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EFFECT OF DIFFERENT WATER REGIMES, PLANTING DATES AND ALLELOPATHIC ON RICE WEEDS .

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ABSTRACT

Six experiments were initiated at 2002 and 2003 growing seasons at Agriculture Research Center (ARC), in El-Serw station, Giza, Egypt, to develop and integrated control system to weeds in rice fields. Results could be summarized as follow:

At 30 days after planting with 100 % field capacity, *E. crus-galli* emergence (%) reached the maximum values of 90 and 84 %, respectively..The field capacity of 200 % decreased the emergence of *E. crus-galli* .but, *C. difformis* reached its maximum under the soil condition of 150 % followed by 200 %. While, the soil condition of 100 % and 50% were not proper for the emergence of *C. difformis*. whereas, *E. geniculata* was significantly increased with increasing time of observation after planting up to 60 days under 150 and 200 % field capacity condition.

Emergence of *E. crus-galli* being higher in a short period between 15 to 20 days after planting in both seasons, while maximum emerged seedling of *E. crus-galli* were recorded at the planting date on first of May and reduced significantly when the planting time was delayed. Consequently, emergence of *E. geniculata* seedlings increased with delaying the planting date from mid of April to first of June. Early planting date of rice is an important integral part in suppressing *E. geniculata*. Also, maximum emergence of *C. difformis* for each planting date was occurred at 50 days with little change between the rates of emergence after 50 or 60 days in each planting date and maximum emergence of *C. difformis* were occurred when planting date was delayed to 1st June.

E. geniculata has allelopathic effects on the association weed of *C. difformis*w with increasing the number of emergence of *E. geniculata*, the performance of *C. difformis* was reduced.,and increasing the number of *E. geniculata* at 20 plants/ pot, the competetion effects were significantly increased

INTRODUCTION

Weeds are, without any doubt, a major pest and constraint to increase rice production. Weeds interfere with rice growth in different ways: a) by competing for light , nutrients and water ; b) living or decaying weeds can secrete toxic root exudates or leaf leachates, which depress the normal growth of the rice plant ; c) high weed density creates a habitat for growth of various pest organisms (insects, nematodes and pathogens) which adversely affect rice production ; d) weeds demand high labour inputs for control, *i.e.* nearly 30 % of the required labour ; and huge crop losses may take place in rice fields with high weed infestations which prevent normal harvesting operations (Labrada, 1996). The competitive advantage of weeds over rice is attributed to some weeds which being C4 plants with high photosynthetic rates and corresponding high growth rates (unlike rice, which is a C3 plant) ;

high potential to acclimatize to a changing environment ; and more efficient seed production (Kim and Mody, 1989). Timing of control measures is based on the use of critical thresholds of weed densities or critical period of competition. Kwon *et al*. (1996) found that barnyardgrass showed similar emergence rates when sown between 3 April and 1 May. However, speed of emergence under higher temperatures (seeds sown on 1 May) was faster.with respect to water regimes Hassan and Rao (1994) found that increasing the number of barnyardgrassat 75 and 100% of field capacity.Hassan *et al*.(1996)) found that flooding is effective and economical to control some weeds. Migo *et al*. (2005) found that seedling number of *E. crus-galli* decreased with early flooding. In addition, growth of *E. crus-galli* decreased with increasing water depth. In contrast, the biomass of *C. difformis*. Chou (1995) found that allelopathic is the result of biochemical relation between plants. It is caused by toxic chemicals released by the plant through volatilization, leaching and root exudation or produce during decomposition of plant residues in the soil. Smith *et al*. (1977) mentioned that water seeding with more or less continuous flooding encourages growth of aquatic weeds such as *Eleocharis* obtuse (annual) in the southern US rice field

Although critical competition is known to occur within the first 20-30 days of rice growth, the exact time to apply control measures within this period will depend on a particular weed situation in a given field and/or crop establishment system .Xuan, *et al*.*(* 2005) al.reviewed different plants with strong allelopathic potential on paddy rice weeds. This investigation was undertaken to investigate the effect of planting dates, water regimes and allelopathic effect on the pattern emergence of *Eleocaris geniculata*, *E. crus-galli* , *Cyperus difformis* and *Ammannia* spp.

