomly selected. In one farmer's field, one square meter plot was randomly marked. A one square meter wood frame was used to mark the plot. The frame was thrown away from the middle of the farmer's field and all weeds were collected from the falling point of this field. Then, weeds were separated in to grasses, sedges and broad leaves. The weeds dried weight was taken after drying for 10 days. In one field, three plots were surveyed as replicates by this method. Finally, the average dry weight was measured.

## Data analyzing

Data was analyzed using SPSS data

analyzer. Descriptive analysis was used to examine the different socio-factors of paddy farmers in Beliatta, Okewela and Walasmuula ASDs about weeds and the use of herbicide. Chi square( $\chi^2$ ) tests were used for quantitative data analysis to show associations.

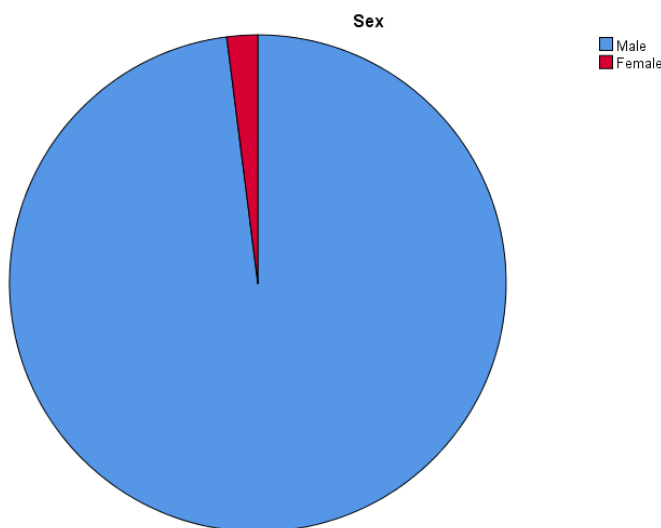
support the rice production in this area. Most of the farmers were living in the village, so that they can easily cultivate their land and maintain the cultivation. Farmers could conduct field practices at any time in the day such as water management.

## RESULTS AND DISCUSSION

### GENERAL BACKGROUND INFORMATION OF THE FARMERS

#### Gender

According to the data presented in Figure 1, 98% of farmers were male and only 2% were female in the study area. Males mostly

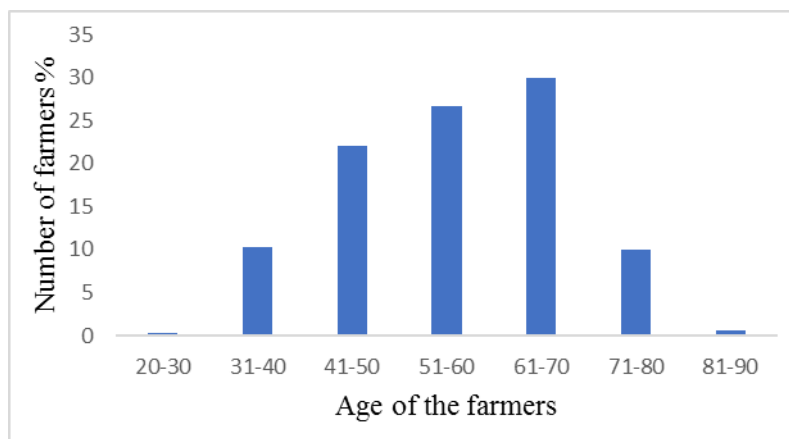


*Figure 1: Distribution of Male and Female farmers in the study area.*

## Age of the farmers

According to the data presented in Figure 2, the largest age group is 61 – 70 years (30%) and smallest

age group is 81 – 90 years (0.7%). The farmers involved in cultivation, in the study area were from the 61 – 70 years' age group.



*Figure 2: Age level of the farmers in the study area.*

## Educational qualification of the farmers

According to the data presented in Figure 3, farmer education levels were different. Majority of the farmers have studied up to grade 5 (30.7%). Education level of the farmers with no education was 7%, grades 6 – 10, 24%, O/L's,

21.3%, A/L's, 14.3%, Diploma, 1.7% and Degree, 1%. Majority of the farmers had education until 1 – 5 grade level. Educated farmers were less in the study area. Therefore, they were not using any new technologies for rice cultivation and weed control.

