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Effect of Preceding Winter Crops and Herbicidal Combinations on Weeds, Yield and Econemic Feasability of Broadcast-Seeded Rice Productivity.

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ABSTRACT

Nowadays, in Egypt there is a big shift towards increasing the cultivated area with broadcast-seeded rice which needs to overcome the heavy out weeds infestation in this case. Thus, four field experiments were conducted at the Experimental Farm of El-Serw Agri. Res. Station, Damietta Governorate in 2014 and 2015 summer seasons, to investigate effect of clover and wheat as two preceding winter crops before sowing the rice as broadcast-seeded rice and six weed control treatments [Saturn at 2.0 L/ faddan + Basagran at 1.5 L/ faddan, Ronstar at 0.75 L/ faddan + Enpul at 20 g/faddan, Rainbow at 0.4 L/ faddan + Enpul at 20 g/ faddan, Rainbow at 0.4 L/ faddan + Basagran at 1.5 L/ faddan combinations, hand weeding twice and untreated check] in each experiment on weeds, rice grain yield and its components with economic evaluation. The main findings indicated that sowing the rice as broadcasted after clover; and weed control treatments irrespective of the preceding winter crops decreased significantly the dry weight of both dicot and monocot weeds and markedly increased rice grain yield (ton/faddan) and its components i.e., plant height, number of tillers/m^2, number of panicles/m^2, number of filled grain/panicle and weight of grain/panicle, that is true in both seasons. In first season the interaction between clover as a preceding winter crop and herbicides combinations i.e. Rainbow 2.5% OD (penoxsulam) at 0.4 L/ faddan followed by Enpul 75% WG (halosulfuron-methyl) at 20 g/faddan; Rainbow 2.5% OD at 0.4 L/faddan followed by Basagran 48% AS (bentazon) at 1.5 L/ faddan; Ronstar 25% EC (oxadiazon) followed by Enpul 75% WG at 20 g/faddan and Saturn 50% EC (thiobencarb) at 2.0 L/faddan followed by Basagran 48% AS at 1.5 L/faddan reduced the total weeds by 91.7, 91.3, 88.5 and 86.3%, respectively, at 70 DAS, and accompanied with significant increases on rice grain yield by 145.3, 154.0, 122.0 and 148.0% than untreated check, respectively. Whilst, hand weeding twice was less effective on reducing the total weeds by 56.5 and 53.4% at the respective assessments and reflect that to increase rice grain yield in both seasons. The highest net income/faddan were obtained by the previous herbicidal combinations in trials preceded with clover than wheat during the two seasons. This study throw lights about suitable and satisfactory herbicidal combinations to overcome the heavy weeds infestation problem in broadcast-seeded rice. These results indicated that under heavy infestation with weeds in broadcast- seeded rice, it is possible to grow broadcast-seeded rice after clover with using one herbicides combinations,(Rainbow at 0.4L/fed + Enpul at 20 g/fed, Rainbow at 0.4L/fed + Basagran at 1.5 L/fed, Ronstar at 0.75 L/fed + Enpul at 20g/fed; and Saturn at 2.0 L/fed + Basagran at 1.5 L/fed) which, gave the highest redution weeds, increase broadcast- seeded rice yield and the highest economic values in both seasons.

Keywords: *preceding crop, penoxsulam, halosulfuron, oxadiazon, thiobencarb, bentazon, weeds, economic analysis, Oryza sativa.*

INTRODUCTION

Rice (*Oryza sativa*, L.) is considered as one of the most important cereal summer crops in Egypt as a daily population diet. Raising its productivity from land area unit is very essential to meet the consistent increased demands. Improvement of rice production can be achieved through replacement of the traditional cultivated varieties by new high yield ones and also by optimizing the cultural practices. Weed control are among the limiting factors of raising rice crop production. With respect to previous crops several studies, pointed out that preceding crop is important factor for limiting grain yield of rice and its attributing variables. Metwally *et al*. (1994) and Bassal *et al*. (1996), indicated that rice grain yield and its attributing variables were superior when the preceding crop was faba bean as compared with wheat. On average in Europe, the potential reduction in rice yields due to uncontrolled weeds has been estimated at 55–60% (Oerke *et al*., 1994).

Several studies (Adigun *et al*., 2005; Singh *et al*., 2006; Mann *et al*., 2007; Singh *et al*., 2008 and Mahajan *et al*., 2009), concluded that chemical weed control is feasible as it is quick easy and economical. Several workers reported about the possibility of weed control by using herbicide alone or in combination with other methods (Singh and Ram, 1990). Researchers reported that herbicides application attended to provide a great weed control and maximum yield of rice (Larelle *et al*., 2003 and Cavanna *et al*., 2004). Zhang *et al*. (2005) stated that the combination of fenoxaprop with bentazon controlled effectively both broad and narrow leaved weeds and increased rice grain yield. According to Joy *et al*. (1991) found that weed flora in rice consisted of 37% grasses, 33% sedges and 30%broadleaves weeds. Barnyard grass control, with penoxsulam, was reported to be at least 99% at 21 days after application, (Ottis *et al*., 2004).

Talbert and Burgos (2007) found that penoxsulam did not injure rice but improved its yields, compared with standard propanil-based programs. Penoxsulam(13.6%) decreased fresh weight of grassy weeds (monocot) and total weeds by, 39.2 and 35%,respectively, compared with the untreated check,(Mousa and Noreldin, 2015). William,(1994) reported that Saturn a PRE(applied as a post early emergence) herbicide active on annual grasses, some broadleaf weeds and sedges. Yousefnia *et al*. (2012) indicated that herbicide application and hand weeding once had the highest grain yield (4584 kg ha-1), compared with, untreated check due to high unfilled grain/ panicle and less panicle number / square meter which had the lowest grain yield (2505 kg ha-1). Jamshid *et al.* (2012) indicated that thiobencarb with mixed bentazon and propanil; oxadiargyl with mixed of bentazon and propanil; butachlor with mixed of bentazon and propanil gave 3454, 3390 and 3349 kg/ha

yield, respectively, compared with three time hand weeding treatment (3044 kg/ha). Grain yield was increased by using penoxsulam (13.6%) and hand-weeding twice by, 41, and 18%, respectively, in the first season, and 44 and 31%, respectively, in the second season as compared with the untreated check in the two seasons, (Mousa and Noreldin, 2015).

