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Efficacy of the combination of herbicide active ingredient metsulfuron methyl, ethyl chlorimurone, sodium (2,4-dichlorophenoxy) acetate in the succession of rice weeds with different doses of cow manure

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Abstract. Field experiments were conducted in Godean Subdistrict, Yogyakarta Special Region in June- August 2018, with Regosol soil type to evaluate the efficacy of the combination of active ingredients herbicide methyl metsulfuron, ethyl chlorimurone and natrium salt against rice weed growth at various doses of cow manure. The research was carried out by using a complete randomized block design with five doses of cow manure (0, 5, 10, 15 and 20 tons/ha) and control without application of herbicides and cow manure. They were applied at recommended doses at the 2- to 3-leaves. That weeds grown on the control are *Monochoria sp*, *Ludwigia sp*; *Spenochlea sp*, *Mimosa invisa*, *Echinochloa sp*, *E. cruss galii*, *C. iria*, and *Fimbrtilis*. The higher the dose of cow manure shows the higher rate of weeds growth. There is a shift in weeds that can be controlled by herbicides with the same dose between low doses of cow manure and high doses. The herbicide application tested was effective in controlling broad leaf weeds at various doses of cow manure. The higher the dose of cow manure, the lower the efficiency of weed control.

1. Introduction

Rice or paddy has not only been the staple food for more than half of the humanity [1] but also shaped the culture, diet and economy of the majority of the world's population, especially in the east and south-east Asian countries. Its production primarily depends on good agronomic practices, and the most consistent and the highest yields of the crop can be harvested in irrigated systems [2]. Good agronomic practices include the effective fertilization, water and weed management, lower plant densities and sustainability of the farmers.

The cow manure as organic fertilizer is commonly used as a basic fertilizer on rice plants. Cow manure as fertilizer not only can be used for large quantities rice plants, but also rich in nutrients, especially nitrogen, phosphate and potassium. Cow manure organic fertilizer improves soil fertility while increasing rice growth and yield by creating ideal soil conditions for rice plants. Ideal soil conditions for rice plants also result in a higher rate of weed growth. The presence of weed seeds carried by cow manure which originally experienced dormancy, was able to break its dormancy due to favorable growing conditions.



Weedy rice generally includes species of genus *Oryza* which grows naturally and vigorously in and around rice fields [3]. Therefore, it is very hard to control weedy rice in cultivated rice area since it is classified in the same genus and species as cultivated rice [4]. The growth of weeds brings the problems to the growth and yield of rice. The reduction in production caused by the situation is economically more important than a decrease in production due to insects, fungi, or other disruptive organisms [5]. Loss of production due to weeds around the world is estimated to reach 10-15%, even can reach 86% if without control. Nationally, rice production decreases as the result of weed disturbance reaches 15-42% for upland rice and upland rice 47-87%. IRRI [6] reported that weed control costs 50% of total production costs. *Echinochloa* spp. caused greater loss in growth and yield of rice as compared to *Marsilea quadrifolia*, *Cyperus difformis* and *Eclipta prostrata*. *Ammania baccifera* [7] and *Cyperus* spp., as a whole constituted 83.8 and 87.4 % of the total weed flora, respectively, under direct sown puddled rice [8]. The most problematic and common weeds in rice especially in Asia are *Cyperus iria*, *Cyperus maritimus*, *Echinochloa glabrescens*, *Cyperus rotundus*, *Cyperus difformis*, *Paspalum distichum*, *Echinochloa colona*, *Echinochloa crus-galli*, and *Marsilea minuta* [9,10,11].

One way to control weeds is by using the herbicides, because they are more effective and efficient than other methods. One of the herbicides for rice weeds is an active ingredient herbicide sodium (2,4-dichlorophenoxy) acetate 75,6%, methyl metsulfuron 0.7%, ethyl chlorimuron 0.7% and the other additional ingredients 23%. Pre-grown and after-growth herbicides that are selective to control weeds in rice plants, crops without crops and wet rice planting preparation. Mixing the active ingredients of herbicides is intended to expand the spectrum of control. The purpose of this study was to evaluate the efficacy of the combination of active ingredients herbicides methyl metsulfuron, ethyl chlorimurone and natrium salt against rice weed growth at various doses of cow manure

2. Material and methods

Field research was carried out in Godean, Sleman, Yogyakarta Special Region during June-September 2018. This research was based on soil chemical analysis. Godean Regosol is dominated by sand fraction. (sand 87.7%, dust 8.0% and clay 4.30%); with pH 6.33, 1.22% organic C, 0.16 g kg/N, 15.89 g kg/P, 0.38 g kg/K. The experiment was conducted in a randomized complete block design (RCBD) with five doses of cow manure (0, 5, 10, 15 and 20 tons/ha) and control without application of herbicides and cow manure (untreated).

