ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Soil Weed Seed Bank Responses from Fallow Land to Different Herbicides

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ABSTRACT

This research was conductedin Abenggi of village, District Landono, Regency of South Konawe, Province of Southeast Sulawesi, Indonesia.This study aims to determine thesoil weed seed bank responses to different herbicides on fallow. There are five kinds of herbicides were used as treatments i.e.: Control (ctl), Gramazone as 1 ml per 2.68 ml of water (H1), Billy 20 WPas 0.336 mg per 3.36 ml of water (H2), dupont ally 20 wg as 1.26 mg per 4.2 ml of water (H3), Dupont ally 10/10 WP as 0.126 mg per 1.51 ml of water (H4) andTi - Gold 10 w as 504 mg per 4.2 ml of water (H5). Soil weed seed bank were identified based on weed species on fallow land, coefficient community and important value of weed. The results showed that various at herbicides have an influence on the soil weed seed bank on fallow land. The weeds species found before treatment with herbicides there are 18 species and after receiving the treatment of herbicides were reduced to 10 weeds species. Effective herbicide suppresses the growth of soil weed seed bank is Billy 20% WP.

Keywords: coefficient community, fallow, herbicides, seed bank, weed density

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ISSN: 0975-8585

INTRODUCTION

The presence of weeds in a crop relating to the deposit of weed seeds in the soil. The weed seeds can be stored and can survive for decades in a state of dormancy and germination will germinate if the requirements can be fulfilled. The soil weed seeds bank are reserves of viable seeds present on the surface and in the soil. The seedbank consists of new seeds recently shed by a weed plant or older seeds that have persisted in the soil for several years. The seed bank is an indicator of past and present weed populations. Stated that one of the mayor factors affecting annual weed populations is the large and potentially transied soil seed bank [3]. Similary with [6], that weed seed bank are dormant propagules of weeds in the soil which will develop into an individual weeds if conditions permit. In practice, the soil's weed seed bank also includes the tubers, bulbs, rhizomes and other vegetative structures throught which some of our most serious perennial weeds propagate themselves [7].

On fallow land are found growing vegetation and the potential to produce seeds in large quantities and dormancy that will be stored in the soil. This condition will affect the types of weeds and control methods to be applied by farmers in the coming season, especially during land clearing, after tillage and pre-planting. This statement reinforced by [9] that carry over the viable seed in the soil from previous years can buffer the effects of weed control and hence maintain the weed problems. [8] Stated that the formation of the soil weed seed bank was rather a long process of competition between crops and weeds as well as among weeds.

A prolonged use of herbicides contributed to the spread of weed species resistant to chemical weed control and the growth of their seedbank in the soil. Under no herbicides, soil weed seedbank increased significantly when annual weeds with a large seed yield become prevalent. An increase in ploughing depth led to a decrease in soil weed seedbank, whereas differents loosening depths had no obvious effect on soil weed seedbank. Thus, the concentration of weed seeds in the ploughed layer depends on crop wediness, the biological and morphological features of crops and weed species, soil fertility and significant extent, the quality of the agrotechnological methods applied. [11] reported that the pre-emergence application had high weed density in all the periods of estimation and weed density increased gradually along periods of assessment while the post emergence plots had relatively low weed density. The herbicides were selected on demand, depending on the weed species present in the field [1].

MATHERIALS AND METHODS

Soil Weed Seed Bank Sampling

The soil weed seed bank was sampled in March 2016, arranged in quadrat methods with five plots were placed randomly (sampling sites),each plots 50 x 50cm in size. The weed species that grow on every plots of observation were pulled and stored in a bag that had been labeled to identify and count the number of individuals of each weed species. The soil sampling conducted after the weeds in each plot repealed with 0-10 cm in depth. All soil samples (5 plots) were placed into separate plastics bags and returned to the net house for processing or next step.

