Iraqi J. Agric. Res. Vol.20 No.1 pp.206- 216 July/2015

APPLICATION OF ALLELOPATHIC POTENTIAL OF TWO CULTIVARS OF SUNFLOWER RESIDUES IN COMBINATION WITH LOWER RATE OF TRIFLURALIN HERBICIDE FOR WEED CONTROL IN MUNGBEAN

A. A. Tawfiq I. S. Alsaadawi

ABSTRACT

Field study was undertaken to explore the response of weeds and mungbean crop to soil incorporated with sunflower residues in combination with lower rate of a pre-plant herbicide (Trifluralin). Sunflower residues of two cultivars Shumoose and Sin Altheeb at 3.2 and 6.4 t ha^{-1} were used either alone or in combination with trifluralin at 1.2 L ha^{-1} (50% of label rate). Trifluralin at full label rate (2.4 L ha^{-1}), weed control and weed free treatments were also included for comparison. Plots treated with 50% of label rate of herbicide and amended with sunflower residues of cultivar Sin Altheeb recorded least weed density and dry biomass and this suppression was much greater than the residue treatments alone and more than cultivar Shumoose. Application of herbicide at 50% rate in plots amended with Sin Altheeb residue resulted yield 64% more than with the label rate of herbicide treatment. Chromatographic analysis of sunflower amended field soil revealed the presence of several potent allelopathic compounds in the residues of both cultivars with greater quantity in Sin Altheeb than in Shumoose. Periodic data revealed that maximum quantities of these phytotoxins were coincided with the period in which maximum suppressive activity against weeds was noticed under field condition, which explain the activity of phytotoxins on weed suppression. The other advantages of this method in improving soil physical and chemical properties are briefly discussed.

INTRODUCTION

Weed infestation is one of the major factors which not only compete with crop plants for different resources but occasionally interfere with crop growth by releasing toxic substances in the rhizosphere (26). Potential yield reductions caused by uncontrolled weed growth throughout growing season have been estimated to be 45 to 95%, depending on crop species and ecological and climatic conditions (4).

Chemical weed control is a very effective method for suppressing weeds, and herbicides proffer a substantial boost in crop productivity through efficient weed control (30). But excessive and indiscriminate use of herbicide may lead to crop injury, human and animal health concerns, soil and water pollution and herbicide resistance in weeds (28). Due to these limitations, scientists have searched for alternative weed control methods. One of the possible methods for reducing or minimizing the use of herbicides may be the use of allelopathy phenomenon (7, 12, 31). Several strategies have been developed to use this phenomenon for weed control such as crop rotations, intercropping, allelopathic mulches, and spray of allelopathic plant water extracts (8, 11, 16). In recent years, allelopathic crop extract has been used alone or in combination with the lower doses of herbicides for weed control in several crops (9, 10, 15). However, to employ this technology, large volumes of sprays are required for field application, and therefore

College of Sci.- Baghdad Univ.- Baghdad, Iraq.
Received: June/2014
Accepted: Feb./2015

appropriate concentrations for each crop should be determined for large scale field operations. In addition, the process is time consuming and cost effective (34). Due to these limitations, a practical approach has been developed where the residues of allelopathic crops have been left to dry under field conditions and then promptly incorporated into production sites for weed management (22). Low herbicide doses were applied along with residue incorporation. By applying this technique, it was found that application of sunflower or sorghum residues in combination with lower rate of herbicides provide weed suppression and crops yield similar to that achieved by the label rate of the tested herbicides (2, 3).

Mungbean is an important legume crop in Iraq following sunflower in crop rotation. Uncontrolled weeds may reduce mungbean yield in range between 28-90% compared with weed free conditions (1, 25). The weeds are customarily managed by application of pre emergence trifluralin herbicide (27). Information concerning the effect of combination of sunflower residues and lower rate of herbicide has not been explored for weed management in mungbean. The present study was, therefore, conducted to evaluate the possibility of using of allelopathic sunflower residues in combination with reduced (50% of label rate) trifluralin rate for weed control with the objective of getting cost effective and safe weed control in mungbean.

