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INFLUENCE OF SOME HERBICIDES ON THE GROWTH AND PROPAGATIVE CAPACITY OF PURPLE NUTSEDGE (*Cyperus rotundus* L.).

El-Rokiek, Kowthar G.; I. M. El-Metwally; Nadia K. Messiha and Samia A. Saad El-Din

Botany Department, National Research Centre, Dokki, Cairo, Egypt.

ABSTRACT

Pot experiments were conducted during the two summer seasons of 2005 and 2006 in the greenhouse of the National Research Centre to study the influence of the herbicides basagran, glyphosate, nominee and serious on the growth and propagative capacity of purple nutsedge. Treatments of purple nutsedge were carried out with these herbicides at the two concentrations for each herbicide after two weeks from sowing. The results revealed that the number of mother shoots was significantly reduced by both concentrations of glyphosate (7200&9600 ppm) and nominee (600&800 ppm). On the other hand, this result was obtained by the high concentration of basagran (3700 ppm) after 45 and 75 days from sowing. The results also indicated that basagran (2800&3700 ppm) and glyphosate (7200&9600 ppm) induced pronounced significant reduction in the growth of both aerial and underground organs of purple nutsedge, furthermore, growth of aerial and underground organs were completely inhibited by nominee (600&800 ppm) and serious (300&400 ppm) after 75 days from sowing. Determination of total carbohydrates indicated significant reduction with all herbicides reaching complete inhibition by nominee and serious. Similarly, estimating N, P and K revealed complete inhibition of these nutrients by the later two herbicides. In general, it could be concluded that while there was a regrowth of purple nutsedge by both herbicides basagran and glyphosate, complete inhibition occurred by both herbicides nominee and serious.

INTRODUCTION

Purple nutsedge is a perennial weed that infected agricultural lands allover the world (Edenfield *et al*., 2005; Durigan *et al*., 2006 and Swamy *et al*., 2006). Purple nutsedge is considered the world's worst weed (Holm *et al*., 1991; Horowitz, 1992 and Kim *et al.*, 1998). It has become such a problem because of the plant's biological adaptability (Teo and Nishimoto, 1973 and Neeser *et al*., 1997). It posses an extensive vegetative structure of rhizomes and tubers which are also propagative (Nishimoto, 2001).

The fact that tubers may remain dormant in the soil further favour its survival, hence, eradication of purple nutsedge is difficult (Kim *et al*., 1994). This difficulty is also attributed to its apical dominance (El-Masry and Rehm, 1977) as well as its high competitive ability as C4 plants (Wills, 1987).

Several workers tried to control purple nutsedge by different herbicides. Kim *et al*. (1998) obtained 100% control of purple nutsedge by post-emergence application of the herbicide pyrazolosulfuron (serious) one week after transplanting. Hassan *et al*. (2004) and Swamy *et al*. (2006) realized similar results. Moreover, the herbicide bispyribac-sodium (nominee) was found similarly to control purple nutsedge as well as other perennial weeds (Moshtohry, 2001; Covarelli, 2003; Risi *et al.*, 2004 and Messiha, 2005). However, while pyrazolosulfuron or nominee controlled purple nutsedge completely, the herbicide glyphosate was found to control 90% of this weed

or yellow nutsedge (Akin and Shaw, 2001; Ameena and George, 2004; Singh *et al*., 2004; Butler *et al.*, 2006; Durigan *et al*., 2006 and El-Rokiek *et al*., 2006). On the other hand, bentazon (basagran) was the least effective as 44% regrowth of purple and yellow nutsedge was obtained (Akin and Shaw, 2001; Koger *et al*., 2002; Altland *et al*., 2003; Ferell *et al*., 2004).

The object of this investigation is to compare between some different herbicides on the growth and propagative capacity of purple nutsedge and to select which one that could induce complete control of this weed under the condition of greenhouse of NRC. There is no doubt that the selection between some herbicides to choose which one is effective may be the best chance of controlling purple nutsedge.