Herbicides Application in Net House Treatment

The soil samples were taken from the field first wind dried for 2 days to reduce the moisture content in the soil. Further refined from lumps and cleaned all the litter and other debris mixed with the soil. The soil samples at each observation plot evenly divided by 25 sections (5x5) overlaid on the vessel sprouts with a length of 24 cm and 10 cm thickness. Herbicide applications carried out on soil samples that have been prepared on the vessel sprouts in accordance with the recommended dosage (Table 1). A set of conventional herbicides was applied according to local commercial standards as an herbicide sequence or tank mixture of different herbicides.

ISSN: 0975-8585

Table 1: Kinds of and dose of herbicides

No.	Treatment	Active ingredient	Dose of Herbicides
1.	Control (ctl)	With out herbicides	With out herbicides application
2.	Gramazone (H1)	Prakuat	1 mlper 2.68 mlof water
3.	Billy 20 WP (H2)	etilpisazusulfuron 20%	0.336 mg per 3.36 ml of water
4.	Dupont ally 20WG (H3)	metilmetsulfuran 20%	1.26 mg per 4.2 ml of water
5.	Dupont ally 10/10 WP (H4)	etilpirazosulfuron 20%	0.126 mg per 1.51 ml of water
6.	Ti-gold 10 WP (H5)	etilpisazosulfuron 10%	504 mg per 4.2 ml of water

Observations of Variable

The variables were observated in this research include:

1. Coefficient community of weed species in fallow, calculated with formula recommendated by Triharso [12]:

$$C = \frac{2W}{a+b} x\ 100\%$$

C= Coefficient community
W = the number of weed species that produces the lowest on two plots of individual observations
a = the sum of all the individual lowest on the first community
b = the total number of individuals on the second community
If the value of C above 75% is means the weeds in each plot observation are uniform and the value of C below 75% means that the weeds in each plot observation are not uniform.

2. Weeds species composition and sum dominance ratio (SDR) on fallow and net house treatment.The species composition of the soil weed seedbank in net house treatment calculated on 30 and 60 day after treatment (DAT). Each weed species that grow was identified based on the description.Importance value of weeds, calculated with formula recomanded by Chaves and Bhadanari [2]:

$$\text{Relative density} = \frac{\text{number of individuals of species}}{\text{Total number of individual}} x\ 100\%$$

$$\text{Relative dominance} = \frac{\text{dominance of species}}{\text{dominance of all species}} x\ 100\%$$

$$\text{Relative frequency} = \frac{\text{frequency of species}}{\text{sumfrequency of all species}} x\ 100\%$$

Sum of dominance ratio (SDR) = Relatif density + relative dominace + relative frequency

RESULT AND DISSCUSION

Coefficient Community of Weeds Specieson Fallow

Table 2 indicates that the coefficient community highest in the comparison of plot I:III (90%)and lowest in the comparison of plot IV:V (18.18%). This result indicates that plot of I and III has a uniform weed species, whereas other types of weeds on the plot is not uniform. [1], weed density and weed species composition differ between the two sites due to soil condition and crop management practice. This result similary with stated by [4] that processes affecting the weed seed bank in production fields are complex and will vary greatly based on the management practices used and the timing of their application.

ISSN: 0975-8585

Table 2: Coefficient community of weed each plot observed

No.	Plot Ratio	Coefficient Community (%)
1.	I:II	51.00
2.	I:III	90.00
3.	I:IV	52.17
4.	I:V	54.55
5.	II:III	60.00
6.	II:IV	26.09
7.	II:V	24.00
8.	III:IV	58.82
9.	III:V	52.63
10.	IV:V	18.18

