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Selektivity of Alachlor Herbicide on Sweet Corn (*Zea mays saccharata L.*) and Nutsedge (*Cyperus rotundus L.*)

Selektivas Herbisida Alachlor pada Jagung Manis (Zea mays saccharata L.) dan Teki (Cyperus rotundus L)

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ABSTRACT

These experiments were conducted in Ecology Laboratory Faculty of Agriculture, Sriwijaya University, from June up to August 2007. Lab. Experiments (I and II) using petridishes and filter paper whatman of 9 cm diameter. Eight level of alachlor herbicide concentrations (i.e. 0, 0.003, 0.03, 0.3, 3, 30, 300, 3000 ppm) were replicated four times. The observations were of germination percentages, root and shoot length, root and shoot dry weigth of both sweet corn and nut sedge. To collect all the data were on seven-day germination period, except all the germination percentages were daily counted. The similar trend of reduction occurred in root and shoot dry weight on sweet corn and nutsedge, when a high rate of concentration was used, especially for the sweet corn. In sweet corn, application of alachlor herbicide at 3000 ppm reduced the root dry weight of 35.0% (Expt I), 45.0% (Expt II), and shoot dry weigth of 39.90% (Expt I), 59.59% (Expt. II). In nutsedge, however, the severe reduction has occurred from the alachlor rate of 3 ppm, i.e. root dry weigth was reduced 57.58% (Expt. I), 60% (Expt II), and shoot dry weight was reduced 68.33% (Expt.I), 69.5% (Expt. II). The higher values of GR50 for all variables occurred in sweet corn than in nutsedge, depicting that alachlor herbiside rolled as a selective herbicide in sweet corn and nutsedge, when they were planted interactively.

Key words: Selectivity, herbicide, sweet corn, nut sedge, GR50

ABSTRAK

Penelitian dilaksanakan di Laboratorium Ekologi Fakultas Pertanian, Universitas Sriwijaya, mulai bulan Juni sampai Agustus 2007. Percobaan laboratorium. (I dan II) menggunakan petridis dan kertas saring whatman berdiameter 9 cm. Delapan konsentrasi herbisida alachlor (yaitu. 0, 0.003, 0.03, 0.3, 3, 30, 300, 3000 ppm) dengan empat ulangan. Parameter yang diamati meliputi persentase perkecambahan, panjang akar, panjang unas, berat kering akar dan pucuk untuk keduanya yakni jagung manis dan rumput teki. Data dikumpulkan selama 7 hari selama periode perkecambahan, kecuali persentase perkecambahan dihitung setiap hari. Hasil penelitian menunjukkan terjadi penurunan berat kering akar dan berat kering pucuk baik pada jagung manis maupun rumput teki, ketika satu taraf konsentrasi dinaikkan, terutama pada jagung manis. Pada jagung manis, aplikasi herbisida alachlor pada konsentrasi 3000 ppm menurunkan berat kering akar 35.0% (percobaan I), 45.0% (percobaan II), dan berat kering pucuk 39.90% (percobaan I), 59.59% (percobaan II). Pada rumput teki penurunan telah terjadi dari konsentrasi alachlor 3 ppm, yaitu. pada berat kering akar menurun 57.58% percobaan. I), 60% (percobaan II), dan pada berat kering pucuk menurun 68.33% (percobaan. I), 69.5% percobaan II). Nilai tertinggi GR50 untuk semua variabel terjadi pada jagung manis dibanding rumput teki. Dapat digambarkan herbisida alachlor sebagai herbisida selektip pada jagung manis dan rumput, ketika keduanya ditanam secara interaktif.

Kata kunci : selektivitas, herbisida, jagung manis, teki, GR50

INTRODUCTION

Weeds on the sweet corn always become a serious problem. The loss caused by weeds is about 20 percent until 50 percent (Syawal, 1998).