MATERIALS AND METHODS

Pot experiments were carried out at the National Research Centre, during two successive summer seasons of 2005 and 2006. The stock of purple nutsedge (*Cyperus rotundus* L.) used as a source of tubers was collected from a dense stand at National Research Centre experimental station at Shalakan, Kalubia Governorate. Seventy two pots (30cm diameter), filled with alluvial soil, were used in these experiments. Tubers of purple nutsedge were sown at 5cm depth (one tuber / pot). Eight pots were served as control. The remainders (64 pots) were divided into four groups. In the first group, post emergence herbicide basagran (bentazon), 48% (3-isopropyl 1 H-2, 1, 3-benza thia diazin-4-(3 11) one, 2, 2-dioxide was applied at rates of 2800 and 3700 ppm. In the second group, the post emergence herbicide glyphosate (N-phosphonomethyl) glycine, (48 %) was applied at rates of 7200 and 9600 ppm, in addition, in the third group the post emergence new herbicide nominee 2% (SL), bispyribac-sodium 2, 6[(4-6-dimethoxy pyrimidin-2- yl)oxyl] applied at rates of 600 and 800 ppm. In the fourth and last group, the post emergence new herbicide, serious, 10%, pyrazosoulfuron ethyl isopropyl 5-**[**[[{(4, 6-dimethoxy-2-pyrimidinyl) amino] carbonyl] amino} sulfonyl**]**-1-H-pyrazole-4-carboxylic acid, which was applied at rates of 300 and 400 ppm. All herbicides were sprayed to purple nutsedge after two weeks from sowing. All sprays were performed by a glass atomizer fixed to a graduated tube at a rate of 15 ml per plant. Eight replicates were used for each treatment and all pots were arranged randomly and kept outdoors.

The following characters were recorded after 45 and 75 days from sowing.

1- Number of mother shoots / tuber.
2- Number of leaves of mother shoots / tuber.
3- Length of mother leaves (cm).
4- Number of daughter shoots / tuber.
5-Number of leaves of daughter shoots / tuber.
6- Number of rhizomes / tuber.
7- Length of rhizomes (cm) / tuber
8- Number of propagative organs / tuber (basal bulb and tubers) / plant.
9- Dry weight of aerial (g / plant).
10- Dry weight of underground organs (g / plant).
11- Total dry weight (g / plant).

Herbicidal activity on some chemical constituents of purple nutsedge.

The effects of different herbicides on the content of total carbohydrates, nitrogen, phosphorus and potassium, were determined at the two stages (45 and 75 days after sowing). The aerial and underground samples were dried at 45^0C for 96 hrs. Dry samples were ground and stored for determining the following items:

Determination of total carbohydrate contents

Determinations of total carbohydrate content in the aerial and underground organs of treated and untreated plants were extracted according to Herbert *et al*. **(**1971) and estimated colourimetrically by the phenol-sulphoric acid method as described by Montogomery (1961).

Determination of nitrogen, phosphorus and potassium contents (NPK)

Nitrogen, phosphorus and potassium contents were determined in dried foliage and underground organs at the two stages of growth (45 and 75 days after sowing) according to the official and modified methods of analysis (A.O.A.C., 1984).

The data were subjected to standard analysis of variance by means and LSD at 5% (Snedecor and Cochran, 1967).

RESULTS

Growth characters of mother shoots

The results of different herbicides on the number of mother shoots / tuber, number of leaves of mother shoots and length of mother shoots (cm) of purple nutsedge after 45 and 75 days from sowing are shown in Table (1). The results show that the number of mother shoots / tuber was not significantly decreased with the two concentrations of basagran (bentazon) at 2800 and 3700 ppm after 45 days after sowing (DAS). However, the decrease in the number of mother shoots / tuber was significant with the two concentrations after 75 days from sowing as compared with the control. The number of mother shoots / tuber decreased significantly with the high concentrations of glyphosate (9600 ppm) and nominee (800 ppm) after 45 days from sowing when compared with the control, while the two concentrations of glyphosate and nominee (bispyribac-sodium) induced significant decrease in the number of mother shoots / tuber after 45 days from sowing. The data in Table (1) also reveal that the number of mother shoots / tuber decreased significantly with both concentrations (300 and 400 ppm) of serious (pyrazolosulfuron) after 45 and 75 days from sowing in comparison to the control.

