

Weed Management in Broadcast-Seeded Hybrid Rice (*Oryza sativa* L.)

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ABSTRACT

Two field experiments were carried out at the experimental farm of Sakha Research Station, Kafrelsheikh, Egypt during 2016 and 2017 summer seasons to select the best weed control treatments for two Egyptian hybrid rice varieties under broadcasting method. Two rice hybrids {Hybrid-1 (Sk2034H) and Hybrid-2 (Sk2151H)}. Six chemical weed control treatments included; Penoxsulam 2.5% at two rates (0.018 and 0.024 kg ai ha⁻¹) + Azimsulfuron 50% at rate of 0.014 kg ai ha⁻¹, Bispyribac-sodium 2% at two rates (0.029 and 0.038 kg ai ha⁻¹) + Azimsulfuron 50% at rate of 0.014 kg ai ha⁻¹, and Fenoxaprop-ethyl 7.5% at two rates (0.045 and 0.063 kg ai ha⁻¹) + Azimsulfuron 50% at rate of 0.014 kg ai ha⁻¹, were applied as compared to weedy check plots (control). A split plot design with four replications was used where, rice hybrids were allocated in the main plots while weed control treatments were applied in sub-plots. The results showed that, H₁ rice variety (Sk2034H) recorded the lowest dry weight of grassy weeds, *C. difformis* and total weeds, and scored the highest rice dry weight, number of panicles per square meter, filled grains per panicle and rice grain yield, while H₂ was the best in 1000-grain weight and panicle weight during the two seasons. Bispyribac-sodium 2% at recommended dose (0.038 kg ai ha⁻¹) or Fenoxaprop-ethyl 7.5% at reduced rate mixed with Azimsulfuron 50% at rate of 0.014 kg ai ha⁻¹ gave the lowest weed biomass and the best rice growth values in addition to yield and yield components in 2016 and 2017 seasons. The obtained results revealed that the best weed control, rice dry matter, yield and yield components were achieved by applying Bispyribac-sodium 2% at recommended dose (0.038 kg ai ha⁻¹) or Fenoxaprop-ethyl 7.5% at reduced rate mixed with Azimsulfuron 50% at recommended dose (0.014 kg ai ha⁻¹) with cultivation of Egyptian hybrid-1 (Sk2034H) except for panicle weight and 1000-grain weight of rice which obtained by H₂ rice hybrid treated with the same mixtures of herbicides during the two seasons of study.

Keywords: Rice, direct-seeded, rice hybrids, yield, dry eight weeds, herbicide, and weed control.

INTRODUCTION

Rice (*Oryza sativa* L.) is one of the most important gramineae and cereal crops in Egypt. It is considered as the most important food for about the half of world population, contributing about 20% of cereal consumption. Rice cultivation can help in reclaiming saline soils by leaching salts with irrigation water to be good soils for a lot of crops. Shebl *et al.*, 2009 reported that to increase rice production you can choose one of two ways ;(1) increasing the cultivated area by rice but it will be faced by limiting water in Egypt. (2) Increasing rice productivity per unit area by release high yielding ability rice varieties and short duration to save water.

Hybrid rice technology is an important way to increase rice production in Egypt. Hybrid rice has the potential to produce 15-25% greater yield when compared with inbred cultivars (Walker *et al.*, 2008). So that it must be adopt package of recommendation including good weed management to exploit this advantage.

Weeds are become a limit factor in rice production especially under direct seeded rice system, it can share the crop in water, nutrition, light and space, it can cause yield losses by 10-100% depending on competitiveness ability of crop and method of rice planting (Van Heemst, 1985), and ranged from 14-93 in direct-seeded rice (Ranjit, 1997). So it is necessary to find out a good integration among rice varieties, agricultural practices, biological, mechanical and chemical weed control to reduce or avoid yield losses caused by weeds (Abd El-Naby, 2013).

Chemical weed control is the most effective method to manage weeds and produce a high yield under direct-seeded rice (DSR) system, chemical control may be by using single herbicide or make a mixture of two herbicides different in mode of action to

control most of dominant weeds in the field. Abou El-Darag (2016) showed that the efficient weed management and higher grain yield of rice were obtained by the integration between cultivation any of H₄ or H₁₀ rice hybrids when applied with mixture of Bispyribac-sodium 2% at rate of 0.03 kg ai ha⁻¹ + Thiobencarb 50% at rate of 1.8 kg ai ha⁻¹.

The present study aimed to select the best weed control combinations from the recommended herbicides to achieve the best weed control, rice growth and higher grain yield for two Egyptian hybrid rice varieties.

MATERIALS AND METHODS

Two field experiments were carried out during 2016 and 2017 seasons at Sakha Agricultural Station, ARC, Egypt. Seed rate of 24 kg ha⁻¹ from rice seeds were broadcasted at 20th of May in both seasons of study. Plot size was 15 m² (5 m x 3m). A split plot design with four replications was used where, rice varieties were allocated in the main plots while weed control treatments were applied in sub-plots. The rest rice agricultural practices were applied as recommended for broadcast-seeded rice.

Studied factors were as follow:

a- Rice varieties:

- 1- Hybrid-1 (Sk2034H).
- 2- Hybrid-2 (Sk2151H).