Rice plants of Ciherang cultivars were planted by transplanting, seedling age 21 days after dispersing. Fertilization of rice plants is done by means and dosage of farmers (Urea 150 kg/ha and NPK 350 kg/ha). Herbicides used are herbicides with three active ingredient combinations of metsulfuron methyl, ethyl chlorimurone, sodium (2,4-dichlorophenoxy) acetate with the Ally plus 77 WP trademark. Application of herbicide was carried out at 12 days after planting using a deflector nozzle to deliver 300 l/ha of herbicide solution. The dosage of herbicide used is recommended dosage. Spray calibration was carried out by methods carried out by Caseley [12] and Turner and Gillbanks [13].

Vegetation analysis method using destructive method, sampling was carried out using the quadratic method (1m × 1m) taken systematically in each sample plot with 3 replications. Destructive weed sampling was taken at the age of 14 days after application of herbicide (DAA), 28 DAA, 42 DAA and 56 DAA.

The data collected were weed population per species, weed dry weight per species, weed press frequency, and the weed species. Weed dry weight was obtained by using an oven at a temperature of 75 °C to a constant weight of approximately 4 days [14]. The data obtained is used to calculate Sum Dominance Ratio (SDR), and Community Coefficient (CC). SDR is calculated using the following formula [15].

$$\text{SDR of a sp.} = \frac{\text{relatif density} + \text{relative frequency} + \text{r elatif dominance}}{3}$$

Relative density, relative frequency and relative dominance were measured from the following equation:

$$\text{Relative density of a sp.} = \frac{\text{Absolute density of a sp.}}{\text{total absolute density of all spp}}$$

$$\text{Relative dominance of a sp.} = \frac{\text{Absolute dominance of a sp.}}{\text{total absolute dominance of all spp}}$$

$$\text{Relative frequency of a sp.} = \frac{\text{Absolute frequency value of a sp.}}{\text{total frequency value of all spp}}$$

Absolute density of a species was equal to total number of plants of that species in the sample plot, absolute dominance of a species was the total biomass of that species in the sample plot.

$$\text{Absolute frequency of a species} = \frac{\text{number of plot containing the sp.}}{\text{total sample plots}}$$

Community coefficient (CC) was calculated as suggested by Bonham [16]

$$CC = \left(\frac{2W}{a} + b \right) \times 100 \%$$

CC=community coefficient,

W = total of the lowest SDR value of all species from each community:

A = total of all SDR values from the first community and

B = total of all SDR values from the second community.

CC values indicated homogeneity of weed

Community coefficient values indicated homogeneity or similarity among the weed communities. According to Bonham [16]. CC value >71% (good to excellent homogeneity) is a required condition for carrying out weed control experiment. communities among the herbicides. excellent (91- 100%), good (71-90%), fair (56-70%), poor (45-55%) and unacceptable (<45%) [16].

The data were analyzed by using SAS package for analysis of variance (ANOVA) and significant differences were tested using Tukey's studentized range test at the 5% level of probability [17].

3. Results and discussions

The results of weed vegetation analysis before the application of cow manure as organic fertilizer is 2-4 leafy *E. Crusgalii* (30.23%) dominant weed, followed by *L. chinensis* with 2-3 (28.11%) *Ludwigia sp.* (19.50%), *Cyperus sp.* (9.32%) and *Fimbritis* (7.43%) and *L. octovalvis sp.* (5.41%). While the results of weed vegetation analysis before the application of herbicides can be seen in Table 1. Weeds that appear on various doses of cow dung are *E. cruss galii*. *L. chinensis* (gramine) 2-4 leaves, *C. rotundus* (sedges) 2-3 leaves and *L.octovalvis* (wide leaves) 2 leaves.

Table 1. Weed populations before application of herbicides at various doses of cow manure as organic fertilizer.

| Treatment (Cow Manure) | Population and Number of Leaves | | | | | | | |
|---------------------------|---------------------------------|--------|-------------------|--------|------------------|--------|------------------|--------|
| | ECGHI | | LFCHI | | CYPPIR | | LUDOC | |
| | Pop | Leaves | Pop | Leaves | Pop | Leaves | Pop | Leaves |
| Doses 0 ton/ha | 21.0 ^b | 2-2 | 10.2 ^b | 2-3 | 5.0 ^a | 2-3 | 2.4 ^a | 2 |
| Doses 5 tons/ha | 19.2 ^b | 2-4 | 12.6 ^b | 2-3 | 7.3 ^a | 2-3 | 4.0 ^a | 2-3 |
| Doses 10 tons/ha | 24.0 ^b | 2-4 | 8.7 ^c | 2-3 | 4.4 ^a | 1-3 | 3.2 ^a | 2-4 |
| Doses 15 tons/ha | 33.8 ^a | 2-3 | 12.4 ^b | 2-4 | 5.0 ^a | 2-3 | 2.4 ^a | 2 |
| Doses 20 tons/ha | 29.0 ^a | 2-4 | 15.4 ^b | 2-4 | 5.0 ^a | 2-1 | 3.6 ^a | 3 |
| Untreated | 30.0 ^a | 2-4 | 18.6 ^a | 2-3 | 4.2 ^a | 1-2 | 2.3 ^a | 3 |

