



THE CRITICAL PERIOD OF WEED COMPETITION OF DIRECT SEEDED RICE IN SALINITY LAND

[8]

Tagour¹, R.M.H.; G.M. Abd El-Hamed¹ and I.M. El-Metwally²

1- Weed Research Laboratory, Agricultural Research Center, Giza, Egypt

2- Mubarak City for Scientific Research, Arid Lands Cultivation and Development Research Institute, Borg El-Arab, Egypt

Keywords: Weed Competition, Rice and Salinity soil

ABSTRACT

Two Field experiments were conducted during the two summer seasons of 2007 and 2008 at EL-Serw Agricultural Research Station, Damietta Governorate, Egypt to study the effect of the time removal of weeds on associated weeds, growth, yield and its components in direct seeded rice in salinity land. *Echinochilon crus – galli*, *Echinochilon colunum*, *Cyperus difformis*, *Cyperus longus* and *Dicanthium annulatum* were the major weed species. Competition beyond 8 and 10 weeks from sowing and weed competition for the whole season caused drastic reduction in the panicle length, number of panicles / m² weight of 1000grain and grain yield. Grain yield of rice increased significantly with the increase of the duration of weed-free period. Weed free for the whole season and weed free for 10,8,6 and 4 weeks from sowing and weed removal at 4 and 6 weeks from sowing gave good results in this respect in both seasons. The period during 4 and 6 weeks after sowing was found to be an important factor in crop/weed competition. Weed cause 20 to 95% yield loss. Direct seeded rice ecosystems are most vulnerable to weed competition. Weed free is the most common and predominant method of control and is cost-effective. In direct seeded rice emergence of weeds begins with the germinating rice seedlings. This leads to competition between weeds and crop right from the very early stages. The degree of yield losses would depend on the type of weeds and the stage and duration of their competition

with the crop. It could be concluded that the critical period of weed competition in direct seeded rice among 4- 6 weeks from rice sowing, thus it's important to remove the weeds at this time.

INTRODUCTION

Rice is grown by direct seeding method as well as transplanting method. Weed competition is more severe in the direct seeded crop than in the transplanting crop. Weed cause 20 to 95% yield loss (Gogoi, *et al* 1996 and Karim, *et al* 1998). Hand weeding is the most common and predominant method of control and is cost-effective. In direct seeded rice emergence of weeds begins with the germinating rice seedlings. This leads to competition between weeds and crop right from the every early stage. The degree of yield losses would depend on the type of weeds and the stage and duration of their competition with the crop.

The competitive effect of a given density of weeds emerging with the crop depends strongly on the length of the period they remain in the field (i.e. the time of weed removal). The relationship between the duration of competition and crop yield reduction is approximately sigmoidal: weeds competing for a short period have little effect on crop yield; allowing the weeds to compete for a longer time, the yield reduction increases (Sattin, and Sartorato, 1997).

The existing practice of manual weeding has to continue since there is no herbicide available which can be used effectively and safely for weed control in direct seeded rice. Under these circumstances, it is necessary to identify the critical period of weed control in direct seeded rice. Manual

weeding where necessary should be carried out during critical period (CP) because the weedy rice panicles must be done after CP to reduce seed banks of the ensuing crops (Azmi, and Baki, 2006). The objective of this study was to investigate the effect of the time removal of weeds on associated weeds, growth, yield and its components in direct seeded rice in salinity land.

MATERIALS AND METHODS

Two field experiments were carried out during summer season of 2007 and 2008 at El-Serw Agricultural Research Station, Agricultural Research Center, Damietta Governorate, Egypt to study the effect of the time removal of weeds on associated weeds, growth, yield and its components of direct seeded rice in salinity lands. The soil texture was clay. The chemical and physical analysis of the used soil during the two growing seasons are illustrated in Table (1).

The experiments consisted of ten treatments as follows for the whole season for 4, 6, 8 and 10 weeks from sowing, as well as, weed free for 4, 6, 8 and 10 weeks from sowing and weed free for the whole season and up to harvest.