MATERIALS AND METHODS

Plant materials and site

Seeds of sunflower cv Shumoose and Sin Altheeb were obtained from the State Board for Agricultural Researches, Ministry of Agriculture, Iraq and local market respectively. Seeds of mungbean cv. local were purchased from the local market. The experiment was conducted in the Experimental Field of Botanical Garden, Biology Department, College of Sci., Baghdad University and Baghdad, Iraq. The field is characterized by loam soil with pH 7.4, EC 1.5 dS m^{-1} and 0.37 % organic matter.

Preparation of plant residues

Seeds of Shumoose and Sin Altheeb cultivars were separately sown on 28 February 2012 in randomly selected plots (4×4 m), keeping 75 cm space rows and 15 and 30 cm distances between seeds to obtain planting densities of 4.4 and 8.8 plant/m^2, respectively. Fertilizers used were nitrogen as urea (46% N) at 240 kg and triple super phosphate (46% P_2O_5) at 240 kg ha^{-1}. All phosphorus and one third of nitrogen were applied at sowing, while the remaining amount of nitrogen was divided in two equal parts and applied after 6 and 11 weeks (flowering time) after sowing. The field received recommended irrigation water during the entire course of study. At physiological maturity, heads were removed and the plants were harvested, air dried for several days under sun light and then tilled twice by using a disc plough to incorporate sunflower residues into the soil. Residue free weed control treatment was maintained on an intentionally un-cropped area of the same field. Field measurements revealed that the planting densities of 4.4 and 8.8 plants m^{-2} after removal of heads of sunflower plants correspond to residue application rate of about 3.2 and 6.4 t ha^{-1}.

Efficacy of sunflower cultivars residues in combination with reduced rate of trifluralin on weeds and mungbean

The plots of previous experiment were divided into sub plots measuring 2×2 m. Seeds of mungbean were manually sown at mid of July in 30 cm spaced

rows and 15 cm between plants. Nitrogen as urea (46% N) at 80 kg ha^{-1} and phosphorus as triple super phosphate (46% P_2O_5) at 240 kg ha^{-1} were applied to these plots. All phosphorus and half of the nitrogen were applied at planting during seed bed preparation, while remaining nitrogen was applied after two weeks. All plots received equal irrigated water during the growth period. Treatments were comprised of Shumoose and Sin Altheeb residue rates (3.2 and 6.4 t ha^{-1}) with and without half rate of trifluralin (1.2 L ha^{-1}). A control without sunflower cultivars residue and trifluralin application, label rate of trifluralin and weed free treatments were maintained for comparison. Weeds from weed free plots were manually removed every week by hand pulling throughout the crop's life span. Trifluralin was applied as pre-plant soil incorporation. Volume of spray (300 L ha^{-I}) was calibrated using water. At physiological stage of crop (60 days after sowing), weeds were cut from ground surface and oven dried at 70 °C for 72 h. Data on weed density and biomass was converted and expressed as per plot. Data on mungbean traits, yield and yield components (number of pods per plants, number of seeds per pod and weight of 100 seeds) were recorded from randomly selected samples following standard procedures at physiological maturity of crop.

All experiments were conducted in randomized complete block design under split plot arrangement with four replications. The data were analyzed using analysis of variance (ANOVA) using GENSTAT computer software package. Mean values were separated using least significant difference (LSD) at P≤0.05 probability level (33).

Identification of phytotoxins in sunflower residues and their dynamic in sunflower amended soil.

For isolation and identification of allelochemicals in the residues of test sunflower cultivars, above ground of mature Shumoose and Sin Altheeb cultivars were collected from the field, air dried in oven at 70 ˚C for 3 days and ground by electrical grinder. One gram of plant powder of each cultivar were added to 10 ml HPLC methanol and allowed to stand for one hour, then filtered. The filtrate was kept in refrigerator until use.

