Integrated Control of Purple Nutsedge (*Cyperus rotundus*) and Yellow Nutsedge (*Cyperus esculentus*)

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ABSTRACT— ***Purple and yellow nutsedges are among the ten hard to kill perennial weeds with very rapid growth and prolific numbers, most of them remain dormant in the soil and sprout through long periods. Unfortunately, the most effective herbicides against these two sedges can control only the germinated plants without any side effect against tubers either dormant or sprouting. In other words it is important to spray again the new sprouting plants grown above soil several time with very high expensive, and become impossible to done. The aim of this work was to test same growth promoting substances through laboratory experiment which indicated that Kinetin (0.5ppm) increased tuber sprouting by 85% and 82% for purple and yellow nutsedge, respectively. Indol-butyric acid (1ppm) was very effective toward purple (83% activate) while thiourea at 2% concentration was the most activator to yellow nutsedge (87.5% activation). The two experiments were conducted in greenhouse in sandy and clay soil and repented at two succeeding season 2013 and 2014, using pre and post emergence herbicides. Propyzamide (1L. /Fadden) was the most effective pre emergence herbicides in particular in sandy soil and to lesser extend in clay soil. With post emergence herbicides, glyphosate + non ionic surfactant (NIS) and Halosulferon + NIS were the most effective herbicides whatever the soil type. Two filed experiments were carried out in the first one showed the import of using solar energy as the most economic method to enhance and activate the sprouting of tubers of the two nutsedges, using clear polyethylene mulch with thickness 60 micron, the activation reached to 616% in case of purple nutsedge and 357% for yellow nutsedge. The second experiment in field concerning integrated control of both nutsedges and gave excellent solution for controlling nutsedges. The best results was obtained when cover the soil with clear mulch 60 micron for 10 days then sprayed the vegetative growth of both purple and yellow nutsedge with glyphosate(Baron)+Top film, after 50 days of spray this treatment gave 95 and 89% control of yellow and purple nutsedge, respectively.***

Keywords--- Purple and yellow nutsedges, herbicides, tuber sprouting, clear polyethylene mulch

1. INTRODUCTION

Purple nutsedge and yellow nutsedge are considered the most troublesome weeds all over the world, both of them are hard to kill perennial weeds with very rapid growth, purple and yellow nutsedges have been ranked as the world's first and 16th worst weeds, respectively [1],[2]. In general, both series weeds most of their reproduction is by prolific tubers. Purple and yellow nutsedges are considered to be economic threat to vegetable crop production around the world, [3]. Since purple nutsedge shoots which grown underground far from light passes a sharp point which able to penetrate a potato tuber and destroy its yield and other crops as well [4]. In order to achieve good control of purple and yellow nutsedge, it is very important to know everything about their life cycle and growth habits. The infested areas contain millions of tubers and rhizomes which survive in the soil and sprout in the spring if the soil temperature become 43 ^{o}F or greater which permit the sprouting of yellow nutsedge or become 54 ^{o}F which is suitable to the sprouting of purple nutsedge. The majority tubers occur in the top 6 inches (15cm) of soil where they can survive for 1 to 3 years. These perennial plants produce these tubers on rhizomes, or underground stems that grow as deep as 8 to 14 inches (20cm – 35cm) below the soil surface. Buds on the tuber sprout and grow to form new plants. The great difference between yellow and purple nutsedge is that in case of yellow nutsedge, only a single tuber forms at the end of a rhizome, while in case of purple nutsedge the tubers grow in chins with several of them on a single rhizome [5]. Finally due to purple and yellow nutsedge competition, crop losses are very great in many crops whatever the inventions with only one of there or the two, purple nutsedge is favored by high light, warm temperature, sandy soil and moist soil conditions, it is a severe problem in most irrigated summer crops. It has been reported to infest, rice cowpea, cotton, beans, soybeans, tomatoes, melons, carrots, lawns, tree and vine crops, turf and ornamental [3], [6], [7], [8], [9], [10], [11], [12]. Yellow nutsedge is problem also in cotton, rice, bean, soybeans, tomatoes, melons, carrots, tree and vine crops, turf and ornamental [7]. In general if heavy infestation is present on agricultural land, value can be reduced by great amount of Egyptian pounds /