Both hybrids were introduced by breeding program at Rice Research and Training Center (RRTC).

b- Weed control treatments:

- T₁- Penoxsulam 2.5% OD (Rainbow) + Azimsulfuron-methyl 50% WG (Golivar) at rate of (0.018+0.014 kg ai ha⁻¹).
- T₂- Penoxsulam 2.5% OD at recommended dose + Azimsulfuron-methyl 50% WG at rate of (0.024+0.014 kg ai ha⁻¹).

- T₃- Bispyribac sodium 2% SL (Nominee 2%) + Azimsulfuron - methyl 50% WG at rate of (0.029+0.014 kg ai ha⁻¹).
- T₄- Bispyribac sodium 2% SL at recommended dose + Azimsulfuron-methyl 50% WG at rate of (0.38+0.014 kg ai ha⁻¹).
- T₅- Fenoxaprop-ethyl 7.5% EW (Whipsuper) + Azimsulfuron-methyl 50% WG at rate of (0.045+ 0.014 kg ai ha⁻¹).
- T₆- Fenoxaprop-ethyl 7.5% EW at recommended dose + Azimsulfuron-methyl 50% WG at rate of (0.063+0.014 kg ai ha⁻¹).
- T₇- Weedy check (control).

Both of T₁ and T₂ treatments were applied at 15 days after sowing (DAS), while T₃ and T₄ treatments were sprayed at 25 DAS, while both of T₅ and T₆ treatments were applied at 35 DAS. All chemical control treatments were sprayed in 300 liter water per hectare on wet land by using Knapsack sprayer then the soil was flooded by water after 24 hours from herbicidal application and kept water for 5 days after treatment (DAT).

At 80 DAS, weeds were sampled by area of 50 x 50 cm quadrat replicated two times for each plot, weed samples were cleaned, classified, air dried then oven dried to stable weight, dry weight as g.m⁻² was recorded. Also, rice dry weight was measured at the same time of sampling by the same method. Before harvest, panicles were counted in two random quadrates of 50 x 50 cm and number of panicles per square meter was recorded. After rice maturity, the central 6 m² from each plot were

manually harvested, air dried, threshed and cleaned to determine grain yield then recorded rice grain yield at 14% moisture content.

Data analysis: the collected data were subjected to proper statistical analysis of variance according to Snedecor and Cochran (1971). Weed data were statistically analyzed by MSTATC program after transformation, while rice collected data were directly analyzed by MSTATC program then the means of both weeds and rice characters were compared by using Duncan's Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

A- Weeds:

1- Effect of rice hybrids and weed control treatment on dry weight of weeds:

Dry weight of grassy weeds, *C. difformis* and total weeds as affected by rice hybrids and weed control treatments in 2016 and 2017 seasons are presented in Table (1).

The results indicated that the H₁ rice, gave the lowest values of dry weight of grassy weeds, *C. difformis* and total weeds as compared to H₂ rice hybrid that, gave the highest values of these characters during two seasons of study. The reduction in dry weight of grassy weeds, *C. difformis* and total weeds were obtained by H₁ rice compared to H₂ rice may be due to the high tillering and competitiveness ability of this hybrid against weeds. The obtained results are in agreement with those reported by Clifford *et al.*, (2006), Shebl *et al.*, (2009) and Abon EL-Darag (2016).

Table 1. Dry weights of grassy weeds, *C. difformis* and total weeds as affected by rice hybrids and weed control treatments during 2016 and 2017 seasons.

Factor	Rate (kg ai ha ⁻¹)	Weeds dry weight (g.m ⁻²)					
		Grassy weeds		<i>C. difformis</i>		Total weeds	
		2016	2017	2016	2017	2016	2017
A-Varieties:							
H ₁ - Hybrid 1	-	140.13	95.74	26.61	17.85	166.74	113.59
H ₂ - Hybrid 2	-	170.53	131.27	34.17	26.05	204.70	157.32
F. test		**	**	**	*	**	**
B-Weed control:							
T ₁ - Penoxsulam+ Azimsulfuron	0.018+0.014	271.07 b	148.03 b	22.76 b	18.66 b	293.83 b	166.69 b
T ₂ - Penoxsulam+ Azimsulfuron	0.024+0.014	120.76 c	101.12 c	10.88 d	6.50 d	131.64 c	107.62 c
T ₃ -Bispyribac-sodium+Azimsulfuron	0.029+0.014	83.61 d	74.31 d	12.21 d	8.06 d	95.82 d	82.36 d
T ₄ - Bispyribac sodium+Azimsulfuron	0.038+0.014	27.33 e	22.35 e	10.12 d	5.89 d	37.45 f	28.24 e
T ₅ - Fenoxaprop+ Azimsulfuron	0.045+0.014	26.59 e	21.58 e	20.37 bc	14.23 bc	46.96 e	35.81 e
T ₆ - Fenoxaprop+ Azimsulfuron	0.063+0.014	25.73 e	17.18 e	19.85 c	15.02 bc	45.58 e	32.20 e
T ₇ - weedy check	---	532.25 a	409.99 a	116.52 a	85.30 a	648.77 a	495.27 a
F. test		**	**	**	**	**	**
Interaction:							
AxB		**	**	**	**	**	**

In a column, means followed by the same letter are not significantly different at 5% level according to DMRT.