Rice c.v. Giza 178 was sown on May 30th in both seasons at 70 kg / feddan. Plot area was 16 m² (4m x 4m) during both seasons. Recommended cultural practices were followed to maintain optimum crop growth. Randomized complete block design with four replicates was used. Weeds were identified and classified into the total number, total fresh and dry weights of weeds. Rice was harvested at September 20th in both seasons. The plant height, dry weight of whole plant, panicle length, number of panicles / m², and 1000-grain weight were recorded at harvest.

The grain and straw yields were calculated in ton / fed. All data obtained were statistically analyzed according to Snedecor, and Cochran 1967. L SD at 5 % level of significance was used to compare between means.

Table 1. Chemical and physical analysis of used soil during the two growing seasons

Particle size distribution					PH Of soil Susp 1:25	E.C ds/m At25c	OM %	Total N %	Available N ppm	Available P ppm	Available K ppm
Coarse sand %	Fine sand %	Silt %	Clay %	Texture							
0.24	17.65	17.52	64.59	Clayey	8.7	3.6	1.20	0.038	32	8.30	520

RESULTS AND DISCUSSION

1- Effect of weed competition on weed growth

The major weed species presented in the experimental area were common *Echinochloa crus-galli* (L.) Beauv (Barnyardgrass), *Echinochilon cololum* (L.) Link (Jungle Rice), *Cyperus difformis* (L.) Smallflower umbrellaplant, *Cyperus longus* (L.) Nutsedge and *Dicanthium annulatum* (L.)

Data presented in Table (2) show that different weed free and weed removal duration significantly decreased of total number, fresh and dry weight as compared with weed competition for the whole season (unweeded check) treatment in both seasons.

The highest reduction of control effect % were obtained by weed removal for 4-6 weeks from sowing and weed free for the whole season, as well as, weed free for 10,8,6, and 4 weeks from sowing by 99.7, 99.5, 99.8, 99.8, 99.8, 99.7 and 99.6 respectively in both season when compared with weed competition for the whole season (unweeded check).

On the other side, the lowest reduction of control effect % recorded by weed competition for 8-10 weeks from sowing, as well as, unweeded check by 4.9, 5.7 and 0.0% respectively, compared to other weeds removing treatments in both seasons. It is evident that weed control effect % was progressively decreased as later weed removal period, especially the later stage of rice growth after 8 weeks from sowing. The different between

Table 2. Effect of weed competition duration on total number, fresh and dry weight (gm/m²) of weeds at 60 days from sowing in direct seeded rice plants during 2007 and 2008 seasons

Characters Treatments	Total number of weeds / m ²		Total fresh weight of weeds/ m ²		Total dry weight of weeds/ m ²		Reduction %
	2007	2008	2007	2008	2007	2008	
1- Weed competition for the whole season	14.6	14.3	3767.3	3770.3	797.1	801.7	0.0 %
2- Weed competition for 4 weeks from sowing	1.6	1.0	14.6	12.6	2.3	2.1	99.7 %
3- Weed competition for 6 weeks from sowing	2.4	13.3	16.3	18.1	3.5	3.9	99.5 %
4- Weed competition for 8 weeks from sowing	14.0	14.0	3518.0	3645.3	745.5	773.1	4.9 %
5- Weed competition for 10 weeks from sowing	13.0	13.3	3507.0	3596.3	718.5	788.7	5.7 %
6- Weed free for 4 weeks from sowing	2.0	2.0	15.3	15.0	2.5	2.5	99.6 %
7- Weed free for 6 weeks from sowing	1.1	1.3	11.3	12.6	1.5	2.1	99.7 %
8- Weed free for 8 weeks from sowing	1.0	1.0	10.6	12.3	1.3	1.6	99.8 %
9- Weed free for 10 weeks from sowing	0.6	1.0	8.6	12.0	0.9	1.6	99.8 %
10- Weed free for the whole season	0.6	1.0	8.3	11.6	0.9	1.5	99.8 %
F - Test	**	**	**	**	**	**	
L.S.D. at 5 %	1.62	0.82	180.54	103.23	60.22	22.15	

competed species was due to their capacity to intercept the sunlight. So the crop would take a good chance to use sunlight lonely. Further more, if weeds were left to competition with rice more than 5 weeks, the severity of competition will increase because the depletion of nutrients from the soil by the increased demands of both weeds and rice.