pop: Population, Leaves; number of leaves, ECGHI (*E. Crusgalii*), LFCHI (*L. Chinensis*), CYPPIR : (*C. iria*), LUDOC (*L. octovalvis*)

E. crusgalii and *I. chinensis* showed a different population between cow manure treatment, the higher the dose of cow manure, the higher the population of both weed species, but the community coefficient (CC) between treatments showed greater than 71% indicated good to excellent homogeneity [16]. At the beginning of the growth of rice plants (14 HAS) there were still *E. crusgalii*, *L. chinensis*, *C. iria* and *L. octovalvis* in untreated group, whereas in other treatments there were no weeds found in the observation before herbicide application (Table 1). It is known that at various doses of cow manure as herbicide organic fertilizer applied effectively to control weeds up to 14 HAS.

Table 2. Sum dominance ratio 14 HAS, rice weeds at various doses of organic fertilizer due to herbicide applications

| Treatment (Cow Manure) | Sum Dominance Ratio (%) | | | | | | | |
|---------------------------|-------------------------|-------|-------|-------|-------|-------|-------|-------|
| | ECGHI | LFCHI | FIMMI | CYPIR | CYPDI | LUDOC | MOOVA | MASMI |
| Doses 0 tons/ha | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Doses 5 tons/ha | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Doses 10 tons/ha | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Doses 15 tons/ha | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Doses 20 tons/ha | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Untreated | 39,26 | 35 | 0 | 22,60 | 0 | 3,14 | 0 | 0 |

ECGHI (*E. Crusgalii*), LFCHI (*L. Chinensis*), FIMMI (*Fimbrtilis sp.*), CYPIR: (*C. iria*), LUDOC (*L. octovalvis*) CYPDI (*C. difformis*), MOOVA: (*M. vaginalis*) MASMI (*M. minuta*)

Percentage of weed control Abbot formula: $\% \text{ control} = \left(\frac{N_{UT} - N_t}{N_{UT}} \right) \times 100 \%$ (N_{UT} = number of weeds in untreated plot at specific timing, N_t = number of weeds in treated plot at specific timing). It was confirmed that the weed control percentage in various doses of cow manure treatment was 100% of the EWRC (European Weeds Research Society) scoring, showed the very good weed control. In 28 HAA weeds of *E. crusgalii*, *L. chinensis* and *Fimbrtilis sp* started to present in fertilization of 20 kg/ha, on the land *E. crusgalii*, was a dominant weed followed by *L. chinensis* and *Fimbrtilis sp*.

Table 3. Sum dominance ratio 28 HAA, rice weeds at various doses of organic fertilizer due to herbicide applications

| Treatment (Cow Manure) | Sum Dominance Ratio (%) | | | | | | | |
|---------------------------|-------------------------|-------|-------|-------|-------|-------|-------|-------|
| | ECGHI | LFCHI | FIMMI | CYPIR | CYPDI | LUDOC | MOOVA | MASMI |
| Doses 0 tons/ha | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Doses 5 tons/ha | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Doses 10 tons/ha | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Doses 15 tons/ha | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Doses 20 tons/ha | 45,70 | 25,0 | 15 | 0 | 0 | 0 | 0 | 0 |
| Untreated | 30,56 | 12,5 | 10,1 | 25 | 10,76 | 7,88 | 7,88 | 3,2 |

ECGHI (*E. Crusgalii*), LFCHI (*L. Chinensis*) FIMMI (*Fimbrtilis sp.*), CYPIR: (*C. iria*), CYPDI, LUDOC (*L. octovalvis*), (*C. difformis*), MOOVA (*M. vaginalis*) MASMI (*M. minuta*)

Herbicide application in the treatment of cow manure dosage of 0 to 15 kg/ha gave a very good weed control percentage (100%), whereas in the treatment of cow manure fertilization at a dose of 20 kg/ha for *E. crusgalii* the control percentage was 95%, *L. chinensis* 97.5% and *Fimbrtilis* 90%. Weed control at 20 kg/ha fertilization treatment is still classified as good.