In respect to weed control treatments, all herbicide treatments significantly reduced dry weight of grassy weeds, *C. difformis* and total weeds as compared to weedy check plots during the two seasons. The application of Bispyribac-sodium mixture with Azimsulfuron at the recommended dose as well as Fenoxaprop at the two rates (0.045 and 0.063 kg ai ha⁻¹) mixed with Azimsulfuron at the rate of 0.014 kg ai ha⁻¹ recorded the lowest values of dry weight of grassy

weeds, while the first mixture was more efficient for dry weight of *C. difformis* and equivalent with using both of Penoxsulam or Bispyribac-sodium mixtures with Azimsulfuron at the recommended doses as compared to other treatments in both seasons. It could be observed that the application of Bispyribac-sodium + Azimsulfuron at recommended doses achieved the most efficient reduction in total weeds dry weight during the two seasons of study with

no significant difference between using Fenoxaprop-ethyl at reduced or recommended doses mixed with Azimsulfuron during the second season in this respect. The reduction in dry weight of grassy weeds, *C. difformis* and total weeds might due to herbicidal application which may related to the herbicidal efficiency in germination inhibition and growth of weeds. These results are confirmed with those cited by Ashraf *et al.* (2006), Pal *et al.* (2009) and El-Ghandor (2013).

2- Effect of the interaction between rice hybrids and weed control treatments on dry weight of weeds:

Data on dry weight of grassy weeds, *C. difformis* and total weeds as influenced by the interaction between rice varieties and weed control treatments during 2016 and 2017 seasons are shown in Figures (1, 2 and 3).

Generally, all herbicide treatments caused a significant reduction in dry weight of grassy weeds, *C. difformis* and total weeds under growing the two rice hybrids. Moreover, as shown from data in Figure (1), the application of Bispyribac-sodium + Azimsulfuron (0.038 +0.014 kg ai ha⁻¹) and Fenoxaprop (0.045 and 0.063 kg ai ha⁻¹) +Azimsulfuron (0.014 kg ai ha⁻¹) recorded the lowest values of grassy weeds dry weight under H₁ in the first season. While in 2017 season, the same treatments recorded the lowest dry weight of grassy weeds under the two rice hybrids as compared to weedy check. The highest dry weight of grassy weeds was recorded during with weedy check plots cultivated by h₂ rice variety during two seasons of study.

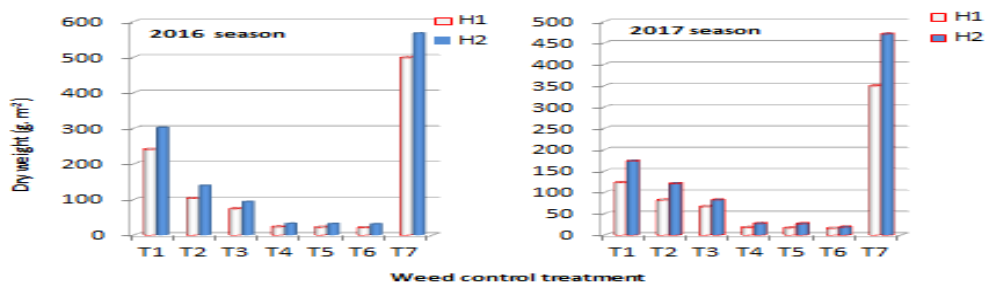


Fig. (1): Effect of interaction between rice varieties and weed control treatment on dry weight of grassy weeds during 2016 and 2017 seasons

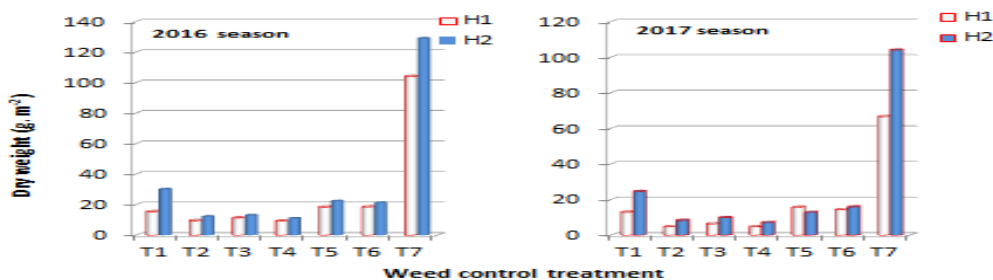


Fig. (2): Effect of interaction between rice varieties and weed control treatment on dry weight of *C. difformis* during 2016 and 2017 seasons

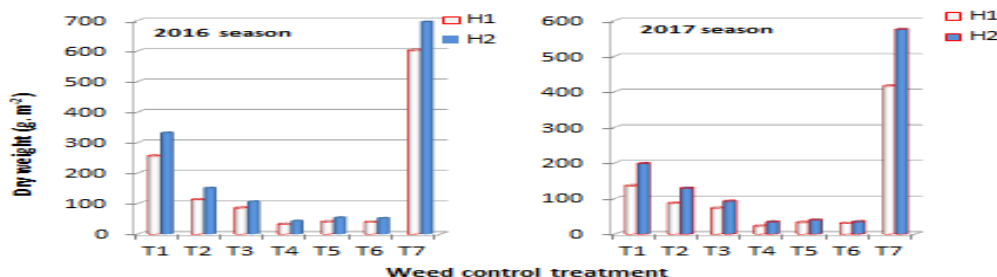


Fig. (3): Effect of interaction between rice varieties and weed control treatment on dry weight of total weeds during 2016 and 2017 seasons