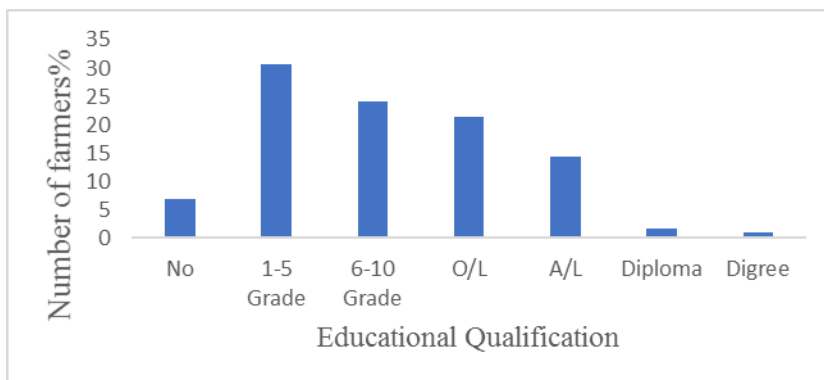


Figure 3: Education qualifications of the farmers in the study area.

**INFORMATION OF AGRICULTURAL PRACTICES**

**Irrigation system of the rice cultivation**

According to data presented in Figure 4, it is clearly seen that the largest number of farmers (52.3%) was under major irrigation

schemes in this area. Only 34.7 % were under minor irrigation schemes. The remaining 13% were rain-fed farmers. Under the major irrigation scheme, water was available and farmers used it for weed control. However, most farmers did not use water for weed control because of poor knowledge.

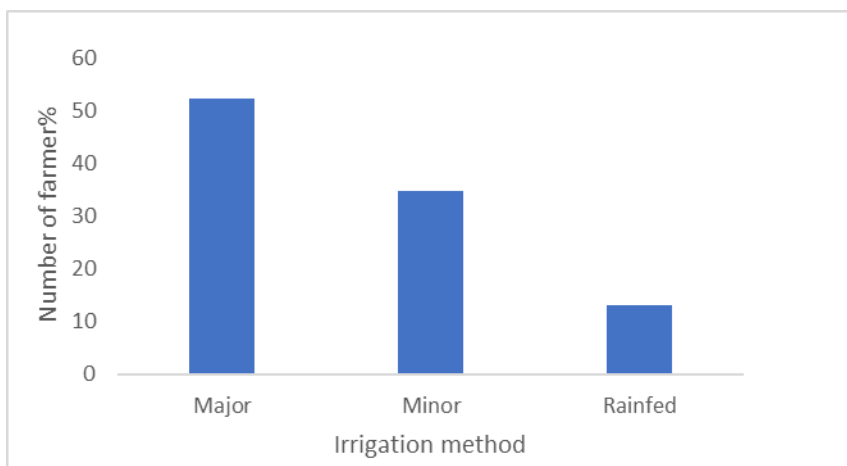


Figure 4: Irrigation system of rice fields in the study area

## Land preparation

According to the data presented in Table 1, around 236 farmers used rotary ploughs for the first land preparation in this study area. However, it is not considered a good practice for first land preparation- mould board ploughs are the most suitable equipment for this preparation. Only 59 farmers used mould board ploughs

for first land preparation. Out of 300, only 141 farmers kept a 5 to 14 days gap between the 1<sup>st</sup> and 2<sup>nd</sup> land preparation. This is the most suitable method for controlling weeds in rice fields. One of the main problems observed in the study area was not using the correct plough in rice fields because mould board ploughs are the more effective tool in controlling weeds during land preparation.

*Table 1: Information on type of tractor, type of plough and Gap between of 1 and 2 land preparation*

Gap between 1st and 2nd Land Preparation	Type of Tractor	Type of plough			Total
		Rotary	Spike tooth harrow	Mould board	
up to 5 days	Two-wheel tractor	5	4	4	13
	Four-wheel tractor	11		0	11
	Total	16	4	4	24
between 5 -14 days	Two-wheel tractor	44		42	86
	Four-wheel tractor	140		1	141
	Total	184		43	227
between 15 -21 days	Two-wheel tractor	15	1	12	28
	Four wheel tractor	21	0	0	21
	Total	36	1	12	49
Total	Two-wheel tractor	64	5	58	127
	Four-wheel tractor	172	0	1	173
	Total	236	5	59	300



## Use of seed paddy

According to the data presented in Table 2, majority of the farmers (210) were using At 362 (3.5 month) paddy variety and 55 farmers were using 4 month At 362 variety. Only 35 farmers used

other paddy varieties for their cultivation. Further, only 72 farmers used government seed paddy where 119 and 109 farmers were using self-seed paddy and private company seed paddy, respectively. Self-raised seed paddy may contain more weed seeds than government certified seed paddy.