MATERIALS AND METHODS

Six experiments were conducted at the Laboratory of the Experimental Station of El-Serw, A.R.C. during the two growing seasons of 2002 and 2003 seasons. These studies aimed to investigate the effect of planting dates, water regime on the pattern emergence of *E. geniculata*, *Echinochloa crus-galli*, *C. difformis* and *Ammannia* spp. beside the allelopathic effect of *E. geniculata* on *C. difformis*. Two experiments were conducted to study the pattern and emergence of *weeds* as affected by water regimes and planting dates. Soil samples of the experimental units were taken from selected field which heavy infected with *E. geniculata*. *E. crus-galli*, *C. difformis* and mixed seeds of the three species of *Ammannia.* Soil were sun dried, grounded and thoroughly mixed, Plastic pot (30 X 30 X 45 cm) were filled with 8 kg of soil, and distributed in completely randomized design with six replicates as block.

Water regimes treatments:

Four water regimes were utilized for study weed emergence. The pots were kept saturated to 50, 100, 150 and 200 % of field capacity for water regimes at 60 days period. Number of emerged weed seedlings were recorded every 10 days and classified to species.

Planting dates treatments:

The treatments included four different planting times *i.e.* 15 April, 1 May, 16 May and 1 June. The pots were kept saturated 2 cm depth of water for 60 days period. Number of emerged weed seedlings were recorded every 5 days. Weeds were identified and classified into their species.

Allelopathic studies of *Eleocaris geniculata* on *Cyperus difformis.*

Soil samples of the experiment were taken from field and sterilized .It kept free from weeds seed. Soils were air dried and grounded. Plastic pot (30 X 30 X 45 cm) were filled with 8 kg of soil, and distributed in completely randomized design with six replicates. Each pot was over-seeded with 0.01 gram from *C. difformis* while *E. geniculata* seedlings were transplanted at 0, 10 and 20 plants**/**pot. The pots were kept saturated to 2 cm depth of water for 60 days period. Number of emerged weeds were recorded every 10 days and classified to species

Statistical analysis of data:

All data were subjected to the statistical analyses according to the technique of analysis of variance (ANOVA) for the treatments means were presented comparison between means of all traits studied was made using New Least Significant Differences (NLSD) method as mentioned by **Steel** and **Torrie ((1980).**

RESULTS AND DISCUSSION

1- Effect of different water regimes on emergence and growth of selected weed species.

***1.1.E. crus-galli*:**

Percentages of *E. crus-galli* emergence reached the maximum values (90 and 84 %) at 30 DAP in 2002 and 2003 seasons, respectively at 100 % field capacity as shown in Table (1). Lower significant emergences were recorded 45 and 30 %, respectively in 2002 and 2003 seasons, under the soil moisture condition of 50 % field capacity. At 150 % field capacity, highly significant few seedlings were observed (11 and 26 %) at 30 DAP in 2002 and 2003 seasons, respectively. While, condition of 200 % of field capacity prevented the emergence of *E. crus-galli***.** These studies clearly indicate that *E.* spp*.* could be largely eliminated by water regime at 200 % of field capacity during the early stage of rice.

Table (1): Number of *E. crus-galli*/pot as affected by different water regime treatments (field capacity %) during 2002 and 2003 seasons.