Fadden. Deleterious losses in potato yield as well as sugar beets and onion due to sedges was observed in many farms in Egypt. These great losses in many crops was due to the abundant of tubers produced, competition on the occupied places in particular with potato plants which decrease the yield from 22 tons to only 3 tons in areas infested with yellow and purple nutsedges in Egypt, and became tubers did not sprout in the same time. In addition even when used a good method of weed control like using plastic mulch, but unfortunately purple nutsedge has the ability to penetrate the plastic mulch [13]. The aim of this study hand removal of nutsedge from heavily infested areas is extremely expensive, and due to the re growth of buried tubers usually it is impossible to get successful method for nutsedge control. The nutsedge are examples of weeds where the economic damage that they do is not only due to the cost in last production of crops and ornamentals but also costs of waging and ongoing ware on this serious pest. It is true that we now have many chemical tools that can be useful in a nutsedge management program [14], yet no one herbicide can completely control nutsedge. It requires a combination of chemical and cultural methods and a lot of patience. Nutsedge management continues to be an elusive goal, one that may take several more research careers and years to solve to enhance a great numbers of nutsedge tubers to sprout by two methods either by using plant grows regulator or by using plastic mulch for two weeks which increase number of sprouting tubers by several times and treated later by glyphosate and non ionic surfactant.

2. MATERIAL AND METHODS

Tubers of purple nutsedge and yellow nutsedge were collected from Agriculture experiments station of Alexandria University, Alexandria, Egypt. The work in this research could be divided into three main parts as follow:

2.1. Laboratory experiment

The effects of Gibberellic acid (GA3) (100, 200, 300, 400 and 500 ppm); Ethephone (1, 1.5 and 2ml/L. water); Thiourea (1 and 2%); Indol -3- butyric acid (1, 2 and 3 ppm); and Kinetin (0.5 ppm) on breaking dormancy and sprouting of nutsedges tubers were carried out during 2014. Tubers of purple nutsedge (*Cyperus rotundus*) and yellow nutsedge (*Cyperus esculents*) were used in this study. Randomized complete design (RCD) was used in this experiment. Four replicates were made for each treatment. Tubers were sterilized for 15 min with a 10% Chlorox solution and them rinsed in running tap water 20 min. they were soaked in 200 ml distilled water solute concentration of growth promoting substances for 3 hr. ten tubers of each replicate of treatment were placed in Petri-dish 9cm in diameter, containing 3 sheets of Whatman No.1 filter paper moistened with 8ml distilled water. The Petri-dishes were covered with aluminum foil, sealed in a polyethylene bag, and enclosed in a black linen bag. Results were taken after 7 days by the number of tubers sprouting in all replication of treatments. [10], [15].

2.2. *Greenhouse experiment*

Greenhouse studies were conducted in 2013 and 2014 at the Greenhouse of water and soil science department faculty of Agriculture El-Shatby, Alexandria University, Egypt to evaluate the efficacy of herbicidal activity against tuber of nutsedge. Experimental units consisted of 30 cm diameter circular pots that were 16 cm tall. Pots of this depth were selected because previous research indicated that 99% of purple nutsedge tubers were distributed within 16 cm of the soil surface [16]. Pots were filled with sandy soil consisting of 87% sand, 4% clay, and 8% silt with pH 8.1 and `0.6% organic matter and clay loam soil consisting of 42.5% clay, 21.5% silt and 36% sand with pH 8.85 and 5% organic matter . Tubers with a biomass of 1 g for purple nutsedge and 0.2 g for yellow nutsedge were planted in pots (ten tubers of purple and yellow nutsedges in each pot 2.5 cm depth) the experiment was arranged as a randomized complete block design with four replications and repeated over time. Each pre- emergence herbicides Acetochlor, Butralin, Metribuzin, Metalachlor, and Propyzamide at rate per Fadden 1 L., 2.5L., 300g, 0.75L., and 1L., respectively were mixed with 800 ml water and irrigated four replicate in each treatment by 200 ml of pre- emergence herbicide solution. Three weeks after nutsedge tubers planting , Bentazone, Propyzamide, Metolachlor, Chlorpropham, Pyrazosulfuron, Rimsulfuron, Nicosulfuron, Halosulfuron, Glyphosate at rate per Fadden 1.5L., 1L., 0.75L., 2L.,80g, 25g, 25g, 20g and 1L., respectively were applied post-emergence herbicides when purple nutsedge averaged 18.5 cm in height , and yellow nutsedge was 27.5 cm in height. Pots were watered twice weekly and fertilized weekly with 200 ml of a 1.5 g L^{-1} solution of 19-19-19. Nutsedge shoot emergence was monitored and new shoot emergence marked weekly after treatment of Pre-emergence herbicides. Visual foliar growth ratings were evaluated relative to the non-treated control at 8 weeks after herbicides application using a scale of 0 (plant death) to 100 (similar to non-treated control). Studies were concluded 8 weeks after planting. Wire mesh (7.8 holes cm^{-1}) was stretched across a wooden frame to sieve and separate the tubers from the soil. Data collected included individual tuber and shoot fresh biomass [17].