Weed Species Composition and Sum Dominance Ratio (SDR) on Fallow Land

Based on the result of this research showed that on fallow land was found 18 weeds species which 12 from broadleaf weeds, 5 from grasses and 1 from sedges with a different value of SDR (Table 3).The result of research showed that at the plot I there are 10 weed species from broadleaf with highs of SDR is *A.conyzoides*(64.06%), 3 weed species from grasses with highs of SDR is *P.amaura*(1.24%)and 1 weed species from sedges with SDR as 2.69%.At the plot II there are 8 weed species from broadleaf with highs of SDR is *B.alata*(28.40%), 4 weed species from grasses with highs of SDR is *I.cylindrica*(12.34%) and 1weed species from sedges with SDR as 9.88%.At the plot III there are 5weed species from broadleaf with highs of SDR is *B.alata*(45.85%), 1weed species from grasses with SDR as 4.17% and 1 weed species from sedges with SDR as 4.17%.At the plot IV there are 7 weeds species from broadleaf with highs of SDR is *B. capensis*(30.67%), 1 weed species from grasses with SDR as 6.67% and 1 weed species from sedges with SDR as 10.67%.At the plot V there are 8 weeds species from broadleaf with highs of SDR is *B.capensis*as27.27%, 1 weed species from grasses with SDR as 19.00% and 1 weed species from sedges with SDR as 7.44%.The different rate of SDR each plot observations with regard to the number of seeds in the soil deposits. The soil weed seed bank can be influenced by the habits of farmers in manure uses sterilized. [8] Stated that the application of the organic fertilizers significantly reduced the density of the soil weed seed bank.

Table 3: Weeds species and SDR (%) in all plot observated

No	Species of weed	SDR (%) of weed species at the plot				
		I	II	III	IV	V
	Broad leaves					
1.	*Borreriaalata*(Aubl) DC	26.86	28.40	45.83	21.33	0.17
2.	*Phyllanthusniruri*L.	0.82	3.71	0.00	0.00	0.00
3.	*Mimosa pudica*L	0.21	1.23	0.00	1.33	3.31
4.	*Ludwigiahyssopifolia*(G.Don) exell	1.03	2.47	8.33	6.67	8.26
5.	*Ageratum conyzoides*L.	64.06	2.47	4.17	5.33	4.13
6.	*Ageratum haustonianum* Mill	1.65	0.00	0.00	0.00	0.00
7.	*Bergiacapensis*L.	0.21	20.99	29.17	30.67	27.27
8.	*Scopariadulcis*L.	0.21	1.23	4.17	0.00	2.48
9.	*Microcarpaea minima* (Koen.) merr	0.21	3.71	0.00	0.00	0.00

10.	*Linderniahyssopioides* (L.) Haines	0.21	0.00	0.00	0.00	10.74
11.	*Hedyotisdiffusa*Wild	0.00	0.00	0.00	4.00	8.26
12.	*Cyanotisaxillaris* (L.) sweet	0.00	0.00	0.00	8.00	0.00
	Grasses					
1.	*Digitariaadscendens*Henr	0.41	4.94	4.17	6.67	0.00
2.	*Paspalumconjugatum* Berg	0.21	0.00	0.00	5.33	19.00
3.	*Polytriasamaura* (Buese) O.K	1.24	3.71	0.00	0.00	0.17
4.	*Imperatacylindrica* (L.) beauv	0.00	12.34	0.00	0.00	0.00
5.	*Eriocaulonheteroleois*Steud var. *nigricans*Koern	0.00	2.47	0.00	0.00	5.79
	Sedges					
1.	*Cyperussp*	2.69	9.88	4.17	10.67	7.44
	Total	**100**	**97.55**	**100**	**100**	**97.02**

Species Compositions of Soil Weed Seed Bank from Fallow in Net House Treatment

The result of research indicates that at the 30 DAT there are 8 weeds species from broadleaf, grasses and sedges each with 1 weed species with differ of SDR (Table 4). At the treatment of control there are 6 weeds species from broadleaf with highs of SDR is *L.hyssopifolia*(50.00%), 1 weed species from grasses with SDR as 4.76%.At the treatment of H1there are 5weeds species from broadleaf with highs of SDR is*B.alata*and*L.hyssopifolia*(14.40%), 1weed species from grasses with SDR as 6.56% and1 weed species from sedges with SDR as 10.97%.At the treatment of H2there are 4weeds species from broadleaf with highs of SDR is *B.alata*(26.25%). At the treatment ofH3there are 6weeds species from broadleaf with highs of SDR is*C.rutidospermae*(16.40%), 1weed species from grasses with SDR as 4.76% and 1 weed species from sedges with SDR as 8.76%.At the treatment of H4there are 6weeds species from broadleaf with highs SDR is *L.hyssopifolia*(20.96%), 1 weed species from grasses with SDR as 7.47%.At the treatment of H5there are 4 weeds species from broadleaf with highs SDR is *L.hyssopifolia*(17.42%), 1 weed species from grasses with SDR as 7.42% and 1 weed species from sedges with SDR as 10.24%.This result indicated that application herbicides of Billy 20 WP 0.336 mg per 3.36 ml of water (H2) effective was suppressed the soil weed seed bank it's indicated with lower of SDR (67.97%).