DAP / WR	2002			2003		
	10	**20**	**30 NO. (%)**	**10**	**20**	**30 NO. (%)**
50	2.10	4.00	4.50 (45)	3.60	3.80	3.00 (30)
100	5.33	8.17	9.00(90)	7.60	8.40	8.40 (84)
150	0.00	1.10	1.10 (11)	2.40	2.40	2.60 (26)
200	0.00	0.00	0.00	0.00	0.00	0.00
N LSD 5 %	2.77	3.28	2.68	2.66	2.59	2.54

These conditions could be obtained by the continuous flooding condition or standing water for about 20 days. The germination of *E.* spp*.* was inhibited under the conditions of high depth of flooding condition because of reduced oxygen and accumulation of CO_2 and other gaseous products of anaerobic respiration. Further, prolonged submergence of terrestrial plants may result in their impaired growth and death (Subbulakshmi and Pandian (2002). Suppression of *E. crus-galli* by water management is contingent upon low light levels with the water the profile (Namuco *et al.*2003).

1.2.C. difformis:

In the present study, the stand establishment of *C. difformis* reached the maximum during both seasons at the soil condition of 150 % followed by 200 % field capacity (Table 2). At 200 % field capacity condition of the emerged seedlings until 20 DAP were low and increased significantly at 30 DAP. While, at 150 %, the stand establishment of this weed was better at 20 DAP and new flushes were observed at 30 DAP. Approximately the soil moisture condition of 100 % was not proper for the emergence of *C. difformis*, whereas the submergence conditions not available during the first 40DAP. Earlier studies have shown that *C. difformis* was more tolerant of submergence environment than others.

Further, whether *C. difformis* was submerged or growing above a water surface it can utilize the low high intensity to photosynthesis under submergence as a mechanism for survival. *C. difformis* showed increasing root-shoot ratio with flooding depth. One of the means strategies in the controlling weeds in the Egyptian rice fields suffered from *C. difformis* is switching from wet-seeded condition to dry drill-seeding rice.

***1.3.E. geniculata*:**

The emergence and the establishing of the good stand was significantly increased with increasing time of observation after planting up to 60 days under the 150 and 200 % field capacity conditions Table 2. Moreover, the stand of *E. geniculata* was significantly increased at the 200 % field capacity condition as compared with 150 % field capacity at all dates of observations.

Table (2): Number of *C. difformis* and *E. geniculata* /pot as affected by different water regimes treatments (field capacity %) during 2002 and 2003 seasons.

DAP / WR	2002						2003					
	C. difformis											
	10	20	30	40	50	60	10	20	30	40	50	60
50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100	0.00	3.00	8.00	0.00	0.00	0.00	0.00	2.00	5.00	0.00	0.00	0.00
150	0.00	75.00	97.00	92.0	84.0	72.0	0.00	63.00	89.00	92.	96.0	105
200	0.00	36.00	81.00	83.0	79.0	76.0	0.00	42.00	79.00	81.0	85.0	91.0
N LSD 5 %	-	0.56	0.73	0.94	1.09	1.19	0.31	0.65	1.37	1.44	1.36	1.36
E. geniculata												
50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
150	9.3	2.8	35.7	59.3	69.1	72.1	8.8	22.0	47.2	57.2	57.8	65.4
200	10.5	15.5	38.5	101.8	101.7	130.8	13.6	22.5	36.4	73.6	104.6	129.6
N LSD 5 %	1.77	7.15	7.20	11.90	11.59	17.05	5.063	9.91	19.51	22.87	24.42	27.08

E. geniculata is a tremendous problem in all the northern and east of Delta where the soil is salty and it needs continuous flooding for establishing good stands of rice. In the same time, this water regime is the main factor for the high infestation of this weed. In this respect, Smith *et al.* (1977) mentioned that water seeding with more or less continuous flooding encourages growth of aquatic weeds such as *E. obtuse* (annual) in the southern US rice field. In most of Manzalla, areas where farmers plant rice continuously more than 30 years in the soil, the soil became better than earlier. Therefore, the dry drill-seeded rice is a proper rice system in establishing stand free from *E. geniculata*. Drill – seeded rice is just flush the field every 5 to 6 days and the soil is looking upland during the first 40 days (Hassan ,2002).