*Table 2: Information on source and variety of seed paddy and duration of crop.*

Source	Variety of seed paddy	Age(Month)			Total
		3.5 month	4 month	4.5 month	
Self Seed paddy	At 362	112	0	0	112
	Bg 366	3	0	0	3
	Bg 379/2	0	1	3	4
	Total	115	1	3	119
Private	At 362	98	0	0	98
	Bg 366	7	0	0	7
	Bg 379/2	0	3	1	4
	Total	105	3	1	109
Government	At 362	0	55	0	55
	Bg 300	1	3	0	4
	Bg 366	0	11	0	11
	Bg 379/2	0	0	2	2
	Total	1	69	2	72

### Land preparation and sowing method

According to data presented in Table 3, wood levelers were used by a majority of farmers (98.7%) and is considered a good practice in paddy cultivation. According to Table 4, sowing was done by

broadcasting, by 98.3% of farmers for paddy cultivation in the study area. Usually the weed population is very high in broadcasted paddy cultivation. Transplanting is the best method of controlling weeds because removal of them is easier by using weeders.

Table 3: Method of land leveling.

	Frequency	Percent	Valid Percent	Cumulative Percent
No response	3	1.0	1.0	1.0
Wood leveler	293	97.7	97.7	98.7
Not leveling	4	1.3	1.3	100.0
Total	300	100.0	100.0	

Table .4: Method of cultivation

	Frequency	Percent	Valid	Cumulative Percent
Sowing	295	98.3	98.3	98.3
Transplant	1	0.3	0.3	98.7
Parachute	4	1.3	1.3	100.0
Total	300	100.0	100.0	

### INFORMATION OF THE WEEDS

#### Major weeds species in Study area

Weeds are the major problem in this area. According to data

presented in Figure 5, weed's species *Echinochloa crus-galli* (75%) is the highest grass in the field. Second most problematic weeds are sedges, *Ischaemum rugosum* (73.7%) followed by *Isachne globose* (64.7%). These weeds are grass type.

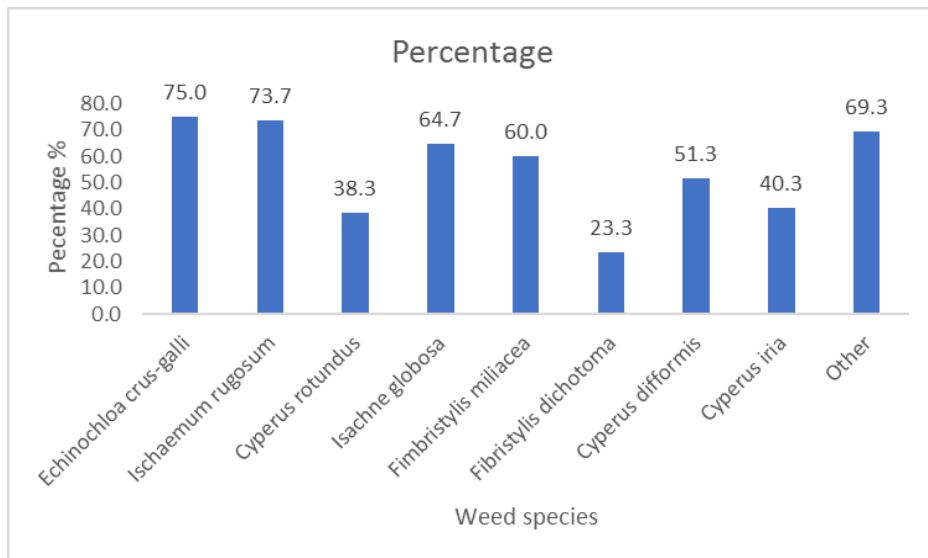


Figure 5: Major weed species in Study area

### Weed control methods

According to data presented in Figure 6, most of the farmers (96%) use herbicides for weed

management. Most of them do not use other weed controlling methods. Therefore, herbicide usage was high in this study area.