2.3. *Field experiment*

Two experiments were conducted in sandy soil pH value 8.1 according to [5]. The first experiment occurred during 2014, and second in 2015. Our experiment included two factors, the first factor is mulch including three treatments, clear polyethylene (PE) colorless sheets 60 micron, 90 micron and non covered (control) were used to cover the plots (plot size was 2 m long and 2 m wide), the second factor is time including four treatments 1, 2, 3 and 4 weeks, arranged in a factorial completely randomized block design (FRCBD) with twelve treatments and four replications. Second experiment PE 60 micron thick, were used to cover the plots (plot size was 2 m long by 2 m wide), while the soil was previously

ploughed, leveled and irrigated, after 10 days polyethylene colorless sheets removed of all plots and treatment by (glyphosate,1L + non ionic surfactant (NIS), 0.25L.)/Fadden and glyphosate alone after 5 days polyethylene sheets removed. Wire mesh (7.8 holes cm-1) was stretched across a wooden frame to sieve and separate the tubers from the soil. Data collected included individual tuber and shoot fresh biomass [17].

3. RESULTS AND DISCUSSION

3.1. Laboratory experiment

This experiment was carried out to measure the sensitivity of yellow and purple nutsedges tubers to certain compounds belongs to the growth promoting substances at different concentrations in order to study its effects on number of sprouting tubers. The effect of the tested compounds was not the same to purple and yellow nutsedges. In general, Indol butric acid (IBA) by all concentration gave highly significant effect on the numbers of sprouting tubers, 1 and 2 ppm gave 83 and 82.5% of sprouting tubers, respectively, while 47.5% only for purple nutsedge. Exactly the same trend was noticed with yellow nutsedge but to lesser extend when used IBA at 1, 2 and 4 ppm. Also Kinetin at 0.5 ppm gave the height increase of numbers of sprouting tubers (N.S.T.) to both purple and yellow nutsedge since it gave 85 and 82% increase of (N.S.T.), respectively the same results concluded by other instigators [15]. On the other hand in case of yellow nutsedge Gibberellic acid with 4 concentration (100 – 400 ppm) cased highly significant increase of N.S.T., since it gave 3.25, 6, 4 and 3.25 with 100, 200, 300 and 400 ppm, respectively but the same trend of GA3 a 200 ppm toward purple nutsedge was observed in case of yellow nutsedge since it gave the highest percentage of increase of (N.S.T.) 60%. Ethephone at 2ml /L and 1.5ml/L only which gave highly significant increase of (N.S.T.) of yellow nutsedge (but not purple nutsedge) which were 4.75 and 3.5 respectively (% increase of N.S.T.) were 47.5% and 35% respectively. Again Thiourea at 2% caused highly significant increase of N.S.T. which was 8.75 (% increase of N.S.T. was 87.5%). In general the aim of this experiment is to search for some chemicals which able to enhance sprouting of *Cyperus spp*. in non crop areas heavily infested with yellow and purple nutsedge tubers and germinated during long period of time. Therefore, this treatment achieves good control of these noxious weeds in non cultured area with a proper herbicide like glyphosate. It very important before spraying the herbicides to enhance tuber sprouting with Kinetin (0.5 ppm) in the presence of the two sedges, while it the infestation with only yellow nutsedge with cheep product like thiourea (2%).

Table (1): Effect of certain treatments on the number of sprouting tubers (N.S.T) of purple nutsedge and yellow nutsedge) and the corresponding percentages of sprouting (%sprouting) assessed after 7 days.