In general, where irrigation facilitates and or water supply is adequate the depth of flooding and its duration can be managed to suppress growth of *E. crus-galli* when combined with direct weed control methods, water management as a part of an integrated weed management system is cost-effective and can give considerable saving in production costs. Weeds have different abilities and strategies to survive flooding stress and exploiting this difference could lead to improve weed management practices. **Chun** and **Shin (1994)** found that in submerged conditions, tuber sprouting *of E. kuroguwai* was greater when buried at cm depth than buried at 5 cm depth.
Water management is a major component of any weed control strategy in rice. The type of weed association with rice is closely related to soil moisture content and water depth (Hassan, 2002). Nishida and Kasahara (1975) observed that C4 plants, such as *E.* spp*.,* predominated under upland conditions, while, C3 plants, such as *C. difformis* and *E.* spp*.,* were dominant under submerged conditions. Thus, many non-aquatic grasses particularly *E. crus- galli* do not survive under submerged conditions, while many sedges do not survive in the uplands.

2-Effect of planting dates on patterns and emergence of weeds
2-1-E. crus-galli

According to planting time, maximum emerged seedlings were recorded at the planting date in the first May and reduced significantly when the planting time of *E. crus-galli* was delayed to 15May. Emergence of *E. crus-galli* seedlings were reduced sharply with delaying planting to 1st of June in the second season Table (3). While, planting the seeds on mid of April in 2002 season approximately was not proper for emergence of *E. crus-galli* seedlings while no emergence occurred. The emergence of *E. crus-galli* seedlings in 2003 season was significantly observed lower at planting date in 15 April as compared to other planting dates. In general, the recommended time of planting direct seeded rice ought to be around the first two week of May. Therefore, much pressure of *E. crus-galli* is expected and intensive integrated control management should be applied.

2-2-E. geniculata

Marked seasonal variation was observed in the pattern of emergence of *E. geniculata* (Table 3) Emergence of *E. geniculata* seedlings significantly increased with delaying the planting date from mid April until first of June. At all sampling dates after planting, the stand of weed seedling markedly increased with time up to 60 DAP for each planting date during both seasons of the study. In 2002 season, the stand became heavy in each planting date after 30 days and gradually Significantly increased up to 60 days**.** While in 2003 season, the stand showed heavily starting from 20 DAP and greatly increased significantly with time up to 60 days. At 60 DAP the variance in number of *E. geniculata* seedlings at planting date on 16th May and 1st June was not significant. While, it was significant when they were compared with other planting dates. These results are very important as it indicated to the lower flushing of weed seedling for the early cumulative temperature for emergence Therefore, early planting date of rice is an important integral part in suppressing *E. geniculata.* De Datta and Baltazar (1996). Im *et al.* (2001) mentioned that the emergence of *E. kuroguwai* tended to increase from year to year and it was difficult to control because of late and continuous emergence. It needs incited to the non-synchronous germination of weed seeds in rice.

Table (3): Number of weeds/m^2 as affected by planting dates

2002								
Weeds	***E. crus-galli***		***E. geniculata***		***C. difformis***		***Ammannia* spp**	
DAP / PD	30	60	30	60	30	60	30	60
15/4	-	-	-	-	-	-	-	-
1/5	92.0	91.0	47.0	286.0	70.0	352.0	84	152
16/5	87.0	85.0	262.0	357.0	419.0	676.0	90	159
1/6	99.0	101.0	214.0	380.0	503.0	680.0	67	168
NLSD 5 %	-	-	20.67	28.80	13.22	33.33	NS	19.21
2003								
15/4	34.0	35.0	347.0	56.0	0.0	0.0	32	74
1/5	120.0	120.0	575.0	614.0	326.0	448.0	79	135
16/5	96.0	92.0	301.0	662.0	325.0	495.0	84	136
1/6	50.0	50.0	298.0	700.0	327.0	602.0	71	122
NLSD 5 %	16.64	31.20	19.05	22.54	4.77	6.28	6.21	29.21