Herbicide is one of effective and efficient control ways on weeds, especially if it is given in the exact dose (concentration). Alachlor can be used as herbicide pre planting and pre emergence with selective characteristic. The ability to disturb plant and weeds depends on the amount substances that can be reached part of plant which is growing or metabolism activity areas (Ashton and Craft, 1973). Under normal conditions alachlor givens a good selectivity in controlling many broadleaved weeds and annual grasses. The basis of its selectivity may be metabolism by tolerant plants as a rate sufficient to keep the leves below that required for growth inhibition. In barley, a susceptible species, for example, alachlor was rapidly metabolized to a water soluble product (Moenandir, 1978).

Peanut under warm spring conditions was shown good tolerance to 1.68 kg ha^{-1} rate of alachlor. Pre emergence sprays of alachlor have proved completely safe to maize and peanut. Potatoes showed good tolerance to alachlor while cotton and leaves were damaged. However, the cotton damaged by this herbicide was under abnormal conditions. Brassicas were more tolerant to alachlor while onion was damaged severely when used at 1.68 – 3.36 kg ha^{-1} (Hodkidson, 1971). Nutsedge is the most widespread and troublesome weed species in cranberry. Demoranville and Devlin (1972) recorded the effect of alachlor on this crop. Distinct inhibitor, effects were demonstrated on vegetative growth and root development in cranberry vines.

One of important consideration in using herbicide is to obtain selective control that kills the weeds but does not damage crop plant of cultivation. Therefore, it needs to know about the optimum dose (concentrate) of herbicide in crop plant in order to avoid the over dose of using herbicide.

The GR_{50} technique was used to determine the amount of alachlor concentrate for 50 percents growth reduction. The GR_{50} calculation was based on depression percentage of root and shoots length, root and shoot dry weight of both seed corn and nut sedge (Winarsih and Moenandir, 1986). The experiment goal is to obtain selectivity of alachlor herbicide on sweet corn and nut sedge using GR_{50} with filter paper media.

MATERIALS AND METHOD

The experiment was conducted in Plant Ecology Laboratory, Faculty of Agriculture, Sriwijaya University, from June up to August 2007

The experiment was set up in Randomized Complete Design, eight treatment (0,0. 0.003, 0.03, 0.3, 3, 30, 300, 3000 ppm) with four times. The experiments were conducted twice (I and II).

GR50 value was Y= bo + b1 X

Where; Y = 5, 00 from 50% value on the table Bliss, X= alachlor concentration.

X antilog, = GR_{50} value

RESULTS AND DISCUSSION

Sweet corn (Experiment I)

Alachlor effects to seed germination, length of root and shoot, fresh weight root and shoot, dry weight root and shoot was shown on Table 1. Analysis of variance with LSD 5%, shows that the percentage of germination between treatments, no significantly. Whereas by using alachlor at 3000 ppm concentrate reduced the length of root and shoot differents 56, 10 and 53.26 % respectively. The fresh weight root and shoot, dry weight shoot and root decrease with increase of concentrate alachlor. The result variants analysis and LSD 5 % shows that 3000 ppm concentrate significantly with different other treatments. While the reduce fresh weight root

and shoot, were 58, 58 and 36, 18% respectively and percentages reduction dry weight root and shoot of sweet corn were. 35.0 and 39.90 % respectively.

Nutsedge (Experiment I)

Effect alachlor on seed germination, length of root and shoot, fresh weight of root and shoot, dry weight of root and shoot sedges in Table 2. Alachlor 30 ppm significantly different with other treatments. 300 ppm nutsedge does not have ability to germinate. The length of root and shoot decrease with increasing of concentrate. Fresh weigth root and shoot nutsedge on 3 ppm, reduced 85.91 and 63.97% and on concentrate 30 ppm reduced 100% on root and shoot.

Fresh weigth root and shoot nutsedge, on 3 ppm consentration, reduction, viz 79.71, and 61.49%. Dry weight root and shoot nutsedge on 3 ppm concentration, reduction, viz. 77.25 and 58.68%.

Sweet corn (Experiment II)

The influence of Alachlor to germination, length of root and shoot, fresh weight and dry weight root and shoot of sweet corn (Table 3). The variants analysis with LSD 5% test, in a fact that the percentage of germination does not have real different in other treatments. Applications alachlor 3000 ppm concentrate, reduction of fresh root weight (41.0%) and dry weight (35.0%), fresh and dry shoot weight viz. 63.29% (root) and 59.59% (shoot).