Treatment	Conc.	purple nutsedge		yellow nutsedge	
		N.S.T	% sprouting	N.S.T	% sprouting
GA3	100 ppm	2	20	3.25	32.5
GA3	200 ppm	4.75	47.5	6	60
GA3	300 ppm	2.25	22.5	4	40
GA3	400 ppm	2.5	25	3.25	32.5
GA3	500 ppm	1.25	12.5	1.75	17.5
Ethephone	1 ml/L	1.5	15	2.75	27.5
Ethephone	1.5 ml/L	2.25	22.5	3.5	35
Ethephone	2 ml/L	1.75	17.5	4.75	47.5
Thiourea	1%	3.5	35	2	20
Thiourea	2%	4	40	8.75	87.5
IBA	1 ppm	8.3	83	6.25	62.5
IBA	2 ppm	8.25	82.5	6.5	65
IBA	4 ppm	4.75	47.5	5	50
Kinetin	0.5 ppm	8.5	85	8.2	82
Control		2.5	25	2	20
Initial No. of tubers / Petri dech		10	10	10	10
$LSD_{0.05}$		1.73		1.24	

3.2. Greenhouse experiment

Two experiments were conducted against two perennial nutsedges (purple and yellow) with different herbicides applied pre or post-emergence treatments in two succeeding seasons (2013 and 2014). In the two experiments, two different soils (sandy and clay soils) were used.

3.2.1 Pre-emergence herbicides

The first experiment includes the pre-emergence herbicides in the two seasons, and the data obtained were recorded in table 2 (for season 2013), and table 3 (for season 2014), from the following results could be concluded:

1-All pre-emergence herbicides caused highly significant decrease of the fresh weight of shoots and roots of both purple or yellow nutsedges in both sandy or clay soil but with different efficacies.

2- Almost the same trend of the highest and lowest efficiency was observed again with yellow nutsedge in both sandy and clay soil since % cont. values were 82% and 42% for Propyzamide and Acetocher respectively in case of shoots fresh weight in sandy soil, while in clay soil the percentages of control of shoots were 71% and 37% for Propyzamide and Acetachlor respectively. The same trend was observed with sandy soil.

3- Metolachlor prove to have moderately effective against purple nutsedge in sandy soil but to lesser extend on clay soil. These results were not agreement of those of [13] and the same results was concluded by other investigators [18].

4- The soil type play a role in herbicide efficiency, general the efficiency of Butralin was reduced in clay soil than in sandy soil. This result is due to the high adsorption of clay soil and need grater amount of herbicides than in sandy soil to compensate the reduction due to adsorption of clay soil. Inexpertly, Mertibuzine in clay soil was more effective on shoot growth than roots.

5- With respect to the behavior of yellow nutsedge in sandy and clay soils, it could be concluded that the rates of growth of either shoots or roots with or without herbicides was greater than the amounts of purple nutsedge, but followed the same trend since the beigest effect was noticed with Propyzamide (82% and 77% control of shoots respectively and 71% and 69% for root respectively) and lowest was Acetochlor (42% and 18% control for shoot and root respectively and 37 and 13% control for shoot and root respectively. In the middle Metalachlor which gave 66% and 68% control in sandy soil while shoot fresh weight was controlled by only 41% in clay soil, but roots fresh weight was moderately sensitive to Metolachlore in clay soil since % cont. was 56%thes results was not agreement with [13].

6- The fresh weight of roots always greater than the fresh wight of the shoots (Table 2) in case of purple and yellow nutsedge in two soils sandy and clay. The same remarks were concluded in table 3 in the second season 2014. The efficiencies of the tested herbicides against both purple and yellow nutsedge were arranged in the following descending order: Propyzamide > Mtalochlor >Metribuzn = Butralin > Acetochlor. **T**he effect of the tested herbicides were more efficient against yellow nutsedge than purple nutsedge in particular on shoots and in sandy soils.

3.2.2. post-emergence herbicides:

1-All of the tested herbicides caused highly significant decrease of fresh weight of both shoots and roots of purple and yellow nutsedges in either sandy or clay soils, with different trends of each case tables 4 and 5.

2-The soil type did not play role in the efficiency of post-emergence herbicides either against purple or yellow nutsedge. For elucidation in case of Propyzamide it could be noticed that its effect against shoots and root growth were almost follow the same trend whether against purple or yellow nutsedge and whatever the soil type they grown in, since percentages of control of the fresh weight of shoot and root of purple nutsedge were 76 and 66% in sand soil respectively and 78 and 72% in clay soil respectively. The same trend was observed in case of yellow nutsedge.