Accordingly, this investigation was carried out to study the effect of preceding crops and herbicides combination on growth, yield and yield components of broadcast-seeded rice.

MATERIALS AND METHODS

Four field experiments two every season were carried out during 2014 and 2015 summer seasons at El-Serw Agricultural Research Station, Damietta Governorate, Egypt, two of them were preceded with clover and the other two experiments were preceded with wheat. Each trial was sown the rice as broadcast (*Oryza sativa* varity Giza 179) and included six weed control treatments (four herbicides combinations, hand weeding twice and untreated check). The objective of this study to detect the integration of the preceding winter crops and weed control treatments on weed control, rice grain yield and its components beside the economic feasibility. Soil texture in experimental field were clayey (Table 1).

Table 1: physical and chemical properties of the soil samples before agriculture rice during 2014 and 2015 summer seasons.

Seasons	Soil Depth (cm)	Particle size distribution				Texture Class	O.M. %	Caco3 %	PH (1:2.5) Suspe
		Coarse sand%	Fine Sand%	Silt %	Clay %				
2014	0-30	1.74	13.34	21.71	63.19	Clayey	1.21	2.35	7.9
2015	0-30	1.71	13.33	21.79	63.21	Clayey	1.22	2.31	7.3

Soil preparation, ordinary calcium super phosphate (15.5% P_2O_5) at the rate of 100 kg/faddan was added pre-sowing. Seeded rice was broadcasted in 10 and 15 May in the first and the second seasons, respectively. Rice grains used at the rate of 60 kg/faddan were soaked in water for about 36 hours and incubated for 24 hours. All agronomic practices in broadcast-seeded rice such as, land preparation, fertilization and irrigation were done as recommended (nitrogen fertilizer at 70 kg/faddan and applied as urea 46.5% N) in three equal doses after sowing. The experimental design was randomized completely block design with four replicates were used and six weed control treatments. The area of plot was 21 m^2 (3mx7m). Weed control treatments were as follow:

1- Saturn 50% EC (thiobencarb) [S-4-chlorobenzyl diethyl (thiocarbamate)] at the rate of 2.0 L/faddan after 7 days from sowing, followed by, Basagran 48% AS (bentazon)[3-isopropyl-1H-2, 1, 3-benzothiadiazin-4(3H)-one 2, 2-dioxide] application at the rate of 1.5 L/faddan after 21 days from sowing.
2- Ronstar 25% EC (oxadiazon) [5-tert-butyl-3-(2,4-dichloro-5-isopropoxyphenyl)-1,3,4-oxadiazol-2(3H)-one] at the rate of 0.75 L/faddan after 8 days from sowing, followed by, Enpul 75% WG (halosulfuron-methyl)[methyl 3-chloro-5-(4,6-dimet hoxypyrimidin-2-ylcarbamoylsulfamoyl)-1-et hylpyrazole-4-carboxylate] at the rate of 20 g/faddan after 21 days from sowing.
3- Rainbow 2.5% OD (penoxsulam) [2-(2,2-difluoroethyl)-N-(5,8-dimethyl[1,2,4] triazolo [1,5-c] pyrimidin-2-yl)-6-(trifluromethyl) benzenesulfonamide] at the rate of 0.4 L/faddan after 15 days from sowing, followed by, Enpul 75% WG (halosulfuron- methyl) at the rate of 20 g/faddan after 30 days from sowing.
4- Rainbow 2.5% OD (penoxsulam) at the rate of 0.4 L/faddan after 15 days from sowing, followed by, Basagran 48% AS(bentazon)[3-isopropyl-1H-2,1,3-benzothiadiazin-4(3H)-one 2,2-dioxide] at the rate of 1.5 L/faddan after 30 days from sowing.
5- Hand weeding twice at 30 and 45 days after sowing.
6- Untreated check.

Herbicides treatments were sprayed by knapsack sprayer CP3 with water volume of 200 L/faddan.

Data recorded:

1- On weeds

Weeds were hand pulled randomly from one square meter from each plot after 70 and 90 days from sowing and classified into two categories: weeds dicotyledons (dicot) and monocotyledons (monocot). Weeds were air-dried, and then oven dried to constant weight for 48 hours at 70˚C. The percent of weed reduction (R) was calculated using the following equation:

$$R = (A - B/ A) \times 100$$

Where: A and B refer to dry weight of weeds in the untreated check and treated plots, respectively.

2- Rice growth characters and yield components:

At harvest, samples were taken from one square meter chosen in center plot and use ten rice plants were collected randomly to and the following characters were determined; number of tillers/m^2, number of panicles/m^2, plant height (cm), panicle length (cm), number of filled grain/panicle, 1000 grain weight (g), grain weight /panicle (g) and the grain yield to calculated (ton/ faddan) at harvest from yield of the whole plot.

3- Soil analysis:

Soil samples were taken from each plot randomly from depth of 0-20 cm from all sites immediately after harvest preceding winter crops and also after rice harvesting. Nitrate in soil samples were determined according to kieldahl method as described by Jackson (1958), available P according to Olsen *et al*. (1954) and

K was estimated flame photo metrically using E.E.L. flame photometer as mentioned by, Richards (1984).

4-Economic studies:

According to Dunan *et al*. (1995), the economic evaluation partial for grain yield of rice (ton/faddan), partial variable costs, gross income (GI), profitability and benefit/cost ratio (B/C) were calculated according to Heady and Dillon (1961), as follows:

Gross income (GI) = (price) 1700 LE*Egyptian pound x grain yield (ton / faddan).

Net income (NI) = gross income – partial costs.

Profitability (P) = (net income/partial costs) x 100.

Benefit/Costs Ratio (B/C) = gross income/partial costs.

*Egyptian Ministry of Supply and Internal Trading 2014 and 2015 seasons.

5- Statistical analysis:

All data were subjected to the statistical and combined analysis for preceding crops experiments in each year. The treatment means were compared using least significant differences (LSD) as mentioned by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

The most dominant weed species in rice fields in this study were *Echinochloa colonum* L., *Brachiaria reptans* L., *Echinochloa crus-galli* L., *Cyperus difformis* L., *Dinebra retroflexa* vahl, *Scirpus maritimus*, L. and *Cyperus rotundus* L. as monocot weeds, and *Ammannia auriculata* Willd and *Eclipta alba* L. as dicot weeds.