Table (1) shows that the number of leaves of mother shoots / tuber and the length of mother leaves (cm) decreased significantly with all concentrations of basagran and glyphosate after 45 and 75 days from sowing as compared to the control. The rate of reduction was increased by increasing the herbicide concentrations. The data in Table (1) show that all concentrations of the herbicides, nominee and serious induced significant reduction in the number of leaves of mother shoots / tuber and their lengths (cm) at the first stage (45 DAS) when compared with the control. However, the number of leaves of mother shoots / tuber and their lengths (cm) were

completely inhibited with all concentrations of nominee and serious at the second stage (75 DAS).

Growth characters of daughter shoots

The data presented in Table (2) show the effects of different herbicides on the number of daughter shoots / tuber and the number of leaves of daughter shoots / tuber of purple nutsedge. It is clear from the table that the number of daughter shoots / tuber and the number of leaves of daughter shoots / tuber decreased significantly when treated with all concentrations of basagran and glyphosate after 45 and 75 days from sowing as compared to the control. The length and number of daughter shoots were completely inhibited when treated with both concentrations of nominee (600 and 800 ppm) after 45 and 75 days from sowing as compared to their corresponding controls (Table 2). The number of daughter shoots / tuber and their number of leaves / tuber decreased significantly with low and high concentrations of serious (300 and 400 ppm) at the first stage (45 DAS) as compared with the control, while in the second stage (75 DAS) treatments with both concentrations of serious completely inhibited the number of daughter shoots / tuber and the number of leaves of daughter shoots / tuber.

Growth characters of underground organs

The experimental results in Table (3) show the effects of different herbicides on the number of propagative organs (basal bulbs and tubers), number of rhizomes / tuber and length of rhizomes / tuber (cm) of purple nutsedge. The data reveal that basagran and glyphosate treatments at the first and second stage (45 and 75 DAS) induced significant decreases in the number of propagative organs / tuber as compared with the corresponding controls. The rate of reduction increased by increasing the herbicide concentration. Foliar application with all concentrations of nominee and serious inhibited to a very high extent the number of propagative organs / tuber at the first stage (45 DAS). On the other hand, spraying of all concentrations of nominee and serious at the second stage (75 DAS) inhibited completely the number of propagative organs / tuber.

Table (3) indicated that foliar application of all basagran and glyphosate treatments at the first and second stages (45 and 75 DAS) induced highly significant reductions in the number of rhizomes / tuber as well as their lengths when compared with their controls. The number of rhizomes / tuber and their lengths were greatly reduced by all concentrations of nominee and serious at the first stage (45 DAS) as compared with the corresponding controls. Furthermore, these concentrations completely inhibited these characters at the second stage (75 DAS) as indicated in Table (3).

Dry weight

The data found in Table (4) show the effects of different herbicides on dry weight of aerial and underground organs and total dry weight of purple nutsedge after 45 and 75 days from sowing. Applying all basagran and glyphosate concentrations significantly inhibited the dry matter accumulation of aerial organs after 45 and 75 days from sowing as compared with the corresponding controls. The rate of reduction increased with increasing the level of the herbicide concentration.

T1-2

T3-4

Dry weight of aerial organs of purple nutsedge was severely affected with all concentrations of nominee and serious at the first stage (45 DAS) when compared with the control. At the second stage (75 DAS) this character was completely inhibited. Concerning the effects of basagran and glyphosate concentrations on the dry matter accumulation in the underground organs after 45 and 75 days from sowing, the results recorded in Table (4) reveal that dry weight significantly reduced by all concentrations of basagran and nominee in the two stages of growth as compared to the corresponding controls. Spraying with all concentrations of nominee and serious inhibited to a very high extent the dry weight of underground organs of purple nutsedge at the first stage (45 DAS). In the second stage (75 DAS), dry weight of underground organs was completely inhibited by the same concentrations.

Total dry weight of purple nutsedge was greatly reduced with treatments of basagran and glyphosate at the two stages of growth (45 and 75 DAS). Foliar application of all concentrations of nominee and serious induced pronounced and significant reduction in the total dry weight of purple nutsedge (45 DAS). Complete inhibition was obtained at the second stage (75 DAS) as shown in Table (4).