4-Bentazone while it showed moderately effective against yellow nutsedge. This herbicide was very weak against purple nutsedge, this finding was agreement with the finding of [19]. The opposite trend was observed in case of Metalachlor which was very effective against purple nutsedge than yellow nutsedge whatever the soil type since it gave 82 and 88% control of shoot and root in sandy soil respectively in case of purple nutsedge while gave only 65 and 59% for shoot and root respectively in sandy soil in case of yellow nutsedge. The effect of Metalachlor in clay soil gave similar results against the two nutsedge.

5-Mixetures of glyphosate or Halosulferon – methyl with nonionic surfactant (NIS) gave the heist effect against shoot fresh weight of yellow and purple nutsedge in sandy and clay soils and to lesser intend with root growth since the percentage of control of purple nutsedge in sandy soil were 96,90,95 and 94 for glyphosate + NIS, glyphosate, almost the same trend was observed in clay soil since the percentage of control were 98, 84, 95 and 93 for glyphosate + NIS, glyphosate, Halosulferon- methyl + NIS and Halosulferon – methyl respectively. This results pointed to the synergistic effect of NIS with glyphosate but not to Halosulferon – methyl. This result was in agreement with the finding of [12] and not in agreement of those of [18].

6-Among the single treatment, Rimsulfuron gave the best results against purple nutsedge in both sand and clay soil either to shoots or roots since it gave 87, 85, 91 and 92% control of shoot and root (sandy) shoot and root (clay) respectively. On the other hand with yellow nutsedge the behavior was changes and the values were 77, 59, 86 and 60% control of shoot and root (sand), shoot and root (clay) respectively.

7-Pyrazosulfuron-ethyl was very effective against purple nutsedge in sandy soil and to lesser extend in clay soil, since the % values were 90% and 90% control in sandy soil for shoot and root respectively, but only 82 and 73% for shoot and root in clay soil respectively was agreement with the finding of [14]. Chlorpropham was moderately effective against the nutsedge in both sandy and clay soils. Generally the lower offences of the tested herbicides in clay soil than in sandy soil may be due to the fast growth in clay soil of both purple and yellow nutsedge [20].

3.3 Field experiments

Two field experiments were carried out in sandy soil in order to investing the role of solar energy on the activation of tubers of purple and yellow nutsedges followed by using certain herbicides.

3.3.1 Effect of solar energy on sprouting of nutsedges:

The first field experiment, tested the effect of clear polyethylene mulch on the break dormancy in tubers of purple and yellow nutsedge since the real problem facing any control strategy of nutsedges is due to the great number of tubers in certain area (e.g. 20 million tuber in Fadden) germinated naturally there several months or years, thus at any time the field night be heavily infested with nutsedge and need several spray treatments with the suitable herbicides which is very expensive. The aim of this experiment is to find out which is much better to activate tuber sprouting by using clear mulch with 60 micron thickness or 90 micron. Also to investigate the time of covering the soil which gave the highest increase of numbers of sprouting tubers. The data shown in table 6 indicated that in general PE 60 is more efficient than PE 90. Since the percentages of activation were 616, 475, 449 and 441 % after one, two, three and four weeks respectively in case of PE 60 compared with 536, 373, 384 and 410% for PE 90, respectively. On the other hand almost there are no significant difference of numbers of grown shoots in case of yellow nutsedge and thus PE60 is less expensive than PE 90 and must be choose with respect to the suitable period of time to caver the soil. After one week highly significant increase of grown shoots of both purple or yellow nutsedge was observed, this was due to the heating the soil through solar energy gained from mulching. On the other hand after two weeks also significant increase of grown shoots but only in case of purple nutsedge and to lesser extent, thus to save time. In conclusion it must be recommended with cover the soil with clear mulch 60 micron for only one week which is stuffiest to enhance the sprouting of most of tubers of the two nutsedges found in the infested certain area.

3.3.2. Integrated control of purple and yellow nutsedg

The second field experiment is really a good expiration to use solar energy as well as certain herbicides treatments through integrated weed control method of nutsedges. The data obtained were recorded in table 7 from which the following could be deduced.