2-3-C. difformis

The condition of planting date on mid April was not suitable for the germination, emergence and growth of *C. difformis* (Table 3). The emergence of *C. difformis* was observed at other planting dates in many flushes. Maximum emergence for each planting date occurred at 50 days with little change between the rate of emergence after 40 or 60 days in each planting date. Better emergence was recorded with planting on mid of May date as compared to 1 May. However, maximum emergences markedly occurred when planting dates was delayed to 1st June. These results were in agreement with those of Hassan (2002), who recorded that approximately, the emergence pattern of *C. difformis* was quite similar to the emergence of *E. geniculata* and completely different from the pattern of emergence of *E. crus-galli*.

2-4- Ammannia spp.

Approximately, the emergence of the *Ammannia* spp. started slowly up to 20 DAP at all planting dates and greatly increased from 30 to 50 DAP and may reduced again as recorded in Tables (3) and meanly due to the intra specific interference of the *Ammannia* plants during the growing season. Better emergence of *Ammannia* spp. occurred during planting date on May and was continues up to 40 and 50 DAP times. This information is requesting a long acting herbicide treatments applied as early post emergence (10 to 20 DAP) and will continue acting as soil performance for about more than 30 days from application.

3- Allelopathic effect of *E. geniculata* on the emergence and growth of *C. difformis*.

It is quite clear from data recorded in Table (4) that, 10 plants/pot of *E. geniculata* had a powerful performance effects on the emergence and growth of *C. difformis* when they planted together in an area of 30 X 30 X 45 cm. These allelopathic effects were observed at 20 DAP and were continues over 60 DAP. At 30 DAP, 10 plants/pot of *E. geniculata* suppressed the number of *C. difformis*/pot by 60 and 74 %, respectively in 2002 and 2003 seasons. At 40 DAP, the suppression effects of *E. geniculata* weeds were reduced to 55 and 30 %, respectively, in 2002 and 2003 seasons, respectively, with increasing the number of emergence of *C. difformis.* The performance of 10 plants/pot of *E. geniculata* was reduced *C. difformis*. Increasing the number of *E. geniculata* to 20 plants/pot significantly increased allelopathic effects. For example, at 30 DAP the performance against *C. difformis* were 90 and 77 %, respectively in 2002 and 2003 seasons. Better efficiency against *C. difformis* at 60 DAP was observed with the high density (20 plants/pot) of *E. geniculata* compared with low density (10 plants/pot). It was demonstrated that the phototoxic magnitudes were the greatest during 30 to 40 DAP or incubation of both weed species. High density of *E. geniculata* suppressed *C. difformis* by 87 and 64 %, respect. in 2002 and 2003 seasons. It could be seemed that the allelopathic performance of *E. geniculata* is density dependent. Approximately, the emergence of the *Ammannia* spp. started slowly up to 20 DAP at all planting dates and greatly increased from 30 to 50 DAP and May reduced again as recorded in Table (4) and Meanly due to the intra specific interference of the *Ammannia* plants during the growing season. Better emergence of *Ammannia* spp. occurred during planting date on May and was continues up to 40 and 50 DAP times. This information is requesting a long acting herbicide treatments applied as early post emergence (10 to 20 DAP) and will continue acting as soil performance for about more than 30 days from application.

Table (4): Effect of *E. geniculata* on emergence of *C. difformis*/m^2 at 2002 and 2003 season.