The maximum accumulation of weed biomass was recorded at 4 weeks after sowing in direct seeded rice. It is evident that most weeds during the early plants was eventually increase at the later stages of direct seeded rice growth. While, biomass of weed species associated with direct seeded rice plant was eventually increase at the later stages of rice growth after 6 weeks from sowing. This because the weed species emerged early, and the competition between weed species and between the weeds and crop. Similar results have been obtained by (Kropff, 1988; Kropff and Spitters, 1991; Gogoi *et al* 1996; Fofana, and

Rauber, 2000; EL-Desoki, 2003 and Azmi, and Baki, 2006) they found that the long term effects, such as the build-up highest rate of dry matter production of total weeds was observed with the unweeded plots.

2- Effect of weed competition on rice plant growth

Data in Table (3) observed that plant height , dry weight of whole plant , panicle length , number of panicles/m², and 1000-grain weight of rice plants at harvest were significantly affected by weed removal treatments at harvest in both seasons.

The treatments of weed free and weed removal periods significantly increased plant height, dry weight of whole plant, panicle length, number of panicles / m², and 1000-grain weight than weed competition for the whole season (unweeded check) in both seasons. The highest results were produced by weed free treatments and weed

Table 3. Effect of weed competition duration on some plant growth and yield components characters at harvest in direct seeded rice plants during 2007 and 2008 seasons

Characters Treatments	Plant height (cm)		Dry weight of whole plant (g)		Panicle length (g)		No. of panicles /m ²		Weight of 1000 grain (g)	
	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008
1- Weed competition for the whole season	53.0	54.0	17.5	17.1	18.6	18.6	266.6	278.3	20.5	20.7
2- Weed competition for 4 weeks from sowing	62.3	63.6	26.0	25.9	20.6	20.6	305.3	308.0	23.2	22.9
3- Weed competition for 6 weeks from sowing	53.3	56.3	18.1	18.1	19.0	19.3	292.6	298.6	21.7	22.2
4- Weed competition for 8 weeks from sowing	53.0	54.6	17.9	17.6	19.0	19.0	290.6	289.3	21.4	21.6
5- Weed competition for 10 weeks from sowing	53.0	54.3	17.9	17.8	18.6	19.0	272.0	280.0	21.0	20.9
6- Weed free for 4 weeks from sowing	58.6	57.6	22.9	22.6	19.3	19.3	301.3	305.3	22.3	22.6
7- Weed free for 6 weeks from sowing	62.0	61.6	24.9	25.1	20.3	20.0	303.3	305.6	22.7	22.8
8- Weed free for 8 weeks from sowing	62.3	63.6	27.0	28.0	21.0	21.0	308.6	308.3	23.9	24.5
9- Weed free for 10 weeks from sowing	62.6	64.3	27.1	28.1	21.6	21.0	312.0	312.0	25.2	24.9
10- Weed free for the whole season	62.6	64.0	28.0	28.4	21.6	21.0	313.3	314.0	25.9	25.0
F – Test	**	**	**	**	**	**	**	**	**	**
L.S.D. at 5 %	3.00	3.16	3.54	2.58	2.65	2.13	11.27	14.25	1.29	0.91

removal at 4 and 6 weeks from sowing, when compared with the other weed removal treatments as well as, weed competition for the whole season in both seasons. On the contrary, the lowest value in this respect in weed removal treatments at 8 and 10 weeks from sowing as well as, weed competition for the whole season. Unweeded treatment reduced the lowest thicker of this trail.

This may be due to that the competition affected crop growth and minimizing is the availability of nutrients, moisture and sunlight. The weed growth there will be one less unit of crop growth. Moreover it with the establishment of crop plants foliage, they will begin to shade the ground. This shading effect reduced the amount of light available for weed germination and development. Meanwhile, on the other side, weed competition during the whole crop life cycle caused reduction of growth characters on rice plants were recorded with height density of weeds. These results coincided with those obtained by (Zimdahl, 1988; Fofana *et al* 1995; Berti *et al* 1996; Hamdan *et al* 1996; Fofana & Rauber, 2000 and EL-Desoki, 2003) recorded that the rice plants growth was affected by weed competition.