Some chemical constituents in purple nutsedge

a-Total carbohydrate contents in aerial and underground organs

Total carbohydrate contents of purple nutsedge at the two stages of growth are illustrated in Table (5). The data show that the total carbohydrate contents of both the foliage and underground organs decreased significantly when treated with all concentrations of basagran after 45 and 75 from sowing in comparison to the corresponding controls. Foliar application of both glyphosate concentrations (9600 and 7200 ppm) inhibited to a very high extent the total carbohydrate contents after 45 and 75 from sowing in both foliage and underground organs. The rate of reduction increased with increasing the concentration of the applied glyphosate. The results in Table (5) also indicate that all concentrations of nominee and serious at the first stage (45 DAS) inhibited to a very high extent the total carbohydrate contents in both foliage and underground organs. The rate of reduction increased by increasing the herbicide concentration. The reduction in the total carbohydrate in the foliage and underground organs treated with the higher concentrations of nominee and serious (800 and 400 ppm, respectively) reached 9.5 and 12.7 % of control (in foliage) and 4.5 and 22 % of control (in underground) after 45 days from sowing. However, after 75 days from sowing the total carbohydrate contents were completely diminished by the same herbicides.

b-NPK contents in aerial and underground organs

The results presented in Table (6a) indicate that there were great reductions in the contents of N, P and K due to treatments with the herbicides, basagran and glyphosate at both low and high concentrations. This reduction in both foliage and underground organs correlated with concentration. It increased with increasing concentration as compared to the corresponding controls.

5-6-6

The reduction caused by glyphosate was higher. In general, the two other nutrients (P and K) follow similar trend. Regarding the effect of the two other herbicides, nominee and serious, Table 6b indicates great reductions in the contents of N, P and K in both foliage and underground organs at the first stage (45 DAS). The rate of reduction increased at the second stage (75 DAS) reaching 100% inhibition.

Discussion

As mentioned previously purple nutsedge is the world's worst weed. This perennial weed has a remarkable ability to survive adverse conditions and then grow explosively (Horowitz, 1992). Purple nutsedge mostly reproduced by tubers **(**Nishimoto, 2001**)**. The tubers may be thought of as a resting stage that allows the weed to survive adverse conditions (Neeser *et al*., 1997). In fact, a large percentage of tubers is often killed during dormancy, but even only one percent of the tubers from a previous infestation is more than enough to bring back the population of this weed (Hauser, 1962). Understanding purple nutsedge control begins with the realization that tubers are the key to the weed's survival. Prevent tuber production can eliminate the weed. Control programs should be aimed at preventing the formation of tubers through prevention of growth of purple nutsedge. If no new tubers are formed, tuber mortality will eventually eliminate purple nutsedge problem.

Approaches that integrate several herbicides to select which one is effective may be the best chance of controlling purple nutsedge.

The results in the present work showed that foliar application of basgran two weeks after sowing induced significant decreases in both aerial and underground organs (Tables 1-4) at the two stages (45 and 75 DAS). The rate of reduction was higher with increasing concentration. These results coincided with those of other workers, Koger *et al.* (2002); Altland *et al.* (2003) and Ferell *et al*. (2004).

However, post emergence application of glyphosate two weeks after sowing can be effective in reducing purple nutsedge populations as indicated in this work (Tables 1-4). This may be due to the ready translocation of glyphosate from treated leaves to the tubers where it adversely affects the viability of buds. These results are also recorded by many investigators (Wang, 2002; Singh *et al*., 2004; Edenfield *et al*., 2005; Durigan *et al*., 2005 & 2006; Butler *et al*, 2006 and El-Rokiek *et al.*, 2006). Meanwhile, complete elimination of all viable buds of the tubers was not achieved by post-emergence treatment of glyphosate (El**-**Masry and Rehm, 1977 and singh *et al*., 2004).