No. of *E. geniculata*	***C. difformis* (DAP)**									
	2002					**2003**				
	20	**30**	**40**	**50**	**60**	**20**	**30**	**40**	**50**	**60**
0	261.8	476.0	523.6	571.0	595.0	880.0	928.0	999.0	1428.0	1666.0
10	119.0	190.4	238.0	261.0	333.2	96.0	240.0	695.0	1309.0	1309.0
20	35.0	50.0	60.0	75.0	75.0	214.0	214.0	357.0	476.0	595.0
NLSD 5 %	47.92	59.30	133.56	85.80	81.93	226.48	152.69	167.94	271.87	159.00

Frank and Dechoretz (1980) indicated strong allelopathic effects of *E. coloradoenis* against aquatic plants in paddy fields. Putnam and Tang (1986) reported that *E. acicularis* and other small spikerushes surveys as a biological control of the unwanted vegetation. The allelochemical given by the spikerushes may aid in reducing the growth of other aquatic weeds as they attempted to path through the mats.

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تأثير السعة الحقلية و ميعاد الزراعة و الأليلوباسي علي حشائش الأرز

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**** مركز بحوث وتدريب الأرز بسخا -مركز البحوث الزراعية**

نم ا قامة ستة تجارب معملية بالصوبة الزجاجية بمحطة البحوث الزراعية بالسرو مركز البحوث الزراعية خلال موسمي ٢٠٠٢ و٢٠٠٣ وذلك لدراسة تأثير السعة الحقلية بمستويات (٥٠و١٠٠و١٥٠و٢٠٠%من السعة الحقلية وكذلك دراسة تأثير اربعة مواعيد للزراعة(٤/١٥و٥/١و٥/١٦و٦/١) وكذلك دراسة تأثير الأليلوباسي لحشيشه شعر القرد علي إنبات ونمو حشيشه العجيرة و استخدم لهذه الدراسة أصص حجمها (٣٠×٣٠×٤٥سم) تم ملئها بثمانية كيلو جرام تربة (عادية)بالنسبة لتجربة السعة الحقلية وميعاد الزراعة وتربة معقمة بالنسبة لتجربة الأليلوباسي واستخدم لذلك تصميم القطاعات التامة العشوائية ذات ستة مكررات. وكانت أهم النتائج المتحصل عليها هي:-

زاد انبثاق وظهور حشيشه الدنيبية بعد ١٥:٢٠يوم من الزراعة وكانت اعلي نسبة عند الزراعة فى بداية شهر مايو بينما سجلت حشيشه العجيرة اعلي نسبة انبثاق عند الزراعة فى أول يونيو وسلكت حشيشه شعر القرد نفس الاتجاه مما يؤدى إلى القول بان ميعاد الزراعة لة دور كبير فى تحديد تواجد وانتشار الحشائش . أنخفض معدل نمو وظهور حشيشه الدنيبية عند ٢٠٠ % من السعة الحقلية بينما سجلت اعلي نسبة انبثاق وظهور بعد ٣٠ يوم من الزراعة فى الموسمين (٩٠و٨٤%٩على التوالي عند ١٠٠ % من السعة الحقلية. وكذلك أظهرت النتائج المتحصل عليها أن أعلى معدل لتواجد وظهور حشيشه العجيرة عند ١٥٠ % و٢٠٠ % من السعة الحقلية تحت ظروف هذه الدراسة فى الموسمين بينما اتضح انه عند ١٠٠ % من السعة الحقلية لم يكن هناك تأثير واضح على انبثاق وظهور حشيشه العجيرة ازداد انبثاق وظهور حشيشه شعر القرد عند ١٥٠ و٢٠٠ % من السعة الحقلية وهذا يوضح أن كمية المياه من العوامل الأساسية التي تحدد ويرتبط معها ظهور الحشائش المصاحبة لمحصول الأرز.

أما بالنسبة لظاهرة الأليلوباسي فقد وجد إن حشيشه شعر القرد يؤثر على اصطحاب وتواجد حشيشه العجيرة معها فى الحقل حيث انةكلما زاد عدد حشيشه شعر القرد فإنه يؤدى إلى إعاقة وانخفاض في أعداد حشيشه العجيرة. كما أتضح أيضاً أن زيادة عدد حشيشه شعر القرد في وحدة المساحة يؤدى إلى زيادة التأثير على الحشائش المصاحبة معها .