3- Effect of weed competition on yield

In both seasons, data presented in Table (4) showed that grain and straw yield per plant obtained from weed free treatments and weed removal at 4 and 6 weeks from sowing were significantly higher than those obtained from the other weed removal treatments as well as, weed competition for the whole season in both seasons. Delaying weed competition up to 8 and 10 weeks from sowing significantly decreased grain and straw yield per plant in both seasons as compared with those which remained weed free from harvest. Weed free treatments and weed removal at 4 and 6 weeks from sowing surpassed other weed removal treatments in grain and straw yield per plant. Unweeded treatment recorded the lowest thicker of this trial.

With regard to grain and straw yield per feddan at harvest significant increase were detected by were increased significantly due to treatments of weed free and weed competition period in both seasons. The loss in grain and straw yield due to weed competition 2.26 to 2.30 ton/fed and 3.34 to 3.38 ton/fed. respectively, in both seasons as

Table 4. Effect of weed competition duration on grain and straw yield per plant [g] and grain and straw yield per feddan of rice plants during 2007 and 2008 seasons

Characters	Grain yield (g) / plant		Straw yield (g) / plant		Grain yield (ton) / fed.		Straw yield (ton) / fed.	
	2007	2008	2007	2008	2007	2008	2007	2008
Treatments								
1- Weed competition for the whole season	17.6	18.3	34.3	36.0	2.26	2.30	3.34	3.38
2- Weed competition for 4 weeks from sowing	25.6	26.6	52.3	53.6	3.82	3.79	4.89	4.86
3- Weed competition for 6 weeks from sowing	24.0	23.6	46.6	48.0	3.45	3.44	4.39	4.38
4- Weed competition for 8 weeks from sowing	20.6	19.6	40.6	40.3	2.95	2.97	3.76	3.77
5- Weed competition for 10 weeks from sowing	18.6	18.6	37.6	36.3	2.60	2.63	3.43	3.46
6- Weed free for 4 weeks from sowing	24.0	24.3	49.3	48.6	3.52	3.52	4.41	4.41
7- Weed free for 6 weeks from sowing	25.6	25.6	50.6	51.3	3.75	3.72	4.75	4.72
8- Weed free for 8 weeks from sowing	26.3	27.0	53.6	52.3	3.88	3.87	4.93	4.92
9- Weed free for 10 weeks from sowing	28.6	28.0	56.6	58.0	4.16	4.16	5.31	5.31
10- Weed free for the whole season	30.0	29.6	58.3	59.6	4.28	4.03	5.43	5.42
F - Test	**	**	**	**	**	**	**	**
L.S.D. at 5 %	3.81	2.68	2.29	3.11	0.06	0.06	0.23	0.25

compared with weed free treatments. This may be due to the effective competition of weeds with rice plants particularly in the early stage of rice growth. Removal of weed at 4 and 6 weeks from sowing produced grain yield ranged from 3.82 to 3.79 and 3.45 to 3.44 ton/fed and straw yield ranged from 4.89 to 4.86 and 4.39 to 4.38 ton/fed., respectively in both seasons. While, weed free treatments produced of grain yield ranged from 3.52 to 4.28 and 3.52 to 4.27 ton/fed. as well as straw yield ranged from 4.41 to 5.43 and 4.41 to 5.42 ton/fed., respectively in both seasons. These treatments significantly produced the highest grain and straw yield per feddan compared with unweeded check in both seasons. The increase in yield and its components induced by weed removal treatments may be due to better control of annual weeds at the critical early period, consequently the competition between plant and associated weeds was decreased giving good chance for growth and improve the filling of grains resulting heavier grains. These results are coincided with those recorded by (Smith, 1988; Berti, and Zanin, 1994; Sattin *et al* 1996; Jaime *et al* 1999; Ahmed, 2000; EL-Desoki, 2003 and Azmi & Baki, 2006).