1-The soil converge with clear mulch as previously mentioned, break the dormancy of both purple and yellow nutsedges and caused highly significant increase of either the numbers of sprouting tubers or grown vegetative growth above the soil surface. The fresh weight of shoots of purple nutsedge after one week was 812.6 grammas while it was 980 grammas for yellow nutsedge in the first (season 2013). Almost similar results were observed in the second season(2014). After activation of sprouting process of nutsedge for 10 days followed with a potent herbicide like glyphosate either singly or in combination with non ionic surfactant (top film), defiantly controlled nutsedge tubers much better than when used herbicidal treatments without activation by using plastic mulch. It could be concluded than yellow nutsedge was little more sensitive to (mulch + herbicide) since in season 2013 the percentages of control of shoots of purple nutsedge were 88 and 89% for glyphosate and (glyphosate + NIS) with mulching respectively similar result was noticed with yellow nutsedge(91 and 92% respectively). In spite of the herbicide treatments without mulch gave 70 and 79 % control for purple and 71 and 76% in case of yellow nutsedge for glyphosate + Top film, respectively. These values of control seems to be very near of those in the presence of clear mulch, in fact the real situation is completely differ since with mulch the glyphosate + Top film gave 89% control of 1985 grammas of purple nutsedge tubers grown in similar area after 50 days of herbicidal treatment compared with 79% control of only 133.25 grammas of the growing shoots in similar area without mulching. Thus the non mulched area will need several herbicidal treatments later once germination of new dormant tuber in same area, while with mulching for 10 days most tubers will germination, then exposed to one spray of herbicide. Generally the best results encourage this theory was noticed from table 7 in season 2014 since glyphosate + Top film with mulch gave 95% control of yellow nutsedge.

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Table(2):Efficacy of certain herbicides applied pre emergence on purple nutsedge and yellow nutsedge on sandy and clay soils as fresh weight of shoot and root in grammas / pots (10 tubers per each pot) as well as the calculated percentage of control (% cont.) of these weeds 60 days after treatment (season 2013)

treatment, and rate/feddan	purple nutsedge (*Cyperus rotundus*)								yellow nutsedge (*Cyperus esculentus*)							
	sand soil				clay soil				sand soil				clay soil			
	shoot wt.	%cont.	root wt.	%cont.	shoot wt.	%cont.	root wt.	%cont.	shoot wt.	%cont.	root wt.	%cont.	shoot wt.	%cont.	root wt.	%cont.
Acetochlor, 1 L.	39.5	24.5	82	26.8	45	18	71	21	55	42	180	18	61	37	140	13
butralin, 2.5 L.	30	42.6	68	39.3	39	29	68	24	38	60	95	57	55	43	95	41
Metribuzin, 300 g	30	42.6	67	40.2	30	45	67	26	41	57	100	55	52	46	100	38
Metolachlor, 0.75 L.	20	61.8	42	62.5	32	42	42	53	32	66	70	68	58	41	70	56
Propyzamide, 1 L.	10	80.9	25	77.7	19	65	29	68	17.5	82	50	77	29	71	50	69
Control	52.3	0	112	0	55	0	90	0	95.5	0	220	0	97	0	160	0
LSD $_{0.05}$	1.56		2.7		3.10		5.20		3.2		12		6.50		12.00	

Table(3):Efficacy of certain herbicides applied pre emergence on purple nutsedge and yellow nutsedge on sandy and clay soils as fresh weight of shoot and root in grammas / pots (10 tubers per each pot) as well as the calculated percentage of control (% cont.) of these weeds 60 days after treatment (season 2014)

treatment, and rate/feddan	purple nutsedge (*Cyperus rotundus*)								yellow nutsedge (*Cyperus esculentus*)							
	sand soil				clay soil				sand soil				clay soil			
	shoot wt.	%cont.	root wt.	%cont.	shoot wt.	%cont.	root wt.	%cont.	shoot wt.	%cont.	root wt.	%cont.	shoot wt.	%cont.	root wt.	%cont.
Acetochlor, 1 L.	40.0	16	78.0	19	46	13	79	10	65.0	41	160	11	65	38	140	8
butralin, 2.5 L.	23.0	52	55.0	43	31	42	55	38	45.5	59	70	61	49	53	81	47
Metribuzin, 300 g	28.0	41	50.0	48	32	40	50	43	52.0	53	75	58	61	42	83	45
Metolachlor, 0.75 L.	20.5	57	39.0	59	35	34	45	49	43.0	61	60	67	58	45	75	51
Propyzamide, 1 L.	12.0	75	26.5	72	21	60	36	59	33.0	70	45	75	42	60	71	53
Control	47.5	0	96.0	0	53	0	88	0	111.0	0	180	0	105	0	152	0
LSD $_{0.05}$	1.8		7.8		2.80		2.5		3.7		12		6.30		9.50	

