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Research Article

PRODUCTIVITY LOW LAND RICE (*Oryza stativa* L.) IN 'SOBARI' ON VARIOUS WEED CONTROL

SUMEKAR YAYAN*, WIDAYAT DEDI, UMIYATI UUM, MUBAROK SYARIFUL AND KURNIADIE DENNY

Department Agronomy, Faculty of Agriculture, Universitas Padjadjaran, Sumedang, 45363, Indonesia
*Corresponding Author: Email-yayan.sumekar@gmail.com

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Abstract- Weed in rice cultivation SOBARI (System of Organic Base on Aerobic Rice Intensification) is an important issue and necessary to receive special handling. The objective of this study was to find ways the most effective weed control and efficient in rice cultivation on SOBARI system. Experiments conducted in paddy fields SPLPP Faculty of Agriculture, University of Padjadjaran in Ciparay. The method used was experimental method with Simple Randomized Block Design (RBD) consisting of 6 treatments and repeated 4. Treatment trials are as follows: A = Without Weeding, B = weeding manually 2 times at 15and 30 DAP, C = weeding manually 3 times at15, 30 and 45 DAP, D = Herbicides Methyl metsulfuron+ 2,4-D, E = Herbicides Bispyribac-Sodium, F = Herbicides Penoxsulam Cyalofop-butyl. The results showed that the use of 2,4-D Methyl metsulfuron, Bispyribac-Sodium and Penoxsulam Cyalofop-butyl suppressed the growth of broadleaf weed, grasses, and sedges that had a similar effect with Weeding manually for 3 times. Weed control manually 3 times on paddy rice cultivation with planting system SOBARI give good influence on the growth and yield components and provide rice yield of 7,13 tons per ha.

Keywords- Rice cultivation, Rice yield, SOBARI, Weed control.

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Introduction

Rice (*Oryza sativa* L.) is a very strategic food commodity in terms of economic, social and political. At this time, the increasing demand for rice continues to rise in line with the development of population [1]. According to the Central Bureau of Statistics [2], Indonesia's population growth rate in 2010 is 1,49 % while the rate of increase in rice production in 2013-2014 actually decreased by 0,94%. In order to offset the need for food, efforts to increase rice production need special attention. Many efforts have been made in order to improve rice production yield, but have not succeeded to produce the maximal level of production, not yet effective. SOBARI (System of Organic Base on controlled Aerobic Rice Intensification) is one of the rice production system that can increase 50-100% yield depending on variety and environment [3,4]. This technology is water-efficient, inorganic seeds and fertilizers with a focus on the utilization of soil biological strength, crop management, fertilization and water system in an integrated and planned to support and maximize the growth and development of rice plants optimally in aerobic conditions. In rice cultivation SOBAR luses a wide plant spacing, water tracing and young seedlings (7-14 days). The use of wide spacing resulted in higher weed growth than narrow plant spacing [5]. Water will stimulate weed growth compared to degraded land [6]. In addition, the use of young seeds, causing the interaction of rice plants with weeds in the critical period will be longer. Weed growth in rice plant cultivation of SOBARI is an important issue that needs special handling. Weeds interact with plants through competition to get one or more limited growth factors, such as light, nutrients, and water. The degree of competition depends on rainfall, varieties, soil conditions, weed density, weed growth, and plant age when weeds begin to compete [7]. Due to competition with weeds, rice planting can reduce yield by 30 to 47% [8]. In an effort to increase rice production, weed control plays an important role to eliminate the adverse effects it causes. Various attempts to control weeds in rice crops have been commonly carried out such as mechanical weed control and chemically or a combination of both. Along with that, in order to obtain high rice yields at relatively low cost, it is necessary to conduct research on the productivity of rice cultivation of SOBARI system in various ways of weed control. This study aims to find ways of controlling the most effective and efficient weeds in the cultivation of rice crops with SOBARI. The results of this study are expected to provide information for all interested parties regarding weed control techniques and can provide high yields at low cost.