1-Effect of the preceding winter crops and weed control treatments:

On weeds:

Data presented in Table 2 indicated that the preceding winter crops decreased the dry weight of both dicot and monocot weeds significantly without their total at two weed assessments in first season but appeared to fluctuated in the second season. In first season, sowing rice after clover reduced the dry weight of monocot and dicot weeds by 12.4 and 6.4%, respectively, at 70 DAS; and 20.7 and 3.4%, respectively, at 90 DAS. In the second season, sowing rice after clover reduced monocot weeds by 28.5% at 90 DAS, whilst, sowing rice after wheat reduced monocot by 8.8% at 70 DAS and dicot weeds by 2.9% at dicot 90 DAS.

Table 2: Dry weight (g/m^2) of annual weeds at 70 and 90 days after sowing as affected by preceding winter crops and weed control treatments in broadcasted seeded rice during 2014 and 2015 seasons

Treatments	Rate/ faddan	Time of application (DAS)	Days after sowing: 70 days Dicot (g/m^2)	70 days Monocot (g/m^2)	70 days Total weeds (g/m^2)	90 days Dicot (g/m^2)	90 days Monocot (g/m^2)	90 days Total weeds (g/m^2)
2014 season								
Preceding crops (A):								
Clover	-	-	63.7	42.3	105.0	65.5	60.3	125.8
Wheat	-	-	68.7	52.7	121.4	82.6	62.4	145.0
F. test			*	*	NS	*	*	NS
Weed control(B):								
Saturn+ Basagran	2L+1.5L	7+21	33.6	17.1	50.7	34.3	29.9	64.2
Ronstar+ Enpul	0.75L+20g	8+21	28.7	12.7	41.4	29.5	19.9	49.4
Rainbow + Enpul	0.4L+20g	15+30	22.4	9.8	32.2	22.4	17.3	39.7
Rainbow + Basagran	0.4L+1.5L	15+30	23.6	12.3	35.9	26.3	15.4	41.7
Hand weeding twice	-	30+45	97.6	72.5	170.1	104.3	98.8	203.1
Untreated check	-	-	241.3	121.6	362.9	261.3	164.3	425.6
F. test			**	*	**	**	**	**
LSD at 5 %			12.11	10.52	21.06	18.32	22.65	31.52
Interaction (A×B)			NS	NS	*	NS	NS	*
2015 season								
Preceding crops(A):								
Clover	-	-	53.0	63.3	116.3	80.8	56.5	137.3
Wheat	-	-	78.0	47.7	125.7	78.5	79.0	157.5
Significance (F. test 0.05)			*	*	NS	*	*	NS
Weed control(B):								
Saturn+ Basagran	2L+1.5L	7+21	25.2	24.5	49.7	33.6	31.5	65.1
Ronstar+ Enpul	0.75L+20g	8+21	25.9	19.8	45.7	26.5	26.3	52.8
Rainbow + Enpul	0.4L+20g	15+30	20.5	13.3	33.8	20.2	22.7	42.9
Rainbow + Basagran	0.4L+1.5L	15+30	23.1	17.9	41.0	26.4	18.1	44.5
Hand weeding twice	-	30+45	102.7	61.1	163.8	116.0	103.7	219.7
Untreated check	-	-	195.2	168.4	363.6	260.6	197.9	458.5
F. test			**	*	**	**	**	**
LSD at 5 %			13.86	14.58	17.36	20.92	21.89	19.79
Interaction (A×B)			NS	NS	*	NS	NS	*

DAS= days after sowing

On the other hand, dry weight of the two weed categories and their total were significantly affected by all weed control treatments in the two assessments in both seasons. In first season, at 70 DAS, weed control

treatments could be arranged in a descending order with regard to their effect on reducing the dry weight of total weeds as follows: Rainbow at 0.4 L/faddan followed by Enpul at 20 g/faddan (91.1%), Rainbow at 0.4 L/ faddan followed by Basagran at 1.5 L/ faddan (90.1%), Ronstar at 0.75 L/ faddan followed by Enpul at 20 g/faddan (88.6%) and Saturn at 2.0 L/ faddan followed by Basagran at 1.5 L/ faddan (86.0%) and hand weeding twice (53.1%), compared with, the untreated check.

The previous respective treatments reduced the total weeds by 90.7, 90.2, 88.4 and 84.9%, compared to untreated check, after 90 DAS. The same treatments arrangement and results approximately were observed at the two assessments in the second season. Rainbow at 0.4 L/faddan followed by Enpul at 20g/faddan; Rainbow at 0.4 L/faddan followed by Basagran at 1.5 L/faddan; Ronstar at 0.75 L/faddan followed by Enpul at 20 g/faddan and Saturn at 2.0 L/ faddan followed by Basagran at 1.5 L/faddan were reduced the dry weight of total weeds by 90.7, 88.8, 87.4 and 86.3 %, respectively, at 70 DAS; and, 90.6, 90.2, 88.5 and 85.8 %, respectively, at 90 DAS, compared to untreated check. Similar results were obtained by Hassan *et al*. (1986) and Mousa and Noreldin, (2015). William,(1994) reported that Ronstar PRE (as pre emergence) herbicide active on annual grasses and broadleaf weeds and noticed that, halosufuron-methyl (as apre-emergence and early post-emergence) had a broad spectrum on controlling broadleaf weeds with some activity on sedges and grass weeds. These results agree with those obtained by, Metwally *et al*., (1994) and Bassal *et al*., (1996).

On grain rice yield and its components:

Results in Table 3 show that, the significant effect of preceding winter crops and weed control treatments on grain yield and some of its attributes of rice cultivar Giza 179 in 2014 and 2015 seasons.

Table 3: Effect of preceding crop and weed control treatments on rice plant characters and grain yield (ton/ faddan) in 2014 and 2015 seasons.