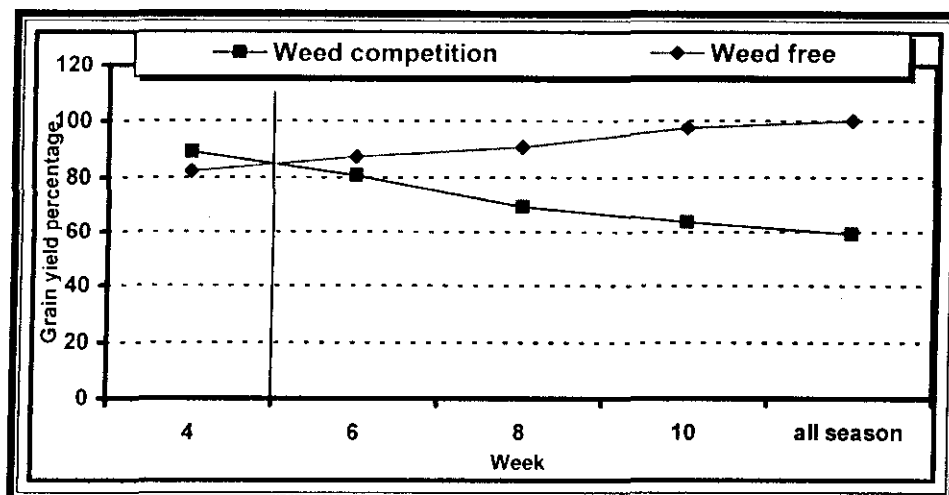
On the other hand, further delaying of weed removal accentuated the adverse effect of weeds and greatly reduced grain at 8 and 10 weeks from sowing ranged from 2.95 to 2.97 and 2.60 to 2.63

ton/fed., and straw yield ranged from 3.76 to 3.77 and 3.43 to 3.46 ton/fed., respectively in both seasons as compared with weed free treatments. (Kropff & Spitters, 1991; Jaime *et al* 1999; Fofana & Rauber, 2000; EL-Desoki, 2003; Saad El-Din, 2003 and Azmi & Baki, 2006) reported that the reduction in grain and straw yields due to increase in reduction of competition was associated with a decrease in number of panicles per square meter and simultaneous increase in the dry matter production of weeds and increase in weed density.

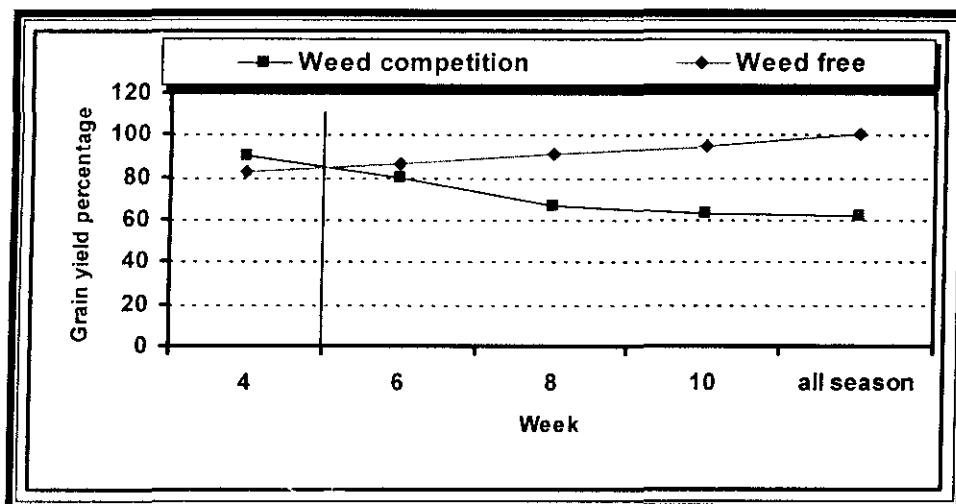
5- Effect of weed competition on critical period

Figure (1) indicated that the critical influence of weeds started to appear on 4th and 6th weeks after sowing. Obviously, the more the delay of hand weeding was the lowest the yield. It can be confirmed that weed competition could seriously affect rice grain yield. Evidently, weed free maintenance for 4 to 6 weeks from sowing is required for good yield.