Materials and Methods

The experiment was conducted in paddy fields SPLPP Faculty of Agriculture, University of Padjadjaran at Ciparay, Bandung, Indonesia at an altitude of 625 m above sea level with the Inceptisol soil type. Materials used in this study are seeds of lowland rice (*Oryza sativa* L.) *cv*. Ciherang, with organic fertilizer, inorganic fertilizer, metsulfuron Methyl herbicide + 2,4-D (Ally Plus), herbicide Bispyribac-Sodium (Nominee), and Penoxsulam herbicide + Cyalofop (Top Shoot). The research method used is experimental method with Randomized Block Design (RBD) consisting of 6 treatments and 4 replications. The size of each experimental plot was 5 x 6 m. Treatment experiment is: A = Without weeding, B = weeding manually 2 times (15 and 30 DAP), C = weeding manually 3 times (15, 30, and 45 DAP), D = Herbicides Methyl metsulfuron+ 2, 4-D, E = Herbicide-Sodium Bispyribac at 15 DAP, F = Herbicides Penoxsulam + Cyalofop-butyl at 15 DAP. The main observations were the percentage of weed cover, weed weight. As for the observation of responses in rice plants include: plant height, number of vegetative tillers, number of generative tillers, thousand grain weight (g), weight of grains per panicle, percentage of grain pithy and yield per plot. For statistical analysis, differences between treatments were tested using F test, whereas the test of difference of mean value of treatment was used Duncan test at 5% significance level.

Results and Discussion

Observation of Weeds

Type of Weed Before Trial

Vegetation analysis result before the experiment, it is known that SDR Broadleaf weeds group were 42,32%, consisted of grasse 39,17% and sedges 18,51%. The dominant weed species in the experimental field were *Ludwigia adscendens* (L.) Hara. (SDR = 28 ,84%), *Cynodondactylon* (L.) Press. (SDR = 22, 81%) and, *Fimbristylis aestivalis* (Retz) Vahl. (SDR = 14, 35%). From data, it can be seen that the predominant weeds before the experiments were widely-leaf weed, especially *L. adscendens* (L.) Hara.

Dry weight of broadleaf weeds

Result of analysis of dry weight of broadleaf weeds as a result of treatment showed that there were significant differences between treatments, especially on observations of 30, 45 and 60 DAP, while at 15 DAP, there was no difference between treatments. This is due to the observation of 15 DAP has not been implemented, so that there is no influence from the treatment, whereas at 30 DAP, the effect of treatment has responded to the weeds dry weight of the broadleaf weed. Without weed control we produce the highest weights of weeds of broadleaf weeds that are very high and distinctly different from other treatments. While manual weeding 3 times (C) gives an effect that is not different from the application of Methyl Metsulfuron herbicide (D). This is in line with Roshid's statement which reveals that methyl metsulfuron herbicide is effective for controlling wide leaf weeds and grass weeds [9].The treatment of Bispyribac-Sodium herbicide (E) and Penoxsulam + Cyalofop-butyl (F) gave no significant effect to the treatment of weeding 2 times (B) to the leaf weed [Table-1].

Table-1 *Effect of Weed Controling on the Dry Weeds of Broadleaf Group on Rice Field in SOBARI*

Treatment	Dry Weight of Broadleaf Weed (g)							
	15 DAP		30 DAP		45 DAP		60 DAP	
A (Control/without weeding)	0,80	a	4.03	b	13,32	b	18,45	c
B (weeding manually 2 times)	0,39	a	1,52	a	3,87	a	7,56	b
C (weeding manually 3 times)	0,23	a	0,59	a	2,43	a	3,14	a
D (Methyl metsulfuron +2,4-D)	0,48	a	0,13	a	2,93	a	3,23	a
E (Bispyribac-Sodium)	0,34	a	0,46	a	3,13	a	5,00	ab
F. (Penoxsulam + Cyalofop-butyl)	0,51	a	0,33	a	3,05	a	5,05	ab

Note: The average value followed by the same letter in the same column indicates no significant difference according to DMRT test at 5%

Dry weight of grasses weeds

The result of statistical analysis on grass weed weight as a result of treatment can be seen in [Table-2]. Treatment of manual weeding 3 times (C) gives no different effect with Bispyribac-Sodium (E) and Penoxulose + Cyalofop-butyl (F). Weeds and weigh more emphasis than other treatments. This shows that the application of Bispyribac-Sodium (E) and Penoxulose + Cyalofop-butyl (F) were effective for weed control that was similar effect with weeding manually for 3 times (C). The herbicide treatment of Methyl metsulfuron + 2,4-D (C) more effective than control manual weeding treatment for 3 times (C).