Table(4):Efficacy of certain herbicides applied post emergence on purple nutsedge (*Cyperus rotundus*) and yellow nutsedge (*Cyperus esculentus*) in sandy and clay soils as fresh weight of shoot and root in grammas / pots 21 days old, as well as the calculated percentage of (% control) of these weeds 60 days after planting (season 2013)

treatment	purple nutsedge								yellow nutsedge							
	sandy soil				clay soil				sandy soil				clay soil			
	shoot wt.	%cont.	root wt.	%cont.	shoot wt.	%cont.	root wt.	%cont.	shoot wt.	%cont.	root wt.	%cont.	shoot wt.	%cont.	root wt.	%cont.
Propyzamide	6.0	76	11.6	66	11.0	78	29.6	72	26.2	74	36.2	79	20.0	81	52.8	79
Bentazon	16.5	33	25.0	27	32.0	34	82.0	22	25.0	75	47.7	72	25.0	77	88.8	64
Metolachlor	4.4	82	4.2	88	11.5	76	29.0	72	35.0	65	70.0	59	22.0	79	95.0	61
Chlorpropham	5.9	76	7.9	77	8.8	82	25.0	76	33.0	67	53.1	69	16.0	85	68.0	72
Pyrazosulfuron-ethyl	2.5	90	3.5	90	9.0	82	28.0	73	26.0	74	58.0	66	21.0	80	84.8	66
Rimsulfuron	3.2	87	5.0	85	4.5	91	8.0	92	23.0	77	71.0	59	15.0	86	98.0	60
nicosulfuron	5.0	80	9.0	74	8.7	82	13.4	87	23.0	77	45.0	74	23.5	78	59.5	76
Halosulferon-methyl	1.5	94	2.9	92	3.5	93	19.0	82	26.0	74	49.3	71	22.0	79	75.0	69
Halosulferon-methyl + NIS (Topfilm)	1.3	95	2.6	93	2.5	95	16.0	85	19.6	80	38.0	78	23.4	78	51.3	79
Glyfosate(Baron)	2.5	90	6.5	81	8.0	84	25.0	76	24.8	75	75.0	56	24.0	77	111.0	55
Glyfosate(Baron) + NIS (Topfilm)	0.9	96	5.2	85	1.0	98	15.0	86	17.0	83	55.0	68	18.7	82	88.0	64
Control	24.8	0	34.3	0	48.7	0	105.4	0	99.4	0	172.3	0	106.4	0	245.9	0
LSD $_{0.05}$	0.10		0.50		0.96		1.8		1.18		1.94		1.98		7	

Table(5):Efficacy of certain herbicides applied post emergence on purple nutsedge (*Cyperus rotundus*) and yellow nutsedge (*Cyperus esculentus*) in sandy and clay soils as fresh weight of shoot and root in grammas / pots 21 days old, as well as the calculated percentage of (% control) of these weeds 60 days after planting (season 2014)