T₁ = Penoxsulam + Azimsulfuron) at rate of (0.0238+0.0357 kg ai ha⁻¹), T₂ =Penoxsulam + Azimsulfuron at rate of (0.0238+0.0357 kg ai ha⁻¹), T₃ = Bispyribac + Azimsulfuron- at rate of (+0.0357 kg ai ha⁻¹), T₄- Bispyribac + Azimsulfuron at rate of (0.381+0.0357 kg ai ha⁻¹), T₅- Fenoxaprop- + Azimsulfuron- at rate of 0.0625 kg ai ha⁻¹, T₆- Fenoxaprop + Azimsulfuron at rate of (0.0625+0.0357 kg ai ha⁻¹) and T₇- Weedy check (control).

For *C. difformis* it is obvious from the results in Figure (2) that, the application of Penoxsulam + Azimsulfuron (0.024+ 0.014 kg ai ha⁻¹) as well as Bispyribac-sodium (0.029 and 0.038 kg ai ha⁻¹) + Azimsulfuron (0.014 kg ai ha⁻¹) recorded the lowest values of *C. difformis* dry weight under H₁ rice hybrid with no significant difference between H₂ treated by T₄ in 2016 season. On the other hand, the lowest dry weights of *C. difformis* were achieved by T₁, T₂, T₃ and T₄ under the two rice hybrids during the second season. The highest dry weight of *C. difformis* was observed in weedy check plot cultivated by H₂ rice variety during the two seasons.

Regarding dry weight of total weeds (Figure 3), the application of Bispyribac-sodium + Azimsulfuron (0.038 +0.014 kg ai ha⁻¹) achieved the lowest values of total weeds dry weight under H₁ and H₂ during the two seasons of study with no significant differences with the treatment of Fenoxaprop (0.045 and 0.063 kg ai ha⁻¹) +Azimsulfuron (0.014 kg ai ha⁻¹) with H₁ rice in second season, while weedy check plot produced the highest dry weight of total weeds under H₂ rice during two seasons of study. The reduction in total weeds dry weight may be due to the highly efficacy of herbicide application in controlling weeds with the presence of H₁ rice may reflect the weed suppressive effect of varietal performance. These results

are confirmed with those cited by Hassan and Shebl (2005) and Shebl *et al.*, (2009).

B- Rice:

1-Effect of rice hybrids and weed control treatment on rice dry weight, number of panicles m⁻² and number of filled grain per panicle:

Rice plants dry weight, number of panicles m⁻² and number of filled grain panical⁻¹ as affected by rice hybrids and weed control treatments in 2016 and 2017 seasons are presented in Table (2).

Data indicated that rice plants dry weight, number of panicles m⁻² and number of filled grain panical⁻¹ were significantly influenced by rice hybrids during the two seasons. H₁ rice hybrid recorded the highest values of rice plants dry weight, number of panicles m⁻² and number of filled grains panical⁻¹ as compared to H₂ rice which gave the lowest values for these studied characters of rice during 2016 and 2017 seasons. Increasing values of these characters by H₁ rice compared with H₂ rice may be attributed to genetic variability for this hybrid which may be able to be superior in dry matter production, producing high panicles number and number of filled grains per panicle, also competitiveness ability against weeds. Similar results were reported by El-Ekhtyar (2004), El-Namaky (2007) and Shebl *et al.* (2009).

Table 2. Rice plant dry weight, number of panicles m⁻² and number of filled grains per panicle as affected by rice hybrids and weed control treatments during 2016 and 2017 seasons.

Factor	Rate (kg ai ha ⁻¹)	Rice dry weight (g. m ⁻²)		Number of panicles (m ⁻²)		Number of filled grains per panicle	
		2016	2017	2016	2017	2016	2017
A-Varieties:							
H ₁ - Hybrid 1	--	1043.66	1165.22	604.24	640.57	109.71	117.14
H ₂ - Hybrid 2	--	883.00	981.81	509.73	570.51	97.43	109.67
F. test		**	**	**	**	**	**
B-Weed control:							
T ₁ - Penoxsulam+ Azimsulfuron	0.018+0.014	722.73 e	854.67 d	539.50 e	583.33 e	96.33 d	101.67 c
T ₂ - Penoxsulam+ Azimsulfuron	0.024+0.014	1229.53 b	1219.99 b	613.33 b	651.33 b	119.33 a	127.50 a
T ₃ - Bispyribac-sodium+Azimsulfuron	0.029+0.014	1099.70 c	1208.67 b	554.33 d	617.33 d	103.83 b	118.00 b
T ₄ - Bispyribac-sodium+Azimsulfuron	0.038+0.014	1297.37 a	1357.67 a	662.33 a	696.00 a	120.00 a	129.50 a
T ₅ - Fenoxaprop+ Azimsulfuron	0.045+0.014	1291.61 a	1344.00 a	654.67 a	687.33 a	119.17 a	128.17 a
T ₆ - Fenoxaprop+ Azimsulfuron	0.063+0.014	950.08 d	1122.00 c	574.72 c	630.12 c	100.17 c	116.00 b
T ₇ - weedy check	---	152.13 f	407.83 e	300.00 f	373.33 f	66.17 e	73.00 d
F. test		**	**	**	**	**	**
Interaction:							
AxB		**	**	*	**	**	**

In a column, means followed by the same letter are not significantly different at 5% level according to DMRT.