Table-2 *Effect of Weed Controlling on the Dry Weeds of Grasses Group on Rice Field in SOBARI*

Treatment	Dry Weight of Grasses Weed (g)							
	15 DAP		30 DAP		45 DAP		60 DAP	
A (Control/without weeding)	0,37	a	4.42	b	13.44	b	15,45	c
B (weeding manually 2 times)	1,39	a	1,62	a	2,87	b	7,33	b
C (weeding manually 2 times)	1,42	a	2,57	a	2,33	a	2,14	a
D (Methyl metsulfuron +2,4-D)	0,53	a	2,43	a	3,93	b	5,23	b
E (Bispyribac-Sodium)	0,41	a	2,56	a	3,24	ab	4,12	ab
F. (Penoxsulam + Cyalofop-butyl)	1,05	a	1,62	a	3,77	ab	4,33	ab

Note: The average value followed by the same letter in the same column indicates no significant difference according to DMRT test at 5%

Dry weight of sedges weeds

All the treatment gave a good effect on dry weight of sedges weeds. Weeding treatment of 2 and 3 times have a similar effect with herbicide application treatments yield sedges weeds and showed not different of each other's, except with treatment without weeding (A) [Table-3]. This is due to weeds that exist in the research field was small as can be seen in the vegetation analysis. The low growth of weeds of the sedges group was also influenced by the shade effect as rice grows higher and larger, this can be due to weeds of the sedges group is one type of plant that is not resistant to shade [10].

Table-3 *Effect of Weed Controlling on the Dry Weeds of Sedges Group on Rice Field in SOBARI*

Treatment	Dry Weight of Sedges Weed (g)							
	15 DAP		30 DAP		45 DAP		60 DAP	
A (Control/without weeding)	0,20	a	2.05	a	6.08	b	7.10	b
B (weeding manually 2 times)	0,00	a	1,03	a	2,32	a	4,45	a
C (weeding manually 2 times)	0,18	a	0,40	a	0,56	a	3,00	a
D (Methyl metsulfuron +2,4-D)	0,05	a	0,45	a	2,16	a	4,00	a
E (Bispyribac-Sodium)	0,15	a	0,41	a	2,03	a	3,08	a
F (Penoxsulam + Cyalofop-butyl)	0,21	a	0,45	a	2,21	a	3,12	a

Note: The average value followed by the same letter in the same column indicates no significant difference according to DMRT test at 5%

Dry weight of total weed

Based on the result of statistical analysis on total dried weed weight, it is known that all herbicide treatments (D, E and F) provide unlike the manual weeding treatment 3 times (C) and manual weeding treatment 2 times (B). However, weeding treatment 3 times gives higher weed suppression compared to manual control 2 times. Differences occurred in weed control treatments, with no control producing the most severe dry weight and significantly different from other treatments, while manual control 3 times yields the least weights of dry weed, although not unlike all control treatments using herbicides [Table-4].

Table-4 *Effect of Weed Controlling on the Dry of Total Weed on Rice Field in SOBARI*

Treatments	Dry Weight of Total Weed (g)							
	15 DAP		30 DAP		45 DAP		60 DAP	
A (Control/without weeding)	1,28	a	10,5	b	32,84	c	41,00	c
B (weeding manually 2 times)	1,78	a	4,17	a	10,06	b	19,34	b
C (weeding manually 2 times)	1,83	a	3,56	a	5,32	a	8,28	a
D (Methyl metsulfuron +2,4-D)	1,06	a	3,01	a	9,02	ab	13,46	ab
E (Bispyribac-Sodium)	0,90	a	3,43	a	8,40	a	13,20	ab
F. (Penoxsulam + Cyalofop-butyl)	1,77	a	2,40	a	9,03	ab	13,50	ab

Note: The average value followed by the same letter in the same column indicates no significant difference according to DMRT test at 5%

Observation of Rice Growth

Plant height

The result of statistical analysis on the average of plant height at each observation time did not get significant difference between the treatments [Table-5]. Plant height is mainly influenced by its genetic and environmental characteristics [11]. In terms of environment, plant height is mainly influenced by its ability to obtain sunlight. The rice plants in all of these treatments get the same relative light because none of the weeds height exceeds the height of the rice plant. In other words all the treatment does not occur light competition so that the height of rice plants in all treatments are not different.