treatment	purple nutsedge								yellow nutsedge							
	sandy soil				clay soil				sandy soil				clay soil			
	shoot wt.	%cont.	root wt.	%cont.	shoot wt.	%cont.	root wt.	%cont.	shoot wt.	%cont.	root wt.	%cont.	shoot wt.	%cont.	root wt.	%cont.
Propyzamide	7.0	76	16.3	68	8.6	80	26.1	76	32.3	69	55.0	70	19.0	83	39.0	80
Bentazon	20.0	32	42.5	15	30.0	29	70.0	35	29.3	72	59.0	68	33.7	71	65.0	67
Metolachlor	4.7	84	9.0	82	8.5	80	29.0	73	35.0	67	88.4	52	35.0	69	71.0	64
Chlorpropham	6.4	78	11.8	77	9.0	79	25.0	77	26.8	75	59.5	67	29.0	75	53.1	73
Pyrazosulfuron-ethyl	5.0	83	12.0	76	7.0	84	25.5	76	32.0	70	63.1	65	22.0	81	51.9	74
Rimsulfuron	4.0	86	9.0	82	4.3	90	7.2	93	26.0	75	75.0	59	18.0	84	67.7	66
nicosulfuron	7.0	76	15.0	70	9.0	79	15.9	85	29.5	72	44.1	76	29.0	75	45.7	77
Halosulferon-methyl	2.0	93	7.5	85	4.0	91	12.5	88	27.0	74	54.8	70	31.5	73	51.8	74
Halosulferon-methyl + NIS (Topfilm)	1.3	95	8.7	83	2.8	93	6.8	94	23.4	78	37.0	80	26.6	77	30.0	85
Glyfosate(Baron)	5.5	81	19.0	62	3.5	92	15.0	86	25.3	76	45.0	75	31.3	73	82.0	58
Glyfosate(Baron) + NIS (Topfilm)	1.1	96	12.0	76	1.1	97	8.1	92	15.3	86	35.0	81	19.0	83	65.0	67
Control	29.3	0	50.2	0	42.5	0	107.9	0	105.9	0	182.5	0	114.5	0	197.6	0
LSD $_{0.05}$	0.44		0.56		1.04		5.2		0.89		1.74		1.77		2.5	

Table(6) Effect of clear mulch 60 micron and 90 micron in number of grown shoots (N.G.S.) of purple and yellow nutsedges after certain intervals (1,2,3 and 4 weeks) on sandy soil as well as the calculated percentages of activation (% activ.) for each

Treatment	one week				two week				three weeks				four weeks			
	purple nutsedge		yellow nutsedge		purple nutsedge		yellow nutsedge		purple nutsedge		yellow nutsedge		purple nutsedge		yellow nutsedge	
	N.G.S	% activ.	N.G.S	% activ.	N.G.S	% activ.	N.G.S	% activ.	N.G.S	% activ.	N.G.S	% activ.	N.G.S	% activ.	N.G.S	% activ.
Clear mulch 60 micron	**44.75**	**616**	**32**	**357**	**51.75**	**475**	**34.0**	**278**	**53.5**	**449**	**36.3**	**282**	**55.5**	**441**	**38.3**	**256**
Clear mulch 90 micron	**39.75**	**536**	**34.5**	**393**	**43.5**	**383**	**35.5**	**294**	**47.25**	**384.6**	**35.8**	**277**	**52.3**	**410**	**36.8**	**242**
Control	**6.25**	**0**	**7**	**0**	**9**	**0**	**9.0**	**0**	**9.75**	**0**	**9.5**	**0**	**10.25**	**0**	**10.8**	**0**

LSD $_{0.05}$ (mulch) **3.3** **LSD $_{0.05}$(time)** **3.8** **LSD $_{0.05}$ (interaction)** **6.6**

Table(7) Effect of clear mulch 60 micron on activation of sprouting tubers of purple and yellow nutsedge alone or followed by glyphosate treatment express as shoot and root fresh weight in grammas /m^2

tratment	season 2013								season 2014							
	Purple nutsedge				yellow nutsedge				Purple nutsedge				yellow nutsedge			
	shoot wt.	%cont.	Root wt.	%cont.	shoot wt.	%cont.	Root wt.	%cont.	shoot wt.	%cont.	Root wt.	%cont.	shoot wt.	%cont.	Root wt.	%cont.
Glyfosate (Baron)	39.5	70	1227.5	33	42	71	1315	31	55	65	1300	33	45	74	1390	31
Glyfosate (Baron)+Topfilm	27.5	79	590.75	68	35	76	650	66	43	72	607	69	37	78	690	66
clear mulch+Baron	247.5	88	597.5	80	215	91	550	87	250	87	603	82	200	92	530	88
clear mulch+Baron +Top film	218.25	89	510	83	195	92	485	89	210	89	517	84	135	95	490	89
Control mulch 10 days	812.5	0	2728.75	0	980	0	2850	0	912	0	2890	0	1020	0	2970	0
control mulch 50 days	1985	0	3060	0	2350	0	4225	0	1890	0	3300	0	2550	0	4350	0
Control	133.25	0	1830	0	145	0	1900	0	155	0	1950	0	170	0	2020	0
LSD $_{0.05}$	40		163		46		176		52		177		95		145	