As shown in Table (2) all herbicide treatments significantly increased rice plants dry weight, number of panicles m⁻² and number of filled grain panical⁻¹ as compared to weedy check plots. Application of Bispyribac-sodium at the rate of 0.038 kg ai ha⁻¹ as well as Fenoxaprop at the two rates (0.045 and 0.063 kg ai ha⁻¹) in mixture with Azimsulfuron at the rate of 0.014 kg ai ha⁻¹ produced the highest values of rice plants dry weight, number of panicles m⁻² and number of filled grain panical⁻¹ with no significant differences with applying of Penoxsulam in mixture with Azimsulfuron at the recommended doses on number of filled grains

panicle⁻¹. The lowest values for these studied characters of rice were recorded in weedy check during the two seasons of study. Increasing in the values of these characters may be attributed to weed suppression by herbicide application, which effectively excluded weed competition as mentioned by Singh *et al.*, (2006).

2- Effect of the interaction between rice hybrids and weed control treatment on rice plants dry weight, number of panicles m⁻² and number of filled grains per panicle:

Data in Figures (4, 5 and 6) showed the significant effect of the interaction between rice varieties and weed

control treatments on rice plants dry weight (g.m^{-2}), number of panicles per square meter and number of filled grains per panicle in the two seasons of study.

H₁ (Sk2034H) rice hybrid treated with both of Bispyribac-sodium 2% at recommended dose or Fenoxaprop-ethyl 7.5% at reduced rate mixed with Azimsulfuron 50% at recommended dose recorded the highest dry matter of rice, panicles per unit area and filled grains/panicle. The same degree of significance was obtained with H₁ treated with mixture of Penoxsulam + Azimsulfuron at recommended doses for number of filled grains per panicle in both seasons of study. On the other hand, weedy check plots cultivated with H₂ rice variety gave

the lowest values in the abovementioned studied characteristics of rice during 2016 and 2017 seasons.

These results may be due to the high tillering ability and yielding potentiality of H₁ especially when weeds efficiently controlled by applying Azimsulfuron mixed with Bispyribac-sodium 2% at recommended dose or Fenoxaprop-ethyl 7.5% at reduced rate which killed all or most of accompanied weeds to avoid crop-weed competition for water, nutrients, light and space led to enhanced vegetative growth and yield components, consequently economic yield of rice. These results are confirmed with those obtained by Shebl *et al.* (2009) and Abou El-Darag (2016).

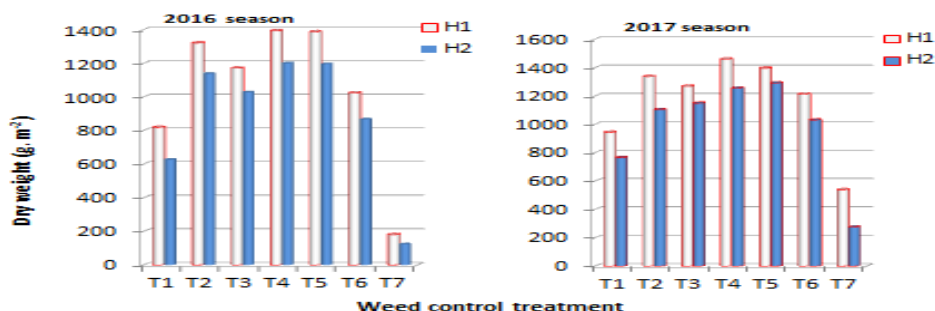


Fig. (4): Effect of interaction between rice varieties and weed control treatment on dry weight of rice during 2016 and 2017 seasons

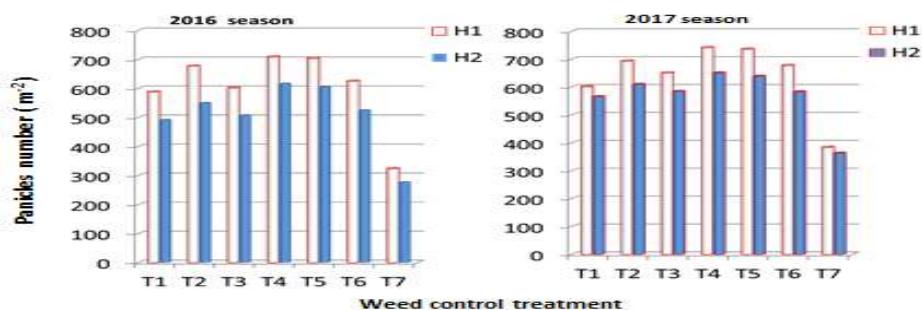


Fig. (5): Effect of interaction between rice varieties and weed control treatment on panicle number of rice during 2016 and 2017 seasons