Nutsedge.

Effect alachlor to seed germination, length of root and shoot nutsedge (Table 4). Application 30 ppm percentage seed germination significant showed with other treatment. And 300 ppm nudsedge cannot seed germination. Length root and shoot reduce with increasing of alachlor concentration. Percentage reduction length root and shoot (3 ppm) viz. 86.40 and 52.61%. Reduction 100% for dry weight, viz 30 ppm (root), 300 ppm (shoot)

From Table 5, it can be seen that the selectivity of herbicide through value of GR 50 from observation of variable. The four variables show that has different sensitivity, root is a plant which has more sensitive while the dry weight shoots more tolerant. In all experiments, the value of GR50, length root is more decrease other variable (nutsedge). Viz. 0.086 ppm (length root) and shoot 0.274 ppm. GR 50 dry weigth viz. 0.143 ppm and shoot 0.361 ppm. GR 50 sweet corn can be acquitted by giving high concentrate of alachlor.

Table 1. Seed germination (%), length of root and shoot (cm) fresh and dry weight (g) of sweet corn at various alachlor concentration (ppm) Experiment I.

Alachlor Concentration (ppm)	Seed germinatin[1)] (%)	Length of root[2)]		Fresh weight of[3)]		Dry	
		Root	Shoot	Root	Shoot	Root	Shoot
		cm					
0.000	87.10 a	11.01 a	11.37 a	27.70 a	34.92 a	20.00 a	21.81 a
0.003	90.00 a	10.90 a	11.05 ab	27.50 a	33.93 a	19.53 a	20.88 ab
0.030	90.01 a	10.71 a	10.68 ab	27.10 a	32.71 ab	19.40 a	20.86 ab
0.300	90.00 a	9.94 ab	9.87 abc	25.98 ab	32.20 ab	18.56 ab	20.40 ab
3.000	90.00 a	9.30 ab	9.30 abc	25.00 ab	30.20 b	17.80 ab	18.90 abc
30.00	87.15 a	8.10 b	8.70 bc	23.70 b	29.70 b	16.50 b	17.10 bc
300.0	90.00 a	7.80 b	8.00 c	20.20 c	25.30 c	12.95 c	15.98 c
3000	90.00 a	4.90 c	5.41 c	11.50 d	21.60 d	7.00 d	11.00 d
LSD (5%)	4.20	2.50	2.60	3.39	3.64	2.64	3.80

Notes : Average number are followed by the same letter in the same colum show no significant difference (p= 0, 05); 1) and 2) = Vx + 0.5 transformation; 3) = 104 and Vx + 0.5 transformation; 4) = 105 and Vx + 0.5 transformation

The result of experiment shows that the percentage of germination sweet corn until 3000 ppm does not show the negative influence, the low percentage of germination with low concentrate that estimates there is seed can be harvested before the maturity physiology of reach, so the seed does not have ability to germinate. In that level the seed does not have adequate food supply and form not complete embryo (Javaid *et al*., 2005; Jordan and Harvey, 1980). In processing the development of maturity of seed needs prepration (Minea *et al*, 2004).

Table 2. Seed germination (%), length of root and shoot (cm) fresh and dry weight (g) of nudsedge at various alachlor concentration (ppm) Experiment I.

Alachlor Concentration (ppm)	Seed germinatin[1)] (%)	Length of root[2)]		Fresh weight of[3)]		Dry	
		Root	Shoot	Root	Shoot	Root	Shoot
		cm					
0.000	8.08 a	1.82 a	3.11 a	2.28 a	2.76 a	1.91 a	2.21 a
0.003	7.65 ab	1.74 a	3.06 a	2.14 ab	2.68 a	1.84 a	2.16 ab
0.030	7.52 ab	1.51 b	2.67 b	2.01 b	2.47 b	1.68 b	2.01 b
0.300	7.39 b	1.22 c	2.41 c	1.82 c	2.10 c	1.59 b	1.70 cd
3.000	6.66 c	0.95 d	1.91 d	1.20 d	1.79 d	1.10 c	1.51 d
30.00	2.72 d	0.71 e	0.88 e	0.71 e	1.17 e	0.71 d	1.02 e
300.0	0.71 e	0.71 b	0.71 e	0.71 e	0.71 f	0.71 d	0.71 f
3000	0.71 e	0.71 e	0.71 e	0.71 e	0.71 f	0.71 d	0.71 f
LSD (5%)	0.63	0.14	0.25	0.15	0.18	0.15	0.17