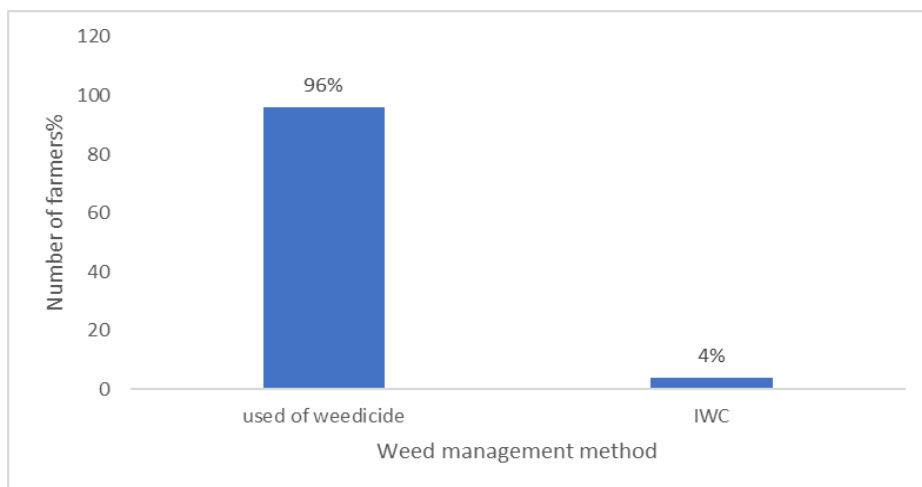
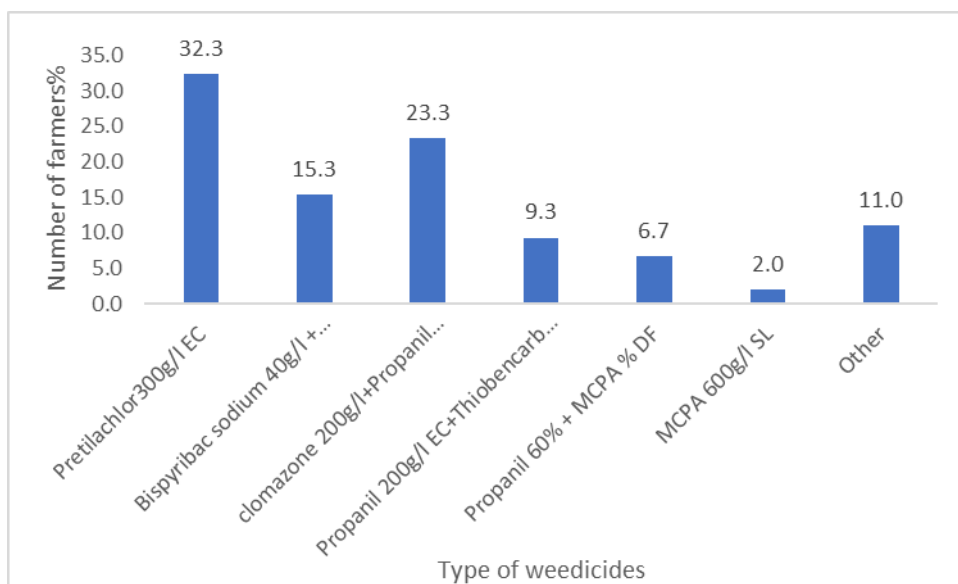


Figure 6: Weed control methods

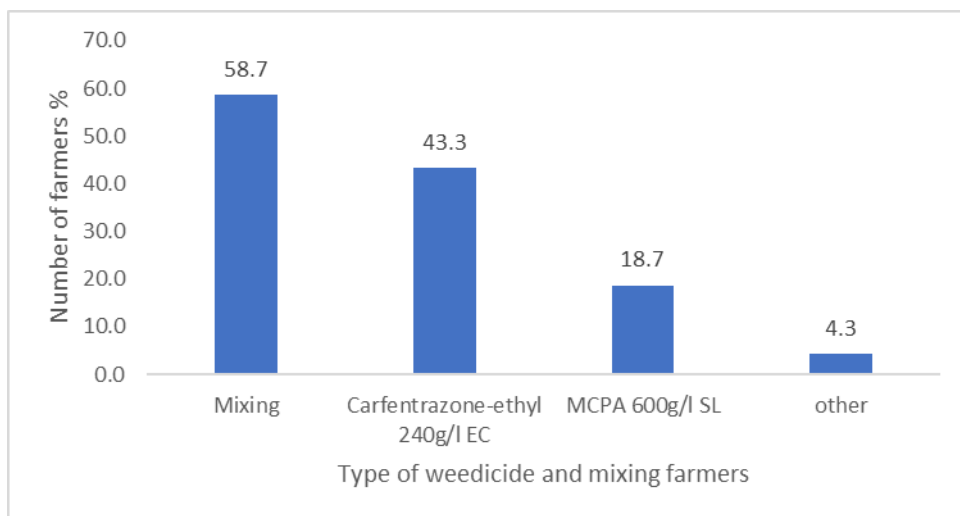
## Herbicide usage

According to the data presented in Figure 7, farmers used more than six herbicides to control the weeds in their paddy fields. Pretilachlor 300g/l EC was used by 32.3% of the farmers while Clomazone 200g/l+Propanil 400g/l EC was used by 23.3% of the farmers.