Table 4: Weed species and SDR (%) at the age 30 day after treatment (DAT) with herbicides

No.	Species of weed	Treatments					
		Ctl	H1	H2	H3	H4	H5
	Broad leaves						
1.	*Ageratum conyzoides*L.	7.14	10.48	0.00	5.85	7.47	15.63
2.	*Amaranthus gracilis* Desf	0.00	0.00	0.00	4.76	0.00	0.00
3.	*Borreria alata* (Aubl.) DC	19.04	14.40	26.25	9.26	11.44	6.14
4.	*Cleome rutidospermae* DC	2.38	0.00	0.00	16.40	5.88	0.00
5.	*Mimosa pudica* L.	2.38	0.00	0.00	0.00	5.88	0.00
6.	*Phyllanthusniruri* (Auct)	14.28	6.56	10.51	5.55	9.85	11.78
7.	*Ludwigiahyssopifolia*(G.Don) Exell	50.00	14.40	20.70	14.02	20.96	17.42
8.	*Ludwigiaoctovalvis*(Jacq.) Raven	0.00	5.58	10.51	0.00	0.00	0.00
	Grasses						
1.	*Paspalum distichum* L. Ridley	4.76	6.56	0.00	4.76	7.47	7.42
	Sedges						
1.	*Cyperus* sp	0.00	10.97	0.00	8.73	0.00	10.24
	Total	**99.98**	**68.95**	**67.97**	**69.33**	**68.95**	**68.63**

Notes: Ctl= Control, H1=Gramazone1 ml per 2.68 ml of water, H2=Billy 20 WP 0.336 mg per 3.36 ml of water, H3=Dupont ally 20WG 1.26 mg per 4.2 mlof water, H4=Dupont ally 10/10 WP 0.126 mg/ per 1.512 mlof water, H5=Ti-gold 10 WP 504 mg per 4.2 mlof water

ISSN: 0975-8585

Table 5: Weed species and SDR (%) at the age 30 DAT without herbicides

No.	Species of weed	SDR (%)				
		Ctl+H1	Ctl+H2	Ctl+H3	Ctl+H4	Ctl+H5
	Broad leaves					
1.	*Ageratum conyzoides* L.	0.00	0.00	1.94	0.27	4.78
2.	*Bergia capensis* L.	0.00	0.00	6.80	0.00	1.73
3.	*Boerhavia erecta* L.	0.00	0.00	0.00	0.27	0.43
4.	*Galingsonga parviflora* Cav	0.66	0.00	0.00	0.00	0.00
5.	*Hedyotis corymbosa* (L.) Lamk	9.63	13.14	44.64	16.98	8.69
6.	*Lindernia anagallis* (Burm.f.) Pennell	0.00	40.00	0.00	27.50	10.87
7.	*Lindernia antipoda* (L.) Alston	0.00	3.43	4.85	7.28	12.61
8.	*Lindernia ciliata* (Colsm.) Pennell	2.64	0.00	0.00	0.00	0.00
9.	*Lindernia crustacea* (L.) F.v.M	0.00	1.14	0.97	0.00	0.00
10.	*Lindernia hyssopioides* (L.) Haines	12.93	0.00	0.00	8.63	11.74
11.	*Microcarpaea minima* (Koen.) Merr	0.00	0.00	0.00	0.00	0.43
12.	*Mitracarpus villosus* (SW.) DC	19.93	0.00	11.65	3.50	0.43
13.	*Hyptis brevipes* Poit	4.32	0.00	0.00	0.54	0.00
14.	*Hypericum japonicum Thunb.ex Murray*	9.64	0.00	0.00	0.00	0.00
15.	*Richardia brasiliensis* Gomez	7.32	2.29	0.00	0.00	0.43
16.	*Borreria alata* (Aubl.) DC	0.66	1.71	0.00	0.81	0.00
17.	*Cleome rutidosperma* DC	0.00	0.00	0.97	0.00	0.00
18.	*Phyllanthusniruri* (Auct)	1.66	0.00	0.00	0.54	0.87
19.	*Ludwigiahyssopifolia*(G.Don) Exell	1.00	0.00	0.97	1.89	6.09
20.	*Sidarhombifolia* L.	1.66	2.29	0.00	0.54	0.00
21.	*Scopariadulcis*L.	0.00	0.00	9.71	0.00	3.05
	Grasses					
1.	*Digitariaciliaris*(Retz.) Koel	0.00	0.00	1.94	0.00	0.00
2.	*Paspalum conjugatum* Berg	0.00	2.86	0.00	0.00	1.30
	Sedges					
1.	*Fimbristylis acuminata*Vahl	9.31	1.14	1.99	9.16	5.66
2.	*Cyperus rotundus* L.	0.00	17.14	0.00	22.11	0.00
3.	*Cyperus* sp	18.61	0.00	13.58	0.00	30.87
	Jumlah	**99.97**	**85.14**	**100.00**	**100.00**	**99.98**