Notes: Average numbers are followed by the same letter in the same column show no significant difference (p= 0.05); 1) and 2) = (V x+0.5 transformation); 3) = 104 and Vx + 0.5 transformation. 4) = 105 and Vx + 0.5 transformation.

Table 3. Seed germination (%), length of root and shoot (cm) fresh and dry weigth (g) of sweet corn at various alachlor concentration (ppm) Experiment I.

Alachlor Concentration (ppm)	Seed germinatin[1)] (%)	Length of root[2)]		Fresh weight of[3)]		Dry	
		Root	Shoot	Root	Shoot	Root	Shoot
		cm					
0.000	90.00 a	10.80 a	11.17 a	28.07 a	34.92 a	20.00 a	22.31 a
0.003	90.00 a	10.38 ab	10.98 ab	27.83 a	33.93 ab	19.53 ab	21.88 ab
0.030	90.01 a	9.88 ab	10.68 ab	27.10 ab	32.71 b	19.40 ab	20.10 bc
0.300	90.00 a	9.10 bc	9.86 abc	26.50 ab	32.20 bc	18.56 abc	19.11 cd
3.000	90.00 a	8.53 c	9.01 cd	25.00 b	30.20 cd	17.80 bc	18.87 cd
30.00	87.15 a	8.08 cd	8.76 cd	24.70 b	29.70 d	16.50 c	17.70 d
300.0	90.00 a	6.72 d	7.70 d	20.36 c	25.30 e	12.95 d	15.15 e
3000	90.00 a	4.75 e	5.16 e	11.51 d	21.60 f	7.00 e	12.50 f
LSD (5%)	2.97	1.49	1.87	2.51	2.00	2.03	2.08

Notes: Average numbers are followed by the same letter in the same column show no significant difference (p= 0.05); 1) and 2) = (V x+0.5 transformation); 3) = 104 and Vx + 0.5 transformation; 4) = 105 and Vx + 0.5 transformation.

Table 4. Seed germination (%), length of root and shoot (cm) fresh and dry weight (g) of nutsedge at various alachlor concentration (ppm) Experiment I.

Alachlor Concentration (ppm)	Seed germinatin[1)] (%)	Length of root[2)]		Fresh weight of[3)]		Dry	
		Root	Shoot	Root	Shoot	Root	Shoot
		cm					
0.000	8.08 a	1.85 a	3.12 a	2.23 a	2.71a	1.90 a	2.20 a
0.003	7.59 ab	1.83 a	2.93 a	2.15 a	2.69a	1.87 a	2.15 a
0.030	7.52 b	1.56 b	2.69 b	2.02 a	2.51a	1.68 b	2.02 a
0.300	7.52 b	1.24 c	2.54 b	1.84 b	2.11 b	1.60 b	1.71 b
3.000	6.73 c	0.95 d	2.21 c	1.21 c	1.88 c	1.14 c	1.53 b
30.00	2.53 d	0.71 e	0.94 d	0.71 d	1.17 d	0.71 d	0.95 c
300.0	0.71 e	0.71 e	0.71 e	0.71 d	0.71 e	0.71 d	0.71 d
3000	0.71 e	0.71 e	0.71 e	0.71 d	0.71 e	0.71 d	0.71 d
LSD (5%)	0.49	0.085	0.19	0.18	0.20	0.16	0.20

Notes: Average numbers are followed by the same letter in the same column show no significant difference (p= 0.05); 1) and 2) = ($\sqrt{x}$+0.5 transformation); 3) = 104 and $\sqrt{x}$ + 0.5 transformation; 4) = 105 and $\sqrt{x}$ + 0.5 transformation.