Table 4. Sum dominance ratio 42 HAA, rice weeds at various doses of organic fertilizer due to herbicide applications

| Treatment (Cow Manure) | Sum Dominance Ratio (%) | | | | | | | |
|---------------------------|-------------------------|-------|-------|-------|-------|-------|-------|-------|
| | ECGHI | LFCHI | FIMMI | CYPIR | CYPDI | LUDOC | MOOVA | MASMI |
| Doses 0 tons/ha | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Doses 5 tons/ha | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Doses 10 tons/ha | 50,00 | 25,50 | 0 | 24,50 | 0 | 0 | 0 | 0 |
| Doses 15 tons/ha | 30,20 | 21,40 | 15,30 | 21,4 | 4,70 | 0 | 0 | 7 |
| Doses 20 tons/ha | 27,80 | 20,30 | 15,69 | 12,70 | 12,60 | 0 | 0 | 0 |
| Untreated | 35,75 | 10,44 | 9,67 | 28,5 | 9,33 | 2,21 | 2,21 | 4,3 |

ECGHI (*E. Crusgalii*), LFCHI (*L. Chinensis*) FIMMI (*Fimbritis sp*), CYPIR (*C. iria*), CYPDI (*C. difformis*), LUDOC (*L. octovalvis*), MOOVA (*M. vaginalis*) MASMI (*M. minuta*)

At a cow manure dose of 10 kg/ha, *E. crusgalii*, *L. chinensis* and *C. iria* weeds started to present at 42 DAA. The two communities can be different, while the weed community in the treatment of cow manure dosage 10, 15 and 20 kg/ha have a value >71 (average 86.56%) so that it has the community is the same, and between these communities with treatment of 0 and 5 kg/ha have values above 71% (89.32%) so both are said to be different weed communities.

Table 5. Sum dominance ratio 56 HAA, rice weeds at various doses of organic fertilizer due to herbicide applications

| Treatment (Cow Manure) | Sum Dominance Ratio (%) | | | | | | | |
|---------------------------|-------------------------|-------|-------|-------|-------|-------|-------|-------|
| | ECGHI | LFCHI | FIMMI | CYPIR | CYPDI | LUDOC | MOOVA | MASMI |
| Doses 0 tons/ha | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Doses 5 tons/ha | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Doses 10 tons/ha | 60,00 | 24,50 | 0 | 15,50 | 0 | 0 | 0 | 0 |
| Doses 15 tons/ha | 40,20 | 21,40 | 15,30 | 11,4 | 4,70 | 0 | 0 | 7 |
| Doses 20 tons/ha | 27,80 | 20,30 | 15,69 | 12,80 | 12,60 | 0 | 0 | 0 |
| Untreated | 30,25 | 10,18 | 10,15 | 30,67 | 10,11 | 5,34 | 5,34 | 4,30 |

ECGHI (*E. Crusgalii*), LFCHI (*L. Chinensis*) FIMMI (*Fimbritis sp*), CYPIR (*C. iria*), CYPDI (*C. difformis*), LUDOC (*L. octovalvis*) MOOVA (*M. vaginalis*) MASMI (*M. minuta*)

In 56 DAA SDR weeds of rice plants showed results that were not much different from 42 DAA. Application of herbicides in various treatments of dairy manure doses shows that there is a shift in rice weeds that grow. At the beginning of the growth of herbicide application it was able to suppress weed growth (Table 2) or weed control percentage 100% weed died perfectly, this was seen from the presence of weeds before the application of herbicides in all treatment plots (Table 1). In subsequent growth weeds begin to grow, especially in the treatment of doses of cow manure that is higher than 10 kg / ha. The availability of herbicides to be absorbed by the soil depends on clay and organic matter. Soil that has clay and soil organic matter content is the greater the adsorbs of the adsorbed herbicides and the fewer the amount in the soil solution. Then the greater the content of clay and soil organic matter the greater the dose needed to control weeds.

The herbicides that are applied to the soil that are given organic ingredients are increasingly greater, with the same dose of effective control getting smaller (Table 2.3, and 4) on the condition of cow manure which is given in small amounts, the herbicide applied is effective for controlling weeds, but in conditions of cow dung given at high doses, the application of the same dose of herbicide is not effective in controlling weeds, especially *E. crusgalii*, *L. chinensis* and *C. iria*. As for the broad-leaf weeds the applied herbicide is effective to control it.

4. Conclusion

The higher the dose of cow manure shows the more higher weed growth rate. There is a shift in weeds that can be controlled by herbicides with the same dose between low doses of cow manure and high doses. The herbicide application tested was effective in controlling broad leaf weeds at various doses of cow manure. The higher the dose of cow manure, the lower the efficiency of weed control.

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