Notes: Ctl+H1=control for Gramazone1 ml per 2.68 ml of water, Ctl+H2=control for Billy 20 WP 0.336 mg per 3.36 ml of water, Ctl+H3=control for Dupont ally 20WG 1.26 mg per 4.2 mlof water, Ctl+H4=control for Dupont ally 10/10 WP 0.126 mg per 1.512 mlof water,Ctl+H5=control for Ti-gold 10 WP 504 mg per 4.2 mlof water

The result of research (Table 5) showed that at the treatment of Ctl+H1 there are 12 weeds species from broadleaf with highs of SDR is *M. villosus*(19.93%), 2 weeds species from sedges with highs of SDR is *Cyperus* sp (18.61%). At the treatment of Ctl+H2 there are 7 weeds species from broadleaf with highs of SDR is *L.anagallis*(40%), 1 weed species from grasses with SDR as 2.86%, 1 weed species from sedges with SDR as 17.14%.At the treatmnet of Ctl+H3 there are 9 weeds species from broadleaf with highs SDR is *H.corymbosa*(44.64%), 1 weed species from grasses with SDR as 1.99%, 1 weed species from sedges with SDR as 13.58%.At the treatment of Ctl+H4 there are 12weeds species from broadleaf with highs SDR is *L.anagallis*(27.50%), 2weeds species from sedges with SDR as 22.11%.At the treatment of Ctl+H5 there are 13 weeds species from broadleaf with highs of SDR is*L.antipoda* sebesar 12.61%, 2 weeds species from sedges with highs of SDR is *Cyperus* sp (30.87%).The differences of SDR each of weed species due to amount of soil weed seed bank as well as the presence or absence of weed seeds dormancy. [5] Stated that the lifting of weed seeds to the surface soil and the availability of appropriate moisture for germination encourage weeds to grow and develop. [4] stated that cultural practices used for crop production influence the composition of the weed seed bank in the soil. Similary with stated by [10] that the weed seed bank reservoir at the study site might be drastically decreased if management practices that prevent germination or make it difficult or that prevent the deposition of new seed in to this bank.

CONCLUSION

The results showed that various at herbicides have an influence on the soil weed seed bank on fallow. The weeds species found before treatment with herbicides there are 18 species and after receiving the treatment of herbicides were reduced to 10 weeds species. Effective herbicide suppresses the growth of weed seed bank is Billy 20% WP.

AKNOWLEGDMENTS

The author would like to thank to the Ministry of Research, Technology and Higher Education of the Republic of Indonesia for the financial assistance through the scheme of National Priorities Research Grant Master Plan for the Acceleration and Expansion of Indonesian Economic Development 2011-2025 in 2016. The authors also thank to the Rector of Halu Oleo University and the Chairman of the Research Institute of Halu Oleo University forserviced an administrative.

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