Treatments	Rate/ faddan	Time of application (DAS)	No. of tillers/ m^2	No. of panicles/ m^2	Plant height (cm)	Panicle length (cm)	No. of filled grains/ Panicle	Grain weight/ panicle (g)	1000-grain weight (g)	Rice grain yield (ton/ faddan)
2014 season										
Preceding crops (A):										
Clover	-	-	315.6	310.23	94.09	21.72	143.24	3.36	21.99	3.27
Wheat	-	-	303.38	291.90	90.24	21.00	132.34	2.31	20.72	3.05
F. test					*	*	*	*	*	*
Weed control(B):										
Saturn+ Basagran	2L+1.5L	7+21	340.96	338.61	95.47	21.66	147.52	3.04	21.97	3.72
Ronstar+ Enpul	0.75L+20g	8+21	333.10	326.23	93.14	21.42	144.03	2.95	21.83	3.33
Rainbow + Enpul	0.4L+20g	15+30	340.00	341.47	96.10	21.72	149.29	3.07	21.92	3.68
Rainbow + Basagran	0.4L+1.5L	15+30	336.12	335.74	94.28	21.53	146.27	3.00	21.77	3.81
Hand weeding twice	-	30+45	314.52	307.34	89.28	20.82	136.55	2.77	20.73	2.56
Untreated check	-	-	189.37	165.93	86.83	19.44	103.10	2.13	19.90	1.50
F. test			**	*	*	NS	**	**	**	**
LSD at 5 %			11.21	14.9	NS	0.75	3.73	0.13	0.04	0.11
Interaction (A×B)			NS	NS	NS	NS	*	NS	NS	*
2015 season										
Preceding crops (A):										
Clover	-	-	304.80	308.62	90.69	21.08	138.82	2.76	22.63	3.29
Wheat	-	-	296.92	288.90	86.58	20.80	130.06	2.30	21.44	3.11
F. test			**	**	NS	NS	NS	*	*	NS
Weed control(B):										
Saturn+ Basagran	2L+1.5L	7+21	334.19	334.12	91.83	21.54	146.13	3.19	23.09	3.66
Ronstar+ Enpul	0.75L+20g	8+21	327.41	326.28	89.30	21.21	140.63	3.02	23.00	3.71
Rainbow + Enpul	0.4L+20g	15+30	336.21	335.28	92.06	21.59	145.88	3.30	22.94	3.83
Rainbow + Basagran	0.4L+1.5L	15+30	329.62	331.72	90.29	21.44	143.35	3.10	22.88	3.74
Hand weeding twice	-	30+45	307.52	305.77	85.01	20.60	134.15	2.68	20.78	2.62
Untreated check	-	-	170.23	159.97	83.48	19.24	98.15	1.73	19.52	1.69
F. test			**	NS	NS	NS	**	**	**	**
LSD at 5 %			13.15	18.91	4.92	0.56	11.16	0.31	0.23	0.27
Interaction (A×B)			*	NS	NS	NS	NS	*	*	*

DAS= days after sowing

Clover as a preceding winter crop caused increases in rice components i.e., plant height by 4.3 and 4.7%, number of tillers/m^2 by 3.9 and 2.6%, panicle length by 3.4 and 1.3%, number of panicles/m^2 by 6.3 and 6.8%, number of filled grain/panicle by 8.2 and 6.7%, grain weight /panicle by, 45.45 and 20.00%, 1000- grain weight by 6.1 and 5.6%, and grain yield by 7.2 and 5.7%, during 2014 and 2015 respectively, as compared with wheat as preceding winter crop. These results agree with those obtained by Metwally *et al*. (1994) and Bassal *et al*. (1996).

Weed control treatments had a substantial increasing effect on rice grain yield and its components i.e., plant height, panicle length, number of filled grain/panicle, grain weight /panicle, 1000-grain weight and grain yield /faddan as compared with untreated check in both seasons (Table 3). Dense weeds growing with rice plants all over the growing seasons in untreated check recorded grain yield by (1.50 and 1.69 ton/faddan) in both seasons, respectively. This drop in grain yield/faddan under the untreated check, may be attributed to the reduction in the values of growth characters, which occurred as a results of the competition between rice plant and weeds for the essential environmental resources i.e., light, and nutrients. Data showed that, weed control treatments, Rainbow at 0.4 L/faddan followed by Basagran at 1.5 L/faddan, Saturn at 2.0 L/faddan followed by Basagran, Rainbow at 0.4 L/faddan followed by Enpul at 20 g/faddan, Ronstar at 0.75 L/faddan followed by Enpul at 20 g/faddan and hand weeding twice increased grain yield of rice /faddan by 154.0, 148.0, 145.3, 122.0 and 70.7%, respectivelyin the first season and; 121.3, 116.6, 126.6, 118.9 and 55.0%, respectively, in the second season as compared with untreated check.

William (1994) reported that, Ronstar PRE (as pre emergence) herbicide active on annual grasses and broadleaf weeds and halosufuron-methyl a broad spectrum PRE (as a pre-emergence) and early POST (as early post-emergence) had abroad spectrum on controlling broadleaf weeds with some activity on sedges and grass weeds.The use of herbicidal combinations in this study led to decrease monocot and dicot weeds and effectively more than hand weeding twice, as well as reduce the critical period of competition between weeds and rice plant, leading to increase vegetative characterise and rice grain yield.

2- Effect of interaction between preceding crops and weed control treatments:

On weeds:

Data presented in Table 4 show that effect of interaction between, preceding winter crops and weed control treatments were significant effect on dry weight of total weeds at two assessments during two seasons. Rainbow at 0.4 L/faddan followed by Enpul at 20 g/faddan, Rainbow at 0.4 L/ faddan followed by Basagran at 1.5 L/faddan, Ronstar at 0.75 L/ faddan followed by Enpul at 20 g/faddan and Saturn at 2.0 L/ faddan followed by Basagran at 1.5 L/faddan were gave, the highest reduction on dry weight of total weeds under preceding crop clover as compared with cultivation after wheat with untreated check at 70 and 90 days after sowing in both seasons. This may be owing to effect to integration between the role effect of preceding winter crops and weed control treatments in controlling weeds associated rice plant.

Table 4: Effect of interaction between, preceding winter crops and weed control treatments on dry weight of total weeds(g/m^2) at 70 and 90 days after sowing during 2014 and 2015 seasons.