On the other hand, significant reductions were recorded by the two concentrations of nominee in both aerial and underground organs in the earlier stage (45 DAS) as shown in Tables (1-4). Furthermore, complete inhibition of both aerial and underground organs were obtained at the later stage (75 DAS) due to foliar application of the two concentrations of nominee two weeks after sowing.

In this respect, similar results were recorded by Moshtohry (2001); Covarelli (2003); Risi *et al*, (2004); Sangakkara *et al*. (2004) and Messiha (2005). Moreover, spraying purple nutsedge with serious two weeks after

sowing at the two concentrations also recorded observable and significant decreases in both aerial and underground organs which reached to complete elimination of the weed in the second stage (75 days from sowing). A similar conclusion was obtained by Kim *et al.* (1998) who recorded 100% inhibition of purple nutsedge by post emergence application of the herbicide serious. These results reinforced by Hassan *et al.* (2004) and Swamy *et al.* (2006).

Analyses of the dried aerial and underground organs of purple nutsedge plants subjected to foliar application of basagran, glyphosate, nominee and serious showed that the decrease in growth of purple nutsedge was accompanied with significant decreases in total carbohydrate (Table 5). In this respect, similar conclusions were obtained in purple nutsedge by Messiha, 1989; Kim *et al*. (1998) and recorded also in other plants (soybean, barley and sunflower and peas) by Kord and Hathout (1993); El-Rokiek (1996) and Messiha *et al*. (2004).

The results also indicated remarkable decrease in nutrient contents (N, P and K) with the reduction in the growth of purple nutsedge by application of all herbicides at all concentrations. This reduction in nutrient contents reached complete inhibition by nominee and serious after 75 days from sowing with the two concentrations. These results are in agreement with those reported by Messiha, 1989; Kim *et al.*, 1998; as well as other plants e. g., barley and sunflower (El-Rokiek 1996) and peas (Messiha *et al*., 2004).

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تأثير بعض مبيدات الحشائش على النمو و التكاثر لحشيشة السعد

كـــوثر جـــاد علـــي الرقيـــق، إبـــراهيم محمـــد المتـــولى، ناديـــة خليـــل مســـيحة و سامية أمين سعد الدين
قسم النبات – المركز القومى للبحوث – الدقى – القاهرة - مصر.

أجريت هذه الدراسة بصوبة المركز القومى للبحوث خلال الموسم الصيفى لعامى (٢٠٠٥و ٢٠٠٦) لدراسة تاثير مبيدات الحشائش البازاجران، الجليفوسيت، النومينى والسيريس على النمو الخضرى و كذلك أعضاء التكاثر الأرضية (البراعم والدرنات) لحشيشة السعد. و فى هذه الدراسة تم رش نباتات السعد بمبيدات الحشائش البازاجران بتركيز (٢٨٠٠ و ٣٧٠٠ جزء فى المليون) الجليفوسيت بتركيز (٧٢٠٠ و ٩٦٠٠ جزء فى المليون)، النومينى بتركيز (٦٠٠ و ٨٠٠ جزء فى المليون) والسيريس بتركيز (٣٠٠ و ٤٠٠جزء فى المليون) و ذلك بعد أسبوعين من الزراعة.

وقد أظهرت النتائج نقص عدد نباتات الأمهات التي تنبت من الدرنة الأم باستخدام كل من الجليفوسيت، النومينى و السيريس بكل التركيزات، بينما أظهرت النتائج نقص عدد نباتات الأمهات باستخدام التركيز العالى فقط من البازاجران(٣٧٠٠ جزء فى المليون) و ذلك بعد ٤٥ و ٧٥ يوم من الزراعة. كما أظهرت النتائج أيضا أن لمبيدات الحشائش البازاجران، الجليفوسيت، النومينى والسيريس تأثير مثبط علي كل من المجموع الخضري و كذلك أعضاء التكاثر الأرضية وذلك بالمقارنة بالنباتات غيرالمعاملة. كما أدت المعاملة بالنومينى والسيريس إلي زيادة في تثبيط النمو و ذلك بالمقارنة بالنباتات غير المعاملة. و قد أظهرت النتائج أيضا أن رش نباتات السعد بالنومينى و السيريس أدى إلي تثبيط كامل لنمو درنات و براعم حشيشة السعد وذلك بعد ٧٥ يوم من الزراعة.وقد صاحب هذا النقص فى النمو نقصا معنويا فى محتوى الكربوهيدرات الكلية فى كل من المجموع الخضري و كذلك أعضاء التكاثر الأرضية. في حين أدت المعاملة بالنومينى و السيريس إلى تمام قتل و جفاف المجموع الخضرى و كذلك أعضاء التكاثر بعد ٧٥ يوم من الزراعة. وقد أظهرت النتائج أيضا نقصا شديدا فى محتوى العناصر النيتروجين، الفوسفور و كذلك البوتاسيوم فى كل من المجموع الخضري و كذلك أعضاء التكاثر الأرضية لحشيشة السعد بإستخدام كل تركيزات مبيدات الحشائش البازاجران، الجليفوسيت، النومينى والسيريس. و قد بلغ هذا النقص١٠٠ ٪ بإستخدام كل تركيزات النومينى والسيريس و ذلك بعد ٧٥ يوم من الزراعة.