Table-5 *High Rice Crops on Soil Treatment and Different Weed Control*

Treatments	Plant height (cm)							
	15 DAP		30 DAP		45 DAP		60 DAP	
A (Control/without weeding)	26,07	a	42,02	a	89,3	a	99,72	a
B (Weeding manually 2 times)	26,07	a	49,02	a	88,3	a	109,71	a
C (Weeding manually 2 times)	22,60	a	46,23	a	86,3	a	110,93	a
D (Methyl metsulfuron +2,4-D)	25,40	a	39,74	a	81,3	a	101,88	a
E (Bispyribac-Sodium)	23,00	a	47,97	a	88,3	a	106,56	a
F. (Penoxsulam + Cyalofop-butyl)	30,40	a	39,44	a	84,3	a	107,88	a

Note: The average value followed by the same letter in the same column indicates no significant difference according to DMRT test at 5%

Number of vegetative tillers

The number of vegetative tillers until the age of 30 DAP did not differ between all treatments, this is because weed growth is still low and has not been significantly different between treatments [Table-6], but the space between the plants is still sufficient and the nutrient needs are still small enough. In the observation of 45 and 60 DAP, it was observed that all weed control treatments both with manual weeding, or by using herbicides gave higher number of tillers compared with without weeding (A), except by manual weeding 2 times (B). This is because weed growth is already high on the other hand the plants require more nutrients, so in the treatment of high weed growth (A and B) there is a higher competition compared with other treatments which in turn will affect the number of tillers.

Table-6 *Number of The number of vegetative tillers in Soil Processing and Different Weed Control*

Treatments	The number of vegetative tillers							
	15 DAP		30 DAP		45 DAP		60 DAP	
A (Control/without weeding)	8,78	A	23,67	a	31,67	a	37,17	A
B (Weeding manually 2 times)	8,67	A	25,37	a	36,37	ab	43,25	A
C (Weeding manually 2 times)	8,93	A	26,67	a	54,67	b	64,13	B
D (Methyl metsulfuron +2,4-D)	7,00	A	20,80	a	53,10	b	62,64	B
E (Bispyribac-Sodium)	8,04	A	25,87	a	56,04	b	59,45	B
F. (Penoxsulam + Cyalofop-butyl)	6,77	A	22.71	a	43,86	b	48,22	B

Note: The average value followed by the same letter in the same column indicates no significant difference according to DMRT test at 5%

Observation of Rice Product Components and Yield

The result of statistical analysis on the average number of panicles per hill, weight of grains per clump, 1000 grain weight and the results can be seen in [Table-7] the results showed that the effect of treatment on the weight of 1000 grains did not show any differences due to1000 grain weight is mainly influenced by genetic properties. The number of panicles per hill, the weight of the seeds per hill and the

yield per ha on the weeding treatment manual 3 times (C) and all the herbicidal treatments (D, E, and F) were higher and significantly different than the manual weeding treatment 2 times and without weeding. This happens because in these treatments weed growth can be reduced so that the competition between plants and weeds is smaller than in the weeding treatment manual 2 times and without weeding.

Table-7 *Component of Results and Results of Rice Crops on Soil Processing and Different Weed Control*

Treatment	number of panicles per hill	weight of grains per clump (g)	1000 grain weight (g)	Yield (ton/ha)
A (Control/without weeding)	19,45 a	31,56 a	23,04 a	3,9 a
B (Weeding manually 2 times)	24,57 b	39,90 b	24,05 a	5,11 b
C (Weeding manually 2 times)	33,16 c	53,84 c	24,88 a	7,13 c
D (Methyl metsulfuron +2,4-D)	29,54 c	48,39 c	23,65 a	6,88 c
E (Bispyribac-Sodium)	28,73 c	46,48 c	23,54 a	6,75 c
F. (Penoxsulam + Cyalofop-butyl)	27,45 c	45.55 c	23,05 a	6,64 c

Note: The average value followed by the same letter in the same column indicates no significant difference according to DMRT test at 5%

Conclusions

In low land rice ultivation with SOBARI the use of Methyil metsulfuron + 2,4-D herbicide, Bispyribac-Sodium herbicide, and Penoxsulam + Cyalofop-butyl herbicide can suppress of broadleafe weeds, grasses, sedges and total weeds as equivalent as manual 3 times weed control. Manual weed control 3 times on low land rice with SOBARI gives a good influence on the growth and yield components and provide rice yields of 7.13 tons GKP. Weed control in low land rice with SOBARI is recommended to be controlled manually 3 times or using Methyl metsulfuron + 2,4-D herbicide, Bispyribac-Sodium herbicide, and Penoxsulam + Cyalofop-butyl herbicide

Application of research: The growth of weeds in Rice cultivation will be a major problem due to decrease the rice productivity. Therefore, weeds handling is one strategy to reduce weed growth. This research showed that handling of weeds manually up to 3 times has similar effects with herbicides application, therefore, with the manually handling it will be more efficient due to reduce the cultivation cost.

Research Category: Rice cultivation

Abbreviations

SOBARI = System Organic Base on Controlled Aerobic Rice Intensification
DAP = Day After Planting
RDB = Randomized Block Design

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