Preceding crops	Weed control treatments	Rate/ faddan	Time of application (DAS)	Dry weight of total weeds(g/m^2) Weed assessments			
				2014 season		2015 season	
				70 (DAS)	90 (DAS)	70 (DAS)	90 (DAS)
Clover	Saturn+ Basagran	2L+1.5L	7+21	46.5	56.8	41.8	61.3
	Ronstar+ Enpul	0.75L+20g	8+21	38.9	45.9	39.6	50.8
	Rainbow + Enpul	0.4L+20g	15+30	28.3	37.6	29.8	39.6
	Rainbow+ Basagran	0.4L+1.5L	15+30	29.5	34.7	39.2	42.3
	Hand weeding twice	-	30+45	147.6	178.3	155.9	203.7
	Untreated check	-	-	339.2	401.5	334.5	425.8
Wheat	Saturn+ Basagran	2L+1.5L	7+21	54.9	71.5	57.6	68.9
	Ronstar+ Enpul	0.75L+20g	8+21	43.9	52.8	51.7	54.8
	Rainbow + Enpul	0.4L+20g	15+30	38.6	45.8	37.8	46.2
	Rainbow+ Basagran	0.4L+1.5L	15+30	42.2	46.4	42.7	49.6
	Handweeding twice	-	30+45	192.5	203.9	171.6	234.3
	Untreated check	-	-	396.5	449.7	392.6	491.2
	F test			*	*	*	*
	LSD at 5%			28.01	33.96	38.39	42.72

DAS= days after sowing

on rice:

Results in Table 5 show that the effect of interaction between, preceding winter crops and weed control treatments were significant effect on, grains weight /panicle (g), 1000-grain weight (g) and Grain yield (ton/ faddan) during two seasons. The highest mean of rice grain yield (3.99 and 3.92 ton/faddan) was obtained from, the effect of, preceding winter crop clover with Rainbow at 0.4 L/faddan followed by Enpul at 20 g/faddan, but, Rainbow at 0.4 L/ faddan followed by Basagran at 1.5 L/faddan gave grain yield (3.89 and 3.82 ton/faddan), Ronstar at 0.75 L/ faddan followed by Enpul at 20 g/faddan (3.81 and 3.76 ton/faddan) and Saturn at 2.0 L/faddan followed by Basagran at 1.5 L/faddan (3.75 and 3.69 ton/faddan), while, the lowest grain yield (1.41 and 1.53 ton/faddan) was resulted from the effect of wheat with untreated check in both seasons, respectively.

Table 5: Effect of interaction between, preceding winter crops and weed control treatments on, grain weight /panicle, 1000-grain weight and grain yield/ faddan of seeded rice in 2014 and 2015 seasons.

preceding crops	Weed control treatments	Rate/ faddan	Time of application (DAS)	grain weight / panicle (g)		1000-grain weight (g)		Grain yield (ton/ faddan)	
				2014	2015	2014	2015	2014	2015
Clover	Saturn+ Basagran	2L+1.5L	7+21	3.56	3.72	22.75	23.87	3.75	3.69
	Ronstar+ Enpul	0.75L+20g	8+21	3.48	3.52	22.53	23.74	3.81	3.76
	Rainbow + Enpul	0.4L+20g	15+30	3.60	3.86	22.61	23.52	3.99	3.92
	Rainbow+Basagran	0.4L+1.5L	15+30	3.52	3.62	22.33	23.64	3.89	3.82
	Hand weeding twice	-	30+45	3.30	3.22	21.14	21.28	2.55	2.72
	Untreated check	-	-	2.67	2.26	20.53	19.71	1.58	1.85
Wheat	Saturn+ Basagran	2L+1.5L	7+21	2.51	2.66	21.18	22.31	3.69	3.62
	Ronstar+ Enpul	0.75L+20g	8+21	2.41	2.52	21.13	22.26	3.55	3.65
	Rainbow + Enpul	0.4L+20g	15+30	2.53	2.73	21.22	22.35	3.37	3.73
	Rainbow+ Basagran	0.4L+1.5L	15+30	2.47	2.58	21.20	22.12	3.72	3.66
	Hand weeding twice	-	30+45	2.23	2.13	20.32	20.27	2.56	2.51
	Untreated check	-	-	1.59	1.19	19.26	19.32	1.41	1.53
LSD at 5%				0.75	0.53	0.63	0.44	0.37	0.43

DAS= days after sowing

3- Correlation between studied characters and rice grain yield:

Data presented in Table 6 indicated that the correlation between dry weight of monocot, dicot weeds species and grain yield of rice was statistically significant and negative at 5% level very and strong with dicot weeds species (- 0.597 and - 0.607) than monocot weeds (- 0.643 and - 0.772) in 2014 and 2015 seasons, respectively. This means that, monocot weeds were more aggressive in their competition to rice than dicot weeds. Correlation between dry weight of total annual weeds and grain yield / faddan were recorded, the highest negative values, on rice grain yield by - 0.869 and - 0.879 at 5% level in the two seasons, respectively. Yousefnia *et al*. (2012) indicated that herbicide application & hand weeding once had negative and significant correlation (- 0.47*) with grain yield. Panicles number / square meter had very high and positive correlation (0.94**) with grain and biological yield. As a result, number of panicles / square meter is considered as the most important and the most effective trait in increasing grain yield. Also, correlation analysis revealed that the grain yield were increased due to type of weed competition were positively contributed to the increase, plant height, panicle length, grain weight/ panicle, 1000-grain weight.

Table 6: Correlation coefficient between, weeds, studied characters and rice grain yield during 2014 and 2015 seasons.

Studied characters	Dry weight of monocot weeds (g/m^2)	Dry weight of total weeds (g/m^2)	Plant height (cm)	Panicle length (cm)	Grain weight/ panicle (g)	1000- grain weight (g)	Grain yield (ton/ faddan)
				2014 season			
Dry weight of dicot weeds (g/m^2)	0.156	0.614*	-0.130	-0.104*	-0.396*	-0.531*	-0.597*
Dry weight of monocot weeds (g/m^2)		0.812*	-0.158	-0.213*	-0.515*	-0.611*	-0.643*
Dry weight of total weeds (g/m^2)			-0.167*	-0.592*	-0.666*	-0.841*	-0.869*
Plant height (cm)				-0.062	-0.136*	-0.278*	-0.201*
Panicle length (cm)					0.801*	0.641*	0.589*
Grain weight/ panicle (g)						0.843*	0.711*
1000- grain weight (g)							0.836*
				2015 season			
Dry weight of dicot weeds (g/m^2)	0.192	0.701*	-0.233*	-0.146*	-0.417*	-0.620*	-0.602*
Dry weight of monocot weeds (g/m^2)		0.841*	-0.364	-0.357*	-0.601*	-0.645*	-0.772*
Dry weight of total weeds (g/m^2)			-0.421*	-0.618*	-0.614*	-0.792*	-0.879*
Plant height (cm)				-0.134	-0.242*	-0.351*	-0.209*
Panicle length (cm)					0.831*	0.672*	0.576*
Grain weight/ panicle (g)						0.816*	0.721*
1000- grain weight (g)							0.801*

4- Chemical analysis of soil:

Data presented in Table 7 revealed that the highest N content was shown after clover, also, indicated that; P and K contents were lower after clover as compared with wheat. This may be attributed to the relatively greater vegetative growth of clover which remove great amount of P through the successive cuttings. This data may suggest that clover plants had higher capability to absorb K and hence remove soil soluble K than wheat.