Based on results of previous experiment, Sin Altheeb residues showed stronger allelopathic potential compared to Shumoose. Therefore, this cultivar was used to follow the dynamic of phytotoxins in residues amended soil at different decomposition periods. Soil samples were taken from plots amended with Sin Altheeb residues (6.4 t ha^{-1}) at 0, 2, 4, 6, 8 weeks from sowing. The soil samples were air dried, grounded by mortar and mixed thoroughly. One gram of soil sample was added in 10 ml methanol, shacked gently and filtered using disposable minister filters 0.2 µm. The filtrate was kept in deep freeze until use. Separation and quantification of individual Phenolic acids were performed using Fast Liquid Chromatogram and following the procedure outlined by (13). Conditions listed in Table (1). Concentration of each isolated compound was determined by the following equation:

$$\text{Concentration (ppm)} = \frac{\text{Area of the sample}}{\text{Area of the standard}} \times \text{Concentration of the standard} \times \text{Dilution factor}$$

Table 1: High Pressure Liquid Chromatogram conditions for separation of phytotoxins from sunflower residues

Parameters	Characteristics
Colum types	C-18 DB, Fast liquid chromatographic (FLC) column
Colum dimensions	50 × 4.6 mm
Particle size	3 µm
Mobile phase	Solvent A: 0.1 % acetic acid in deionized water Solvent B: acetonitrile , 20:80 V/v
UV set	275 nm
Flow rate	1.5 ml/min
Volume injection sample Temperature	25µg/ml 35°c

RESULTS AND DISCUSSION

Weed Population and dry weight biomass

Weed flora dominated the experimental site comprised of several narrow and broad leaf weeds (Table 2). Label rate of herbicide suppressed weed population and weed biomass over control to satisfactory level.

Weed population was significantly suppressed by 59 and 64 of control by the residues of Sin Altheeb and by 36 and 45% of control by the residues of Shumoose, respectively (Table 3). This reduction was further increased by 61 and 55 % of control when Shumoose cultivar residues at 3.2 and 6.4 t ha^{-1} were applied to plots amended with reduced (50% of the label rate) rate herbicide. Sin Altheeb residues at 3.2 and 6.4 t ha^{-1} combined with lower rate of herbicide suppressed weed population by 77 and 73% of control, which was greater than Shumoose at all treatments of residue whether applied alone or in combination with reduced rate of herbicide.

Table 2: Weeds grown in mungbean field

Weed species	Family	Type
Convolvulus arvensis L.	Convolvulaceae	Broad-leaf
Corochorus olitorius L.	Malvaceae	Broad-leaf
Datura inoxia L.	Solanaceae	Broad-leaf
Portulaca oleracea L.	Portulacaceae	Broad-leaf
Cynodon dactylon L.	Poaceae	Narrow-leaf
Cyperus rotundus L.	Cyperaceae	Narrow-leaf
Echinochloa colonum L.	Poaceae	Narrow-leaf
Setaria glauca L.	Poaceae	Narrow-leaf
Sorghum halepense L.	Poaceae	Narrow-leaf

Weed biomass was significantly affected by the incorporation of residues of test cultivars alone or in combination with reduced herbicide rate (Table 3). Incorporation of Shumoose residues at 3.2 and 6.4 t ha-1 significantly suppressed weed biomass by 66 and 77% and in Sin Altheeb 87 and 85% over control, respectively. However, incorporation of Shumoose residues at 3.2 and 6.4 t ha-1 in combination with reduced herbicide rate (50 %) scored 12 and 8 % greater weed biomass suppression than that realized with the Shumoose residue applied at 3.2 and 6.4 t ha^{-1} alone. Similarly, application of Sin Altheeb residues at 3.2 and 6.4 t ha-1 to plots amended with reduced rate of herbicide recorded 8 more weed suppression than residues at the same rates applied alone. Sin Altheeb cultivar at 3.2 and 6.4 t ha^{-1} scored 21 and 8 % more weed biomass suppression than Shumoose at the corresponding residue rates, respectively.