The most important different between as competed species was due to their capacity to intercept the sunlight. So the crop would take a good chance to use sunlight lonely. Furthermore, if the weed were left to compete with rice more than 6 weeks, the severity of competition will increase



Season (2007)



Season (2008)

Fig. 1 . Graphic presentation the critical period of weed competition / rice yield study

because the depletion of nutrients from the soil by increased demands of both weeds and rice. These results are in harmony with those obtained by (EL-Desoki, 2003; Azmi & Baki, 2006 and Roshdy, 2006) found that the critical period of weed competition in rice occurred during 20 to 60 days from sowing. While, (Naidu & Bhan, 1980; Pillaik, 1981; Kolhe & Mitra, 1981; Wells & Cabradilla, 1981 and Sahai *et al* 1983) they found that the critical weed competition occurs up to 4 – 9 weeks after sowing rice. While, Doll, (1994) found that the critical period is approximately centred on the first one-third of the crop growing cycle.

Conclusion: It could be concluded that the critical period of weed competition in direct seeded rice among 4- 6 weeks from rice sowing, thus it's important to remove the weeds at this time for obtaining the maximum grain yield.

REFERENCES

- Ahmed, S.A. (2000).The critical period of weed competition in maize. *J. Agric., Sci., Mansoura Univ.*, 25(5): 2597-2609.
- Azmi, M. and B.B. Baki (2006). Weed flora landscapes and innovative management in direct-seeded culture. *International Rice Congress*

- 2006, **Proceedings of the Second International Rice Congress**, pp. 50-56. New Delhi, India.
- Berti, A. and G. Zanin (1994). Density equivalent: a method for forecasting yield loss caused by mixed weed populations. *Weed Res.*, 34: 327-332.
- Berti, A.; C.M. Dunan; M. Sattin, G. Zanin and P. Westra (1996). A new approach to determine when to control weeds. *Weed Sci.*, 44: 496-503.
- Doll, J.D. (1994). Dynamics and complexity of weed competition. In : Labrada R.; J. C. Caseley and C. Parker. **Weed Management for Developing Countries**, pp. 29-34. FAO, Rome.
- EL-Desoki, E.R. (2003). Weed competition in the field of direct seeded rice. *Bull. NRC, Egypt*. 28(4): 527-534.
- Fofana, B. and R. Rauber (2000). Weed suppression ability of upland rice under low-input conditions in West Africa. *Weed Res.*, Oxford, 40(3): 271-280.
- Fofana, B.T. Koupur; M.P. Jones and D.F. Johnson (1995). The development of rice varieties competitive with weeds. *Brighton of Crop Protection Conf. Weeds. UK.*, 1: 187-192.
- Gogoi, A.K.; H. Brown; G.W. Cussans; M.D. Devine; S.O. Duke; Q.C. Fernandez; A. Helweg; R.E. Labrada; M. Landes; P. Kudsk and J.C. Streibig (1996). Integrated weed management of rice in high rainfall region of India. *Proce. Of the Second International Weed Control Congress. Copenhagen. Denmark. Vols.*, 1-4: 715-719.
- Hamdan, P.; M. Mashhor and H. Watanabe (1996). Yield component analysis of direct seeded rice under several densities of red sprangletop [*leptochloa chinensis* (L) Nees] in Peninsular Malaysia. *Weed Res. Japan*, 4(3): 216-220.
- Jaime, A.; A.J.F. Florez; H.R. Fischer and C.D. Miryam (1999). Predicting Rice Yield Losses Caused by Multispecies Weed Competition. *Agron. J.* 91: 87-92.
- Karim, S.M.R.; T.M.T. Iqbal and N. Islam (1998). Relative yield of crops. *J. of Scientific and Indus., Res.*, 41(6): 318-324.
- Kolhe, S.S. and B.N. Mittra (1981). Weed control in direct seeded upland rice. In **Proceedings 8th Asian Pacific Weed Sci., Soc. Conf.** pp. 67-72 Bangalore, India.
- Kropff, M.J. (1988). Modeling the effects of weeds on crop production. *Weed Res.*, 28: 465-471.
- Kropff, M.J. and C.J.T. Spitters (1991). A simple model of crop loss by weed competition from early observations on relative leaf area of the weeds. *Weed Res.*, 31: 97-105.
- Naidu, N.G. and V.M. Bhan (1980). Effect of different groups of weeds and periods of weed free maintenance on the grain yields of drilled rice. *Indian J. Weed Sci.*, 12: 151-157.
- Pillaik, G. (1981). Land preparation, methods of crop establishment and weed management practices in upland rice. *Int. Rice Comm. News Letters*, 30(1): 43-45.
- Roshdy, M.H.T. (2006). **Effect of Weed Control Treatments on Wheat Plant and Its Associated Weeds**. pp. 11-28. Ph.D. Thesis, Fac. Agric., Mansoura Univ., Egypt.
- Saad El-Din, S.A. (2003). Study the critical period of weed competition in maize. *J. Agric., Sci., Mansoura Univ.*, 28(9): 6665-6677.
- Sahai, B.; V.M. Bhan and R.S. Balyan (1983). Weed emergence and competition in drilled upland rice in India. *Trop. Pest Manage.*, 29(2): 125-128.
- Sattin, M. and I. Sartorato (1997). Role of seedling growth on weed-crop competition. *Proc. of 10th EWRS (European Weed Research Society) Symposium, Poznan, Poland.* pp. 3-12.
- Sattin, M.; A. Berti and G. Zanin (1996). Crop yield loss in relation to weed time of emergence and removal: analysis of the variability with mixed infestations. *Proc. of the Second Int. Weed Control Congress, Copenhagen.* pp. 67-72.
- Smith, R.J., Jr. (1988). Weed thresholds in Southern U.S. rice, *Oryza sativa*. *Weed Technol.* 2: 232-241.
- Snedecor, G.W. and W.G. Cochran (1967). **Statistical Methods**. Iowa State Univ., Press, Ames, Iowa, USA.
- Wells, G.J. and N. Cabradilla (1981). Weed competition in upland rice. **Proceedings of the 8th Asian Pacific Weed Sci., Soc. Conf.** pp. 143-144 Bangalore, India.
- Zimdahl, R.L. (1988). The concept and application of the critical weed-free period. In: Altieri, M.A. and M. Liebmann, eds. **Weed Management in Agroecosystems: Ecological Approaches**. pp. 145-155. CRC Press, Boca Raton, Florida, USA.