Based on these results, it could be concluded that application of treatments, Rinbow at 0.4 L/faddan followed by Enpul at 20 g/faddan or Saturn at 2.0 L/faddan followed by Basagran at 1.5 L/faddan are essential for obtaining higher grain yield under El- Serw conditions when clover was the preceded crop.These results show that, also legumes residues had higher nitrogen content than non-leguminous crops and were confirmed by, Metwally *et al*. (1994) and Bassal *et al*. (1996).

Table 7: Available N, P and K (ppm) as well as, pH at soil after harvesting the preceding winter crops and after rice harvesting.

Available (ppm)	Pre sowing the rice		Post harvesting of the rice	
	Clover	Wheat	Clover	Wheat
N	50.30	28.20	35.80	22.20
P	8.20	11.20	5.70	8.40
K	380.0	465.0	403.0	312.0
pH	7.6	7.8	7.7	7.9

5- Economic analysis:

Data in Table 8 and figures 1, 2, 3 and 4 show that the differences between all studied economic criteria to determine the economic feasibility of rice as affected by, the preceding winter crops, weed control treatments and their interactions through two summer seasons. The partial costs included fixed costs without rental of land (land preparation, price of sowing rice seeds, sowing activities, fertilization, irrigation, weed control, control the pests and harvesting / faddan). The increases of partial costs were obtained with hand weeding at twice and reached to 3700 and 4010 LE/ faddan in the first and the second seasons, respectively, meanwhile the reduction were obtained with untreated check(2700 and 3010 LE/ faddan) in both seasons, respectively.

Gross income were significantly increased by the herbicidal treatments and more than hand weeding twice due to the increase in: number of tillers/ m^2, number of panicles/ m^2 , number of filled grain/ panicle and rice grain yield/faddan. The highest net income(LE/faddan) were obtained by the interactions between clover and Rainbow at 0.4 L/ faddan followed by Enpul at 20 g/faddan, Ronstar at 0.75 L/faddan followed by Enpul at 20g/ faddan and Rainbow at 0.4 L/faddan followed by Basagran at 1.5 L/faddan, 3719, 3507, 3503, 3284, 3212 and 3044LE respectively, during the two seasons when preceding crop clover, but, Saturn at 2.0 L/faddan followed by Basagran at 1.5 L/faddan: 3325 and 2913LE/faddan, respectively, in the first and the second seasons.

The highest profitability were obtained from herbicidal combinations treatments more than, hand weeding twice and untreated check during, 2014 and 2015 seasons. The increase in profitability was obtained by the interactions between clover and the following treatments in a descending order: Rainbow at 0.4 L/faddan followed by Enpul at 20 g/faddan, Ronstar at 0.75 L/ faddan followed by Enpul at 20 g/faddan, Rainbow at 0.4 L/ faddan followed by Basagran at 1.5 L/faddan, Saturn at 2.0 L/ faddan followed by Basagran at 1.5 L/faddan and hand weeding twice by, 121.4, 118.1, 112.6, 100.0 and 17.2%, respectively, in the first season.

Marketable benefit/cost ratio grades were obtained with, Rainbow at 0.4 L/ faddan followed by Enpul at 20 g/faddan, Ronstar at 0.75 L/faddan followed by Enpul at 20 g/faddan, Rainbow at 0.4 L/ faddan followed by Basagran at 1.5 L/faddan, and, Ronstar at 0.75 L/ faddan followed by Enpul at 20g/ faddan, Rainbow at 0.4 L/faddan followed by Enpul at 20g/ faddan and Saturn at 2.0 L/faddan by Basagran at 1.5 L/faddan were 2.21, 2.18, 2.13, 2.03, 1.97, 1.98, 1.88 and 1.87), respectively, through two seasons, with preceding crop clover, but gave,(1.87, 1.94, 2.03, 2.05, 1.88, 1.89, 1.80 and 1.83, respectively, through two seasons, with preceding crop wheat, on profitability during two seasons.

Table 8: Effect of preceding crops and weed control treatments on economic analysis of rice crop during 2014 and 2015 seasons.

Preceding crops	Weed control treatments	Rate/ faddan	Time of application *(DAS)	Economic Parameters			
				Gross Income **(LE/ faddan)	Net Income ** (LE/ faddan)	Gross Income ** (LE/ faddan)	Net Income ** (LE/ faddan)
		2014 season				2015 season	
Clover	Saturn+Basagran	2L+1.5L	7+21	6375	3325	6273	2913
	Ronstar+ Enpul	0.75L+20g	8+21	6477	3507	6492	3212
	Rainbow+ Enpul	0.4L+20g	15+30	6783	3719	6664	3284
	Rainbow+Basagran	0.4L+1.5L	15+30	6613	3503	6494	3044
	Hand weeding twice	-	30+45	4335	635	4624	614
	Untreated check	-	-	2686	14	3245	235
	LSD at 5%			815.2	76.02	279.0	82.0
Wheat	Saturn+ Basagran	2L+1.5L	7+21	6273	3223	6154	2794
	Ronstar+ Enpul	0.75L+20g	8+21	5735	2765	6205	2925
	Rainbow + Enpul	0.4L+20g	15+30	5729	2659	6341	2961
	Rainbow+ Basagran	0.4L+1.5L	15+30	6324	3214	6222	2772
	Hand weeding twice	-	30+45	4352	652	5600	1590
	Untreated check	-	-	2397	303	2601	-409
	LSD at 5%			445.2	92.7	632.4	82.5