The suppression could be attributed to the inhibitory effect of allelochemicals which released during decomposition of sunflower residues and affect the receiver plants (5, 6, 23). Chromatographic analyses revealed that several allelochemicals are present in the residues and these allelochemicals are released in to the soil due to decomposition of the residues. No attempt was made to test the inhibitory effects of these allelochemicals; however several investigators reported that almost all the isolated compounds interfere with various physiological processes such as Inhibition of ion uptake (24), chlorophyll biosynthesis (33), cell membrane stability (17), protein and hormone biosynthesis (14,26) and cell division, and change the ultra-structural components of cells (29). The suppression potential was found to be concentration dependent. (19, 21) pointed out that suppression magnitude in allelopathic interactions is directly proportional to the applied rate of an allelopathic product.

Trifluralin is a dinitroaniline herbicide group that disrupts mitotic cell division through interference with microtubule assembly and kills germinating seeds rather than seedlings. Pre-plant incorporation of trifluralin averted weed density and biomass in mungbean field over weedy check to a satisfactory level. However, when the herbicide was reduced to 50% of label rate and applied to plots amended with different residue rates of Sin Altheeb cultivar, a similar weed or even greater weed suppression than sole application of herbicide was recorded (Table 3). These results confirmed hypothesis proposed by (8) that lower dose of herbicide applied in combination with allelopathic conditions could enjoy a complementary interaction and may help to minimize herbicide usage for weed management in field crops. It seems that a reduced level of herbicide may be feasible for providing satisfactory weed control when it works simultaneously with allelopathic conditions.

Table 3: Effect of different rates of residues of two sunflower cultivars alone or in combination with half label dose of trifluralin herbicide on weed population and biomass in mungbean

Treatments	Weed density (plants/plot)	Weed dry biomass (g/ plot)
Control	44	2126
Trifluralin (label dose)	14	267
	Shumoose cultivar	
Residues at 3.2 t ha-1	28	719
Residues at 6.4 t ha-1	24	493
Residues at 3.2 t ha-1 + 50% rate of trifluralin	17	464
Residues at 6.4 t ha-1 + 50% rate of trifluralin	20	314
	Sin Altheeb	
Residues at 3.2 t ha-1	18	285
Residues at 6.4 t ha-1	16	318
Residues at 3.2 t ha-1 + 50% rate of trifluralin	10	116
Residues at 6.4 t ha-1 + 50% rate of trifluralin	12	148
LSD ≤ 0.05	7.8	242.2

Seeds yield and dry weight biomass

Both label rate of herbicide and weed free treatments significantly increased seed and dry weight biomass over control. Residues incorporation of Shumoose at rates at 3.2 and 6.4 t h^{-1} increased seed yield by 62 and 58% and dry weight by 47 and 73% over control, respectively. Similar trend of

stimulation was also observed by residues of Sin Altheeb cultivar. However, Sin Altheeb scored 20 and 22 % greater biomass over Shumoose at 3.2 and 6.4 t ha^{-1}, respectively. The increase in seed and dry weight was further improved when lower rate of herbicide is combined with sunflower cultivars residue. Reduced rate of trifluralin herbicide when applied to plots amended with Shumoose residues at 3.2 and 6.4 t ha-1 increased seed yield by 20 and 49 % over application of the respective residues alone. Maximum (2.33 t ha^{-1}) seed yield was recorded by integration of reduced rate of herbicide with Sin Altheeb residues rate at 6.4 t ha $^{-1}$ (table 4).

Table 4: Effect of different rates of residues of two sunflower cultivars alone or in combination with half label dose of trifluralin herbicide on seeds and biological yields of mungbean

Treatments	Seed yield (Ton ha-1)	Dry weight biomass (Ton ha-1)
Control (weedy check)	0.89	16.7
Trifluralin (label dose)	1.42	24.6
Weed free	1.61	25.0
	Shumoose cultivar	
Residues at 3.2 t ha^{-1}	1.44	24.6
Residues at 6.4 t ha^{-1}	1.41	28.9
Residues at 3.2 t ha^{-1} + 50% rate of trifluraline	1.62	28.8
Residues at 6.4 t ha^{-1} + 50% rate of trifluralin	1.84	32.2
	Sin Altheeb cultivar	
Residues at 3.2 t ha^{-1}	1.91	27.9
Residues at 6.4 t ha^{-1}	2.03	32.6
Residues at 3.2 t ha^{-1} + 50% rate of trifluralin	2.03	29,2
Residues at 6.4 t ha^{-1} + 50% rate of trifluralin	2.33	37.2
LSD ≤ 0.05	0.48	6.9