الفترة الحرجة لمنافسة الحشائش للأرز البدار في الأراضي الملحية

[٨]

رشدي محمد حسن تجور^١ - جلال محمد عبد الحميد^١ - إبراهيم محمد المتولي^٢

١- المعمل الفرعي لبحوث الحشائش - مركز البحوث الزراعية - الجيزة - مصر

٢- مدينة مبارك للأبحاث العلمية- معهد بحوث زراعة وتنمية الاراضي القاحلة - برج العرب- مصر

الموجز

عمر ٦٠ يوما من الزراعة ، و طول النبات وعدد السنابل في المتر المربع و وزن ١٠٠٠ حبه والمحصول ومكوناته.

- أدت إزالة الحشائش طوال الموسم وإزالة الحشائش لمدة ٤ و ٦ و ٨ و ١٠ أسابيع من الزراعة وكذلك إزالة الحشائش بعد ٤ و ٦ أسابيع من الزراعة إلي أفضل النتائج في النمو والمحصول ومكوناته في لنبات الأرز.
- أدت إزالة الحشائش بعد ٨ و ١٠ أسابيع من الزراعة إلي نقص معنوي في هذا المجال في كلا الموسمين.
- أظهرت الدراسة ان الفترة الحرجة للمنافسة بين الحشائش والأرز البدار بين ٤ - ٦ أسابيع من الزراعة.

أقيمت تجربة حقلية في محطة البحوث الزراعية بالسرو بمحافظة دمياط خلال موسمي الزراعة ٢٠٠٧، ٢٠٠٨ بغرض دراسة تأثير منافسة الحشائش لنباتات الأرز وتضمنت المعاملات منافسة الحشائش طوال الموسم لنباتات الأرز، ولمدة ٤ ، ٦ ، ٨ ، ١٠ أسابيع من الزراعة . وكذلك معاملات إزالة الحشائش طوال الموسم و إزالة الحشائش لمدة ٤ ، ٦ ، ٨ ، ١٠ أسابيع من الزراعة علي نمو الحشائش وكذلك النمو والمحصول ومكوناته لنباتات الأرز وكذلك تحديد الفترة الحرجة للمنافسة بين الحشائش والأرز البدار في الأراضي الملحية.

- أدت زيادة فترة المنافسة في كلا الموسمين لحدوث نقص جوهري للوزن الجاف الكلي للحشائش عند