Table (1): Comparison between the effects of different herbicides on the number of mother shoots / tuber, number of leaves of mother shoots and length of mother shoots (cm) of purple nutsedge after 45 and 75 days from sowing. (Combined analysis of the two seasons).

Herbicides (ppm)	DAS	Control	Basagran		Glyphosate		Nominee		Serious		LSD at 5% level
Growth character		0	2800	3700	7200	9600	600	800	300	400	
Number of mother shoots / tuber	45	2.00	1.75	1.75	1.75	1.50	2.00	1.00	1.00	1.00	0.26
	75	2.75	2.00	1.75	1.25	1.00	1.00	1.00	1.00	1.00	0.47
Number of leaves of mother shoots/tuber	45	10.5	7.00	5.25	5.50	4.00	3.50	2.75	3.50	3.00	0.75
	75	15.5	8.50	6.25	4.25	3.00	0.00	0.00	0.00	0.00	0.83
Length of mother leaves (cm)	45	52.00	39.50	36.00	33.50	28.00	19.75	12.75	18.00	10.00	2.79
	75	84.00	51.75	40.75	34.50	26.00	0.00	0.00	0.00	0.00	3.07

Table (2): Comparison between the effects of different herbicides on the number of daughter shoots /tuber and the number of leaves of daughter shoots / tuber of purple nutsedge (*Cyperus rotundus* L.) after 45 and 75 days from sowing. (Combined analysis of the two seasons).

Herbicides (ppm)	DAS	Control	Basagran		Glyphosate		Nominee		Serious		LSD at 5% level
Growth character		0	2800	3700	7200	9600	600	800	300	400	
Number of daughter shoots / tuber	45	5.75	4.25	3.75	3.75	3.25	0.00	0.00	2.75	2.50	0.81
	75	11.5	5.00	3.00	3.50	2.75	0.00	0.00	0.00	0.00	0.83
Number of leaves of daughter shoots/ tuber	45	16.25	11.75	10.50	9.50	8.50	0.00	0.00	7.50	6.25	1.21
	75	68.0	24.75	15.25	11.75	10.25	0.00	0.00	0.00	0.00	2.46

Table (3): Comparison between the effects of different herbicides on the number of propagative organs (basal bulbs and tubers), number of rhizomes / tuber and length of rhizomes / tuber (cm) of purple nutsedge (*Cyperus rotundus* L.) after 45 and 75 days from sowing. (Combined analysis of the two seasons).

Herbicides (ppm)	DAS	Control	Basagran		Glyphosate		Nominee		Serious		LSD at 5% level
Growth character		0	2800	3700	7200	9600	600	800	300	400	
Number of propagative organs/tuber	45	8.25	6.75	5.75	5.50	5.00	3.25	2.75	2.50	2.00	0.89
	75	26.00	7.00	4.00	5.00	3.75	0.00	0.00	0.00	0.00	0.97
Number of rhizomes /tuber	45	16.25	11.25	10.00	8.50	9.75	5.00	3.00	3.75	2.25	0.98
	75	29.75	9.75	8.25	7.25	6.50	0.00	0.00	0.00	0.00	1.12
Length of rhizomes (cm)	45	66.75	24.50	20. 50	40.00	32.00	26.75	20.50	14.75	20.50	1.97
	75	168.0	56.5	33.50	27.50	24.25	0.00	0.00	0.00	0.00	6.04

Table (4): Comparison between the effects of different herbicides on dry weight of aerial and underground organs and total dry weight of purple nutsedge (*Cyperus rotundus* L.) after 45 and 75 days from sowing. (Combined analysis of the two seasons).