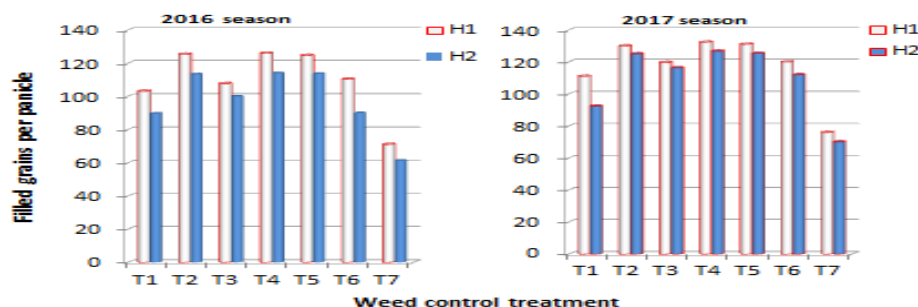


Fig. (6): Effect of interaction between rice varieties and weed control treatment on filled grains per panicle of rice during 2016 and 2017 seasons

T₁ = Penoxsulam + Azimsulfuron) at rate of (0.0238+0.0357 kg ai ha⁻¹), T₂ = Penoxsulam + Azimsulfuron at rate of (0.0238+0.0357 kg ai ha⁻¹), T₃ = Bispyribac + Azimsulfuron- at rate of (+0.0357 kg ai ha⁻¹), T₄- Bispyribac + Azimsulfuron at rate of (0.381+0.0357 kg ai ha⁻¹), T₅- Fenoxaprop- + Azimsulfuron- at rate of 0.0625 kg ai ha⁻¹, T₆- Fenoxaprop + Azimsulfuron at rate of (0.0625+0.0357 kg ai ha⁻¹) and T₇- Weedy check (control).

3-Effect of rice hybrids and weed control treatment on 1000-grain weight, panicle weight and rice grain yield:

Data on 1000-grain weight, panicle weight (g) and rice grain yield (tons ha⁻¹) as influenced by rice varieties and weed control treatments in 2016 and 2017 seasons are presented in Table (3). The obtained results showed that the abovementioned traits were markedly affected by both of rice hybrids and chemical control treatments in both seasons.

Regarding rice varieties, H₂ exceeded H₁ in 1000-grain weight and panicle weight in the two

seasons, it may be due to the genetic background which reflects that H₂ has heaviest grains and panicle weight than H₁. Additionally, H₁ had the superiority in grain yield during both seasons of study. This may be because of the high ability of Sk2034H to produce more dry matter, effective tillers and most of yield attributes. Mahajan and Chauhan (2013) reported that the availability and use of high competitive cultivars would provide effective, season-long, and sustainable weed control in DSR systems. These results are confirmed with those obtained by Shebl *et al.* (2009) and Dass *et al.* (2017).

Table 3. 1000-grain weight, panicle weight and grain yield of rice as affected by rice hybrids and weed control treatments during 2016 and 2017 seasons.

Factor	Rate (kg ai ha ⁻¹)	1000-grain weight (g)		Panicle weight (g)		Grain yield (tons ha ⁻¹)	
		2016	2017	2016	2017	2016	2017
A-Varieties:							
H ₁ - Hybrid 1	--	22.77	23.28	2.11	2.26	8.612	9.096
H ₂ - Hybrid 2	--	24.09	24.60	2.21	2.77	7.825	8.283
F. test		**	**	**	**	**	**
B-Weed control:							
T ₁ - Penoxsulam+ Azimsulfuron	0.018+0.014	22.15 d	22.73 d	2.29 d	2.39 d	7.495 e	8.153 e
T ₂ - Penoxsulam+ Azimsulfuron	0.024+0.014	24.22 b	24.70 b	2.51 b	2.70 b	9.568 b	10.040 b
T ₃ - Bispyribac-sodium+Azimsulfuron	0.029+0.014	23.48 c	23.86 c	2.40 c	2.55 c	8.343 d	8.877 d
T ₄ - Bispyribac-sodium+Azimsulfuron	0.038+0.014	25.18 a	25.52 a	2.68 a	2.97 a	10.540 a	10.920 a
T ₅ - Fenoxaprop+ Azimsulfuron	0.045+0.014	24.92 a	25.35 a	2.65 a	2.89 a	10.517 a	10.808 a
T ₆ - Fenoxaprop+ Azimsulfuron	0.063+0.014	23.77 bc	24.03 c	2.37 cd	2.54 c	8.580 c	9.220 c
T ₇ - weedy check	---	20.30 e	21.39 e	1.29 e	1.59 e	2.488 f	2.828 f
F. test		**	**	**	**	**	**
Interaction:							
AxB	---	**	**	**	*	**	**

In a column, means followed by the same letter are not significantly different at 5% level according to DMRT.