***DAS=days after sowing** ****LE=Egyptian Pound**

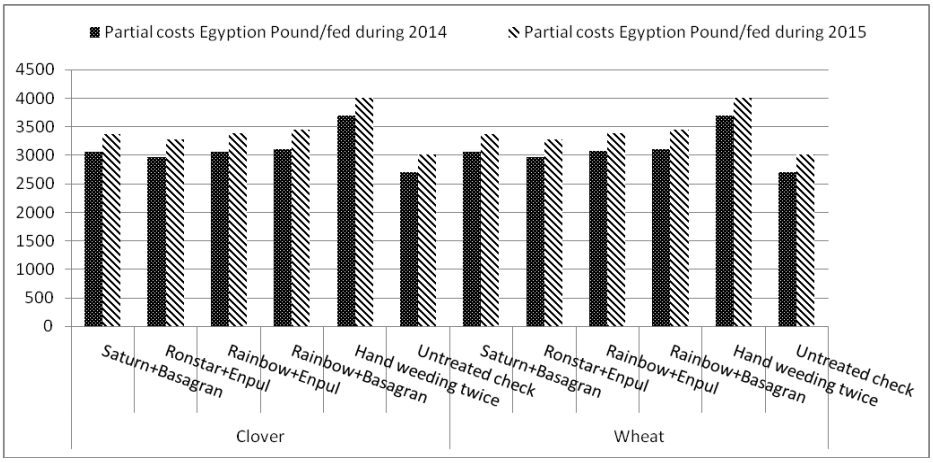

Fig. 1:The relationship between effect of preceding crops and weed control treatments on partial costs during two seasons.

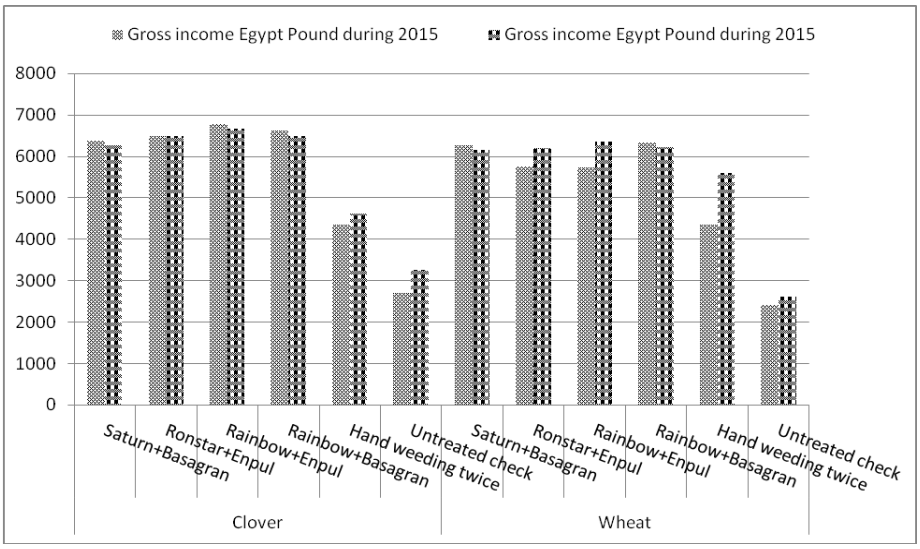

Fig. 2:The relationship between effect of preceding crops and weed control treatments on gross income during two seasons.

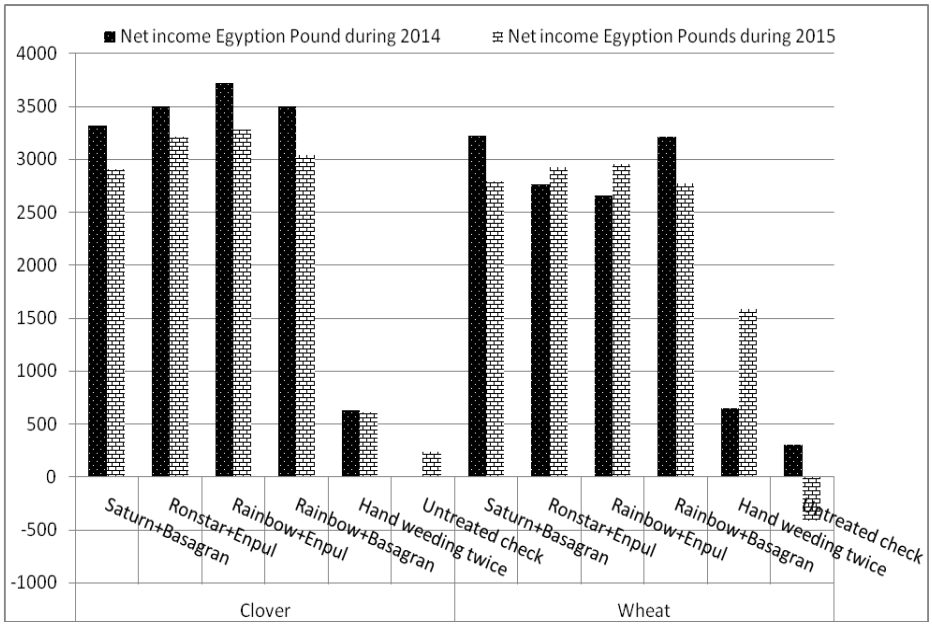

Fig. 3:The relationship between effect of preceding crops and weed control treatments on net income during two seasons.

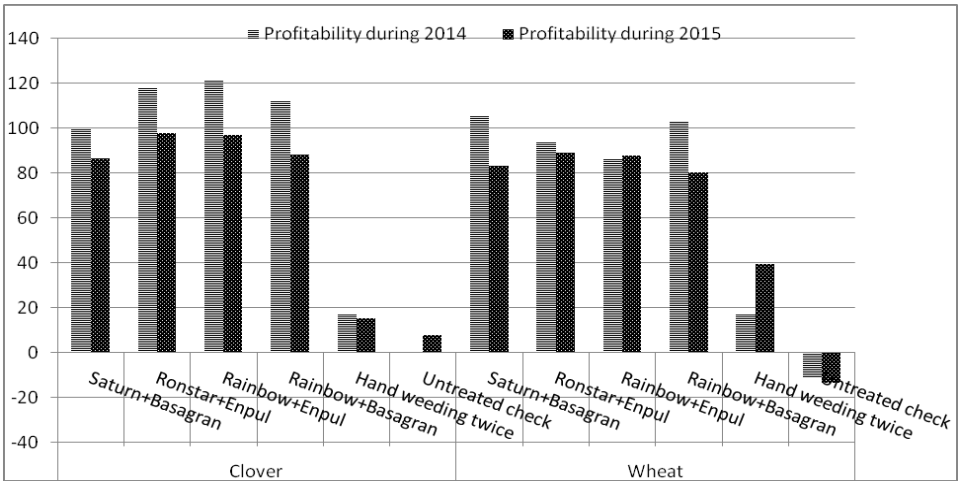

Fig. 4:The relationship between effect of preceding crops and weed control treatments profitability during two seasons.