Herbicides (ppm)	DAS	Control	Basagran		Glyphosate		Nominee		Serious		LSD at 5% level
Growth character		0	2800	3700	7200	9600	600	800	300	400	
Dry weight of aerial organs (g)	45	1.025	0.363	0.293	0.355	0.225	0.300	0.120	0.247	0.200	0.081
	75	13.100	1.100	0.600	0.350	0.214	0.000	0.000	0.000	0.000	0.490
Dry weight of underground organs (g)	45	1.100	0.537	0.505	0.417	0.337	0.260	0.187	0.150	0.150	0.047
	75	17.100	1.850	1.500	0.323	0.263	0.000	0.000	0.000	0.000	0.740
Total dry weight (g / plant)	45	2.125	0.900	0.798	0.772	0.562	0.560	0.307	0.397	0.350	0.091
	75	30.20	2.95	2.1	0.673	0.477	0.000	0.000	0.000	0.000	0.425

Table (5): Comparison between the effects of different herbicides on total carbohydrate contents (mg / g dry weight) of aerial and underground organs of purple nutsedge (*Cyperus rotundus* L.) after 45 and 75 days from sowing. (Combined analysis of the two seasons).

Herbicides (ppm)	DAS	Control	Basagran		Glyphosate		Nominee		Serious		LSD at 5% level
Total carbohydrates (mg /g dry weight)		0	2800	3700	7200	9600	600	800	300	400	
aerial organs	45	239.34	193.03	150.51	162.91	67.63	30.93	22.75	39.23	30.42	5.24
	75	242.63	195.77	171.97	99.56	41.98	0.00	0.00	0.00	0.00	6.26
underground organs	45	287.40	158.86	143.95	180.40	50.57	105.44	13.03	121.90	63.46	7.83
	75	445.10	264.61	248.32	204.4	142.98	0.00	0.00	0.00	0.00	9.89

Table (6a): Comparison between the effects of different herbicides on the percentage of potassium, phosphorus and nitrogen contents of aerial and underground organs of purple nutsedge (*Cyperus rotundus* L.) after 45 and 75 days from sowing.

Herbicides (ppm)	DAS	Control			Basagran						Glyphosate					
		0			2800			3700			7200			9600		
Elements		N	P	K	N	P	K	N	P	K	N	P	K	N	P	K
aerial organs	45	2.498	0.673	0.781	2.066	0.580	0.620	0.883	0.428	0.559	1.037	0.560	0.500	0.620	0.363	0.433
	75	3.620	0.432	0.678	2.866	0.642	0.636	1.138	0.377	0.390	0.883	0.428	0.409	0.543	0.230	0.322
underground organs	45	2.809	1.257	1.066	2.122	0.763	0.806	2.057	0.672	0.639	2.413	0.563	0.371	0.673	0.099	0.286
	75	3.086	1.660	1.133	2.493	1.283	0.873	2.186	1.154	0.690	1.339	0.827	0.377	1.103	0.185	0.352

Table (6) continues (b):

Herbicides (ppm)	DAS	Control			Nominee						Serious					
		0			600			800			300			400		
Elements		N	P	K	N	P	K	N	P	K	N	P	K	N	P	K
aerial organs	45	2.498	0.673	0.781	0.579	0.330	0.433	0.543	0.234	0.141	1.520	0.572	0.390	0.426	0.194	0.252
	75	3.620	0.432	0.678	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
underground organs	45	2.809	1.257	1.066	0.804	0.642	0.614	0.471	0.423	0.018	0.704	0.458	0.686	0.507	0.121	0.442
	75	3.086	1.660	1.133	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

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