Referring to weed control treatments, all chemical weed control treatments considerably increased 1000-grain weight, panicle weight and grain yield of rice as compared with weedy check plots (untreated) in 2016 and 2017 seasons (Table 3). The mixtures of recommended doses from Bispyribac-sodium 2% + Azimsulfuron 50% or Fenoxaprop-ethyl 7.5% at reduced dose + Azimsulfuron 50% at recommended dose recorded the highest values of 1000-grain weight, panicle weight as well as higher grain yield as compared to other treated plots followed by the mixture of Penoxsulam 2.5% at recommended dose + Azimsulfuron 50% over the two seasons of study. Shebl *et al.* (2009) concluded that the integration between H₁₀ rice hybrid and the application of Bispyribac-sodium 2% mixed with Pyrazosulfuron 10% at recommended doses achieved the best weed management and higher rice growth and economic yield of hybrid rice. These results are in harmony with those reported by Mousa and Noreldin (2015). Moreover, Fenoxaprop-ethyl application at reduced rate achieved high weed control as well as recommended dose but the reduced rate was the best in rice vegetative growth, dry matter, yield and

its attributes, it may be due to the harmful effect of high rate from this herbicide which caused phytotoxicity on rice leaves, rice dwarfing and growth delay which reflect on rice dry biomass, panicles number and grain yield. So the best weed control treatment must be effective in controlling and save the crop.

4- Effect of the interaction between rice hybrids and weed control treatment on 1000-grain weight, panicle weight and rice grain yield:

As shown in Figures (7, 8 and 9), the interaction between rice varieties and weed control treatments significantly influenced 1000-grain weight (g), panicle weight (g) and grain yield (tons ha⁻¹) in 2016 and 2017 seasons. H₂ rice hybrid treated with the mixtures of recommended rates from Bispyribac-sodium 2% + Azimsulfuron 50% or Fenoxaprop-ethyl 7.5% at reduced rate + Azimsulfuron 50% at recommended dose gave the highest values of 1000-grain weight and panicle weight in the two seasons of study. On the other hand, the lowest values for both traits were obtained by plots cultivated by H₁ without applying any chemicals (weedy check) during the two seasons of study.

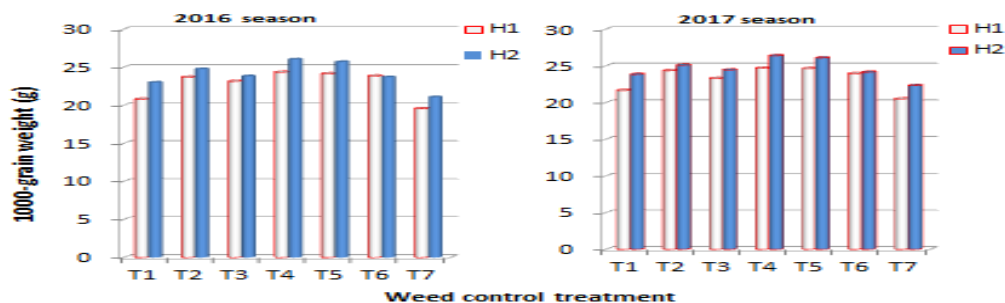


Fig. (7): Effect of interaction between rice varieties and weed control treatment on 1000-grain weight of rice during 2016 and 2017 seasons

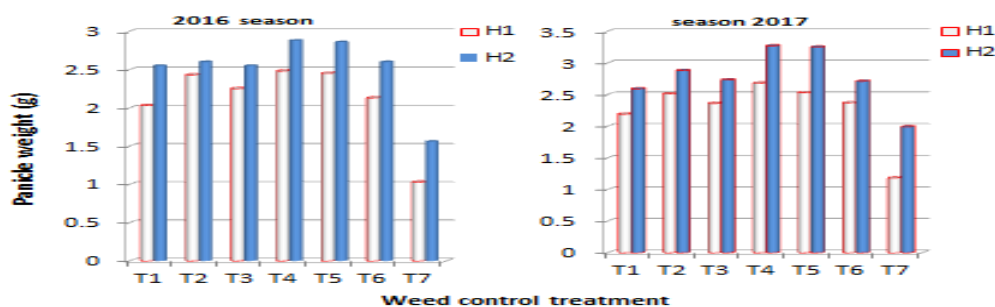


Fig. (8): Effect of interaction between rice varieties and weed control treatment on Panicle weight of rice during 2016 and 2017 seasons

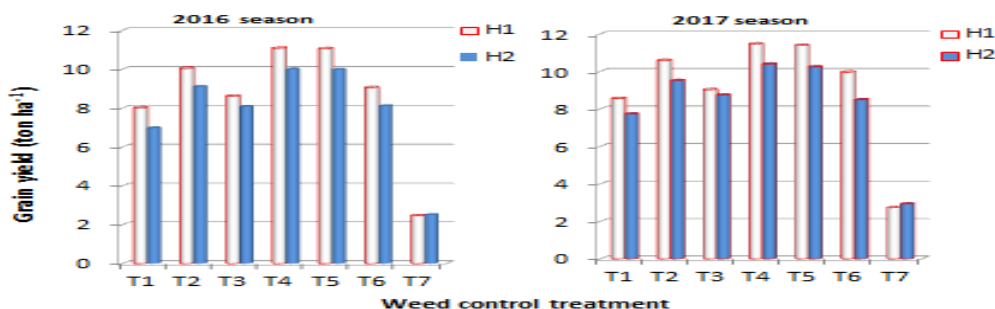


Fig. (9): Effect of interaction between rice varieties and weed control treatment on Grain yield of rice during 2016 and 2017 seasons

T₁ = Penoxsulam + Azimsulfuron) at rate of (0.0238+0.0357 kg ai ha⁻¹), T₂ =Penoxsulam + Azimsulfuron at rate of (0.0238+0.0357 kg ai ha⁻¹), T₃ = Bispyribac + Azimsulfuron- at rate of (+0.0357 kg ai ha⁻¹), T₄- Bispyribac + Azimsulfuron at rate of (0.381+0.0357 kg ai ha⁻¹), T₅- Fenoxaprop- + Azimsulfuron- at rate of 0.0625 kg ai ha⁻¹, T₆- Fenoxaprop + Azimsulfuron at rate of (0.0625+0.0357 kg ai ha⁻¹) and T₇- Weedy check (control).