On the other hand, the results of the interactions between wheat and the herbicidal treatments on Gross income, Net income and profitability% were fluctuated or discomposure but are still superior hand weeding twice and less than obtained with clover in both seasons. These results were agree with those obtained by, (Adigun *et al.*, 2005; Singh *et al*., 2006; Mann *et al.*, 2007; Singh *et al*., 2008 and Mahajan *et al*., 2009).

Thus this study suggest that, the key for expanding cultivated area with broadcasted seeded rice in Egypt is to manage weeds by herbicides combinations to prevent long weed interference through the critical periods of weed competition in such rice plantations than manual weeding.

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تأثير المحاصيل الشتوية السابقة وتوليفات مبيدات الحشائش علي الحشائش والمحصول والجدوى الاقتصادية لإنتاجية الأرز البدار.

رشدي محمد حسن تجور ، إبراهيم السيد سليمان و رمضان أحمد موسي
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اتجهت المساحات المنزرعة بالأرز البدار في مصر إلى الزيادة بهدف تقليل تكاليف العمليات الزراعية إلا أنها تواجه بمشكلة غزو الحشائش. لهذا أجريت أربعة تجارب حقلية بمحطة البحوث الزراعية بالسرو- محافظة- دمياط خلال موسمي ٢٠١٤ و ٢٠١٥م لدراسة تأثير محصول البرسيم و القمح كمحاصيل شتوية سابقة قبل زراعة الأرز البدار واستعمال ستة معاملات لمكافحة الحشائش في الارز البدار[ساتيرن بمعدل ٢ لتر للفدان+ بازجران بمعدل ١.٥ لتر للفدان ، رونستار بمعدل ٠.٧٥ لتر للفدان + انبول بمعدل ٢٠ جرام للفدان، رينبو بمعدل ٠.٤ لتر للفدان + انبول ٢٠ جرام للفدان ، رينبو بمعدل ٠.٤ لتر للفدان + بازجران بمعدل ١.٥ لتر للفدان ، النقاوة اليدوية و معاملة الكنترول] و دراسة تأثيرها على المحصول ومكوناته و الجدوى الاقتصادية. - أوضحت النتائج أن زراعة الأرز عقب برسيم واستعمال مبيدات الحشائش كان له تأثير معنوي على الوزن الجاف للحشائش ثنائية وأحادية الفلقة و كان هناك زيادة ملحوظة في محصول الحبوب (طن/الفدان) و مكوناته مثل عدد الأشطاء ، عدد الداليان/م^{٢} ، ارتفاع النبات ، طول الدالية ، عدد الحبوب الممتلئة/دالية, وزن الألف حبة, وزن حبوب الدالية و محصول الأرز الشعير بالطن/فدان خلال موسمي الزراعة. اظهر التفاعل خلال الموسم الزراعي الأول بين البرسيم كمحصول سابق وتوليفات مكافحة الحشائش مثل رينبو (بنوكسلام) بمعدل ٠.٤ لتر للفدان + انبول (هالوسالفورون)٢٠ جرام للفدان ، رينبو بمعدل ٠.٤ لتر للفدان + بازجران (بنتازون) بمعدل ١.٥ لتر للفدان، رونستار (أوكساديازون) بمعدل ٠.٧٥ لتر للفدان + انبول بمعدل ٢٠ جرام للفدان و ساتيرن (ثيوبنكارب) بمعدل ٢ لتر للفدان+ بازجران بمعدل ١.٥ لتر للفدان نقص في الوزن الجاف للحشائش الكلية بنسبة ٩١.٧، ٩١.٣، ٨٨.٥ و ٨٦.٣% عن معاملة الكنترول بالترتيب بعد ٧٠ يوم من الزراعة. وأيضا أعطت تقريبا نفس النسب بعد ٩٠ يوم من الزراعة وأدى ذلك إلى زيادة ملحوظة في إنتاجية المحصول ب ١٤٥.٣، ١٥٤.٠، ١٢٢.٠ و ١٤٨.٠% بالترتيب لنفس المعاملات السابقة. - سجلت النقاوة اليدوية مرتين أقل تأثير في إنقاص الوزن الجاف للحشائش الكلية حيث نقص بمقدار ٥٦.٥ و ٥٣.٤ % بعد٧٠ و ٩٠ يوم من الزراعة على الترتيب وانعكس دلك على إنتاجية محصول الحبوب للأرز البدار حيث زاد بمقدار ٦١.٤ % فقط. ظهر أعلى صافى ربح من توليفات مبيدات الحشائش مع الزراعة عقب برسيم مقارنة بالزراعة عقب قمح خلال موسمي الزراعة. هده الدراسة ألقت الضوء على توليفات مبيدات الحشائش في محصول الأرز البدار حيث توصى هده الدراسة بإمكانية مكافحة الحشائش في حقول الأرز البدار بالزراعة عقب برسيم مع استخدام أحد توليفات مبيدات الحشائش (رينبو بمعدل ٠.٤ لتر للفدان + بازجران بمعدل ١.٥ لتر للفدان، ساتيرن بمعدل ٢ لتر للفدان + بازجران بمعدل ١.٥ لتر للفدان، رينبو بمعدل ٠.٤ لتر للفدان + انبول ٢٠ جرام للفدان، و رونستار بمعدل ٠.٧٥ لتر للفدان + انبول ٢٠ جرام للفدان) حيث أعطت مكافحة جيدة للحشائش وزيادة إنتاجية محصول الأرز البدار وتحقيق أعلى عائد اقتصادي في الموسمين.