Table 5. GR50 value (ppm) of alachlor concentration for variable of shoots and root length, dry weight of root and shoot of sweet corn and nutsedge on filter paper (Expt. I and II) media.

Experiment Filter paper	GR 50 (ppm)							
	(Sweet corn)				(Nutsedge)			
	Length of		Dry weigtht of		Length of		Dry weigtht of	
	Root	Shoot	Root	Shoot	Root	Shoot	Root	Shoot
I	1778.28	4298.66	2069.14	16102.62	0.064	0.312	0.151	0.313
II	2096.18	3274.55	2571.91	17012.54	0.109	0.236	0.135	0.409
Mean	1937.23	3786.65	2320.52	16557.52	0.086	0.274	0.143	0.361

The percentage of germination on sweet corn less hamper which estimates there is enzyme that can be activate alachlor, while nutsedge no more big hamper. This situation because alachlor herbicide that can be reserved nutsedge hamper amylase syntetic (Amstrong *et al*., 1973) so it can reduce the process of lipid hydrolysis to become glucose in endosperm and the amount of glucose that is sent to growth point lastly, therefore the growing of rhizome can be reduction (Muzik, 1970; Sumarni and Moenandir, 1988).

It can be seen from Table 6 and 7, the all level of effectivity of alachlor on nutsedge more than sweet corn. It can be seen from the value of regression coefficient that shows the relationship between alachlor concentrate and the hamper. For similar hamper, sweet corn need higher alachlor concentrate.This is because of the role of the plantation itself such as morphology, biophysics, biochemistry reaction (Moenandir, 1988. Furthermore (Dixon *et a.l*, 1980), shows that alachlor disturb protein synthesis and dwided in two of the cell though mitoses in culminate in root and up to rhizome.

Table 6. Componen of Linear Regression which shown alachlor effect on sweet corn GR 50

Variable of observation	Component of linear Regresion				GR_{50}
	b0	bX	R	X	
(Experiment I)					
Root length	3.70	0.40	0.98	3.250270	1778.25
Shoot length	3.90	0.29	0.98	3.633334	4298.67
Root dry weight	3.74	0.38	0.97	3.315789	2069.14
Shoot dry weigth	3.78	0.30	0.97	4.206897	16102.62
(Experiment II)					
Root length	4.07	0.28	0.98	3.321429	2096.18
Shoot length	3.84	0.33	0.98	3.515152	3274.55
Root dry weigth	3.67	0.39	0.97	3.410256	2571.90
Shoot dry weight	3.90	0.26	0.96	4.230769	17012.54

Table 7. Component of Linear Regression which shown alachlor effect on nutsedge

Variable of observation	Component of linear Regresion				GR_{50} (ppm)
	b0	bX	R	X	
(Experiment I)					
Root length	6.12	0.94	0.96	- 1.091488	0.063
Shoot length	5.50	0.99	0.97	- 0.505051	0.314
Root dry weight	5.84	1.02	0.96	- 0.823528	0.151
Shoot dry weigth	5.39	0.97	0.96	- 0.402061	0.395
(Experiment II)					
Root length	5.98	1.02	0.96	- 0.960784	0.109
Shoot length	5.56	1.90	0.95	- 0.626373	0.236
Root dry weigth	5.87	1.01	0.94	- 0.870001	0.135
Shoot dry weight	5.38	0.98	0.97	- 0.387754	0.408

CONCLUSIONS

The very higher values of GR50 for all variable occurred in sweet corn than in nutsedge, depicting that alachlor herbicide roled as a selective herbicide in sweet corn and nutsedge, when they were planted interactively.

The more concentration of alachlor herbicides were applied the more reduction of the nutsedge root and shoot length.

REFERENCES

Amstrong , T.F., W.F. Meggitt, and D. Penner. 1973. Absorption, translocation and metabolism of alachlor by Yellow Nutsedge. Weed Sci. 21: 357-362

Aston, F.M, and A.C. Craft. 1973. Mode of Action of Herbicide. John Wiley & Sons. Sydney.