For grain yield, it could be obvious from data in Figure (9) that the highest grain yields of rice were achieved by H₁ which treated with Bispyribac-sodium at recommended dose mixed with Azimsulfuron or Fenoxaprop-ethyl at reduced rate mixed with Azimsulfuron followed by Penoxsulam mixed with Azimsulfuron at the recommended doses in 2016 and 2017 seasons. On the other hand, H₂ cultivated in weedy check plots gave the lowest grain yield in the two seasons. It may be due to the high efficiency of herbicide mixtures in controlling most of dominant weeds in direct-seeded rice especially with cultivating high competitiveness ability and yield potentiality varieties as reported by Abou El-Darag (2016) and Dass *et al.* (2017).

CONCLUSION

In Egypt, hybrid rice technology is an important way to increase rice production especially under limitation of water. It must be having an effective weed management program in broadcast-hybrid rice, the obtained data showed that the efficient weed control was achieved by applying Bispyribac-sodium 2% at recommended dose or Fenoxaprop-ethyl 7.5% at reduced rate mixed Azimsulfuron 50% at recommended dose resulting in higher rice dry matter, yield and its components.

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مكافحة الحشائش في الأرز الهجين بدار

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أقيمت دراسة حقلية بالمزرعة البحثية بسخا - كفر الشيخ - جمهورية مصر العربية خلال الموسم الصيفي لعامي ٢٠١٦ - ٢٠١٧ م بهدف دراسة تأثير معاملات مكافحة الحشائش علي نمو ومحصول الأرز الهجين المنزوع بطريقه البدار. تم تقييم اثنين من الهجين المصريه {هجين-١ (Sk2034H) وهجين-٢ (Sk2151H)} وسبع معاملات لمكافحة الحشائش (بينوكسيولام ٢.٥% بمعدلي ٠.١٨ و ٠.٢٤ كجم ماده فعاله/هكتار + آزيمسلفيرون ٥٠% بمعدل ٠.١٤ كجم ماده فعاله/هكتار ، بيسيريبيك صوديوم ٢% بمعدلي ٠.٢٩ و ٠.٣٨ كجم ماده فعاله/هكتار + آزيمسلفيرون ٥٠% بمعدل ٠.١٤ كجم ماده فعاله/هكتار ، فينوكسابروب ايثيل ٧.٥% بمعدلي ٠.٤٥ و ٠.٦٣ كجم ماده فعاله/هكتار + آزيمسلفيرون ٥٠% بمعدل ٠.١٤ كجم ماده فعاله/هكتار وغير المعامل). استخدم تصميم القطع المنشقة مره واحده ذو أربع مكررات حيث وزعت الهجن في القطع الرئيسية عشوائياً بينما وزعت معاملات مكافحة الحشائش عشوائياً في القطع الشقية. أوضحت النتائج أنه بزراعة الهجين مصري-١ (Sk2034H) تحصل على أقل القيم في الوزن الجاف للحشائش النجيلية ، العجيرة و الحشائش الكلية وزيادة في الوزن الجاف لنباتات الأرز ، عدد السنابل ، وزن السنبله ، عدد الحبوب الممتلئه في السنبله ومحصول حبوب الأرز بينما سجل هجين مصري-٢ (Sk2151H) أعلى القيم فقط في وزن الألف حبه ووزن السنبله خلال موسمي الدراسة. كما أوضحت النتائج أن استخدام ميدي بيبيريبيك صوديوم ٢% بالمعدل الموصي به (٠.٣٨ كجم ماده فعاله/هكتار) أو فينوكسابروب ايثيل ٧.٥% بالمعدل المنخفض مخلوطين مع ميدي ازيبسلفيرون ٥٠% بالمعدل الموصي به (٠.١٤ كجم ماده فعاله/هكتار) أدى إلي إنخفاض الوزن الجاف للحشائش النجيلية ، العجيره و الحشائش الكلية وزيادة في محصول الحبوب ومكوناته مقارنة بباقي المعاملات. كما أظهرت النتائج أيضاً أن افضل معاملات لمكافحة الحشائش ، الوزن الجاف للأرز وكذلك محصول الحبوب ومكوناته كانت عند استخدام بيبيريبيك صوديوم ٢% بالمعدل الموصي به (٠.٣٨ كجم ماده فعاله/هكتار) أو فينوكسابروب ايثيل ٧.٥% بالمعدل المنخفض مخلوطين مع ميدي ازيبسلفيرون ٥٠% بالمعدل الموصي به (٠.١٤ كجم ماده فعاله/هكتار) مع الصنف هجين مصري-١ (Sk2034H) ما عدا وزن السنبله ووزن الألف حبه كانت مع الصنف هجين مصري-٢ (Sk2151H) مع نفس معاملات مكافحة الحشائش تحت ظروف هذه التجربة.