According to data presented in Figure 8, majority of the farmers are tank mixing herbicides with another herbicide (58.7%). Mostly, Carfentrazone-ethyl 240g/l EC is mixed with many chemicals in rice cultivation. But 43.3% of the farmers used Carfentrazone-ethyl 240g/l EC alone and 18.7% of farmers used MCPA 600g/L SL. Only 4.3% of farmers use other herbicides.



*Figure 7: Herbicide usage*



*Figure 8: Herbicide usage and Tank mixing*

### Inefficiency in weed control

According to data presented in Figure 9, there are two types of weeds which are not controlled by herbicides. These weed species are *Ischaemum rugosum* (57.3%) and *Echinochloarus-galli* (49%) which are major grasses in the field. The second most problematic weeds are sedges which are seen in a higher percentage in this study area. Most of the farmers use a lot of herbicides and mixtures of herbicides but are unable to control these two types of weeds, in this study area. This may be due to the poor efficacy of herbicides and/or due to the combining effect of the selection of proper herbicides, misuse, mispractices

of herbicides and other management practices adopted by the farmers (Herath *et al* 2017).

broadcasting method of sowing

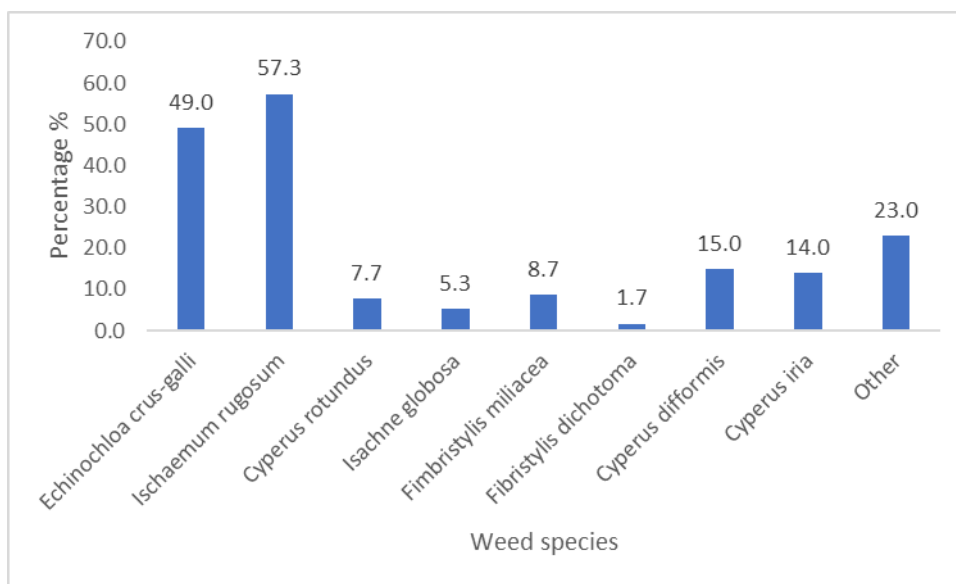


Figure 9: Inefficiency in weed control.

## CONCLUSIONS AND RECOMMENDATIONS

Weed control is a major problem in paddy cultivation in the Hambantota District. A study conducted in farmer's fields revealed that the farmers are not using water for weed control even though most of the farmers are under the major irrigation scheme.

Further, a majority of the farmers are using self-raised seed paddy which tend to have more weed seeds. A majority of farmers also use the rotary plough which is ineffective compared to the mould board plough to control weeds.

Majority of the farmers use

and weed control is made more difficult than in transplanted paddy cultivation. *Echinochloa crus-galli* and *Ischaemum rugosum* are the most abundant weeds in these three ASDs in the Hambantota district. These are the two types of weeds which are the most problematic in this area.

A Majority of farmers use chemical herbicides to control weeds. Most of the farmer's tank mix two or three type of herbicides to destroy weeds. However, most of them have poor knowledge about weeds and herbicide. They mix the herbicides due to their poor knowledge on the active ingredients of these chemicals. Farmers are unaware about the mode of action of the herbicides and what types of weeds are destroyed by a particular type of

herbicide.

Therefore, there is an urgent need to conduct awareness programs for all field level agriculture extension officials and farmers on the proper usage of herbicides.

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