Yield components

Incorporation of sunflower residues at 3.2 and 6.4.4 t ha-1 in to field soil significantly increased the number of pods per plant by 34 and 71% over control for shmoose and by 45 and 63% of control for Sin Altheeb, respectively. However, when the aforementioned residues rates applied to the field soil in combination with reduced trifluralin rate, the number of pods per plant increased by 91 and 104 % of control for Shumoose and 87 and 135% of control for Sin Altheeb, respectively. Maximum number of pods (33.6) was scored in plants grown in plots applied with reduced rate of herbicide and incorporated with Sin Altheeb residues at 6.4 t ha^{-1}.

The number of seeds per pod was significantly increased by residue rate of 6 t ha^{-1} of both sunflower cultivars. This increase was further improved when sunflower residues were combined with reduced trifluralin herbicide. Application of reduced rate of herbicide to plots amended with test residue rates of both cultivars provide statistically more number of seed per pod than that achieved with control treatment. No significant differences were recorded between all treatments and weedy check in 100-seed weight.

It appeared that the weed suppression by the various treatments provides appropriate growth medium for growth of mungbean crop so that significant yield improvement over weedy check was noticed. The increase of mungbean seed yield was apparently due to increase in number of pods per plant and number of seeds per pod. Improvement in crop yield and yield components by

combination of allelopathy with reduced herbicide dose is in line with the previous findings of (3, 18, 20).

The dynamic release of phytotoxins as shown by chromatographic analysis indicated that maximum quantities released during the first four weeks after sowing. This period is coincided with the period in which maximum suppressive activity against weeds was noticed under field condition, which explains the suppressive activity of phytotoxins on weeds.

The inhibitory action of sunflower residues appeared to be concentration dependent and thus determination of the amount of residue in to the soil need to be taken in to the consideration to avoid the negative effect upon crop.

Table 5: Effect of different rates of residues of two sunflower cultivars alone or in combination with half label dose of trifluralin herbicide on yield components

Treatments	Yield components		
	Number of pods/plant	Number of seeds/pod	100- seed weight (g)
Control (weedy check)	14.3	6.2	5.68
Trifluralin (label dose)	20.5	6.5	6.15
Weed free	24.4	6.7	6.18
	Shumoose cultivar		
Residues at 3.2 t ha^{-1}	19.1	6.8	5.52
Residues at 6.4 t ha^{-1}	24.5	7.0	5.16
Residues at 3.2 t ha^{-1} + 50% rate of trifluralin	27.3	7.1	5.59
Residues at 6.4 t ha^{-1} + 50% rate of trifluralin	29.2	7.3	5.53
	Sin Altheeb cultivar		
Residues at 3.2 t ha^{-1}	20.7	6.9	5.91
Residues at 6.4 t ha^{-1}	23.3	7.1	6.14
Residues at 3.2 t ha^{-1} + 50% rate of trifluralin	26.7	7.1	5.72
Residues at 6.4 t ha^{-1} + 50% rate of trifluralin	33.6	7.5	6.06
LSD ≤ 0.05	5.5	0.9	0.65

Isolation and quantification of phytotoxins in residues of sunflower cultivars

Chromatographic analysis revealed the presence of chlorogenic, caffeic, gallic, protocatechuic, syrinigic, coumaric, ferulic, vanillic and sinapic acids as product of sunflower residues decomposition (Table 6). Catechol and terpinol were also observed. A significant amount of these phytotoxins was observed in residues and in incorporated soil. Moreover, total phenolic acids in the residues of Sin Altheeb are 1.4% greater than in the residues of Shumoose cultivar.

Allelochemicals dynamics in sunflower residue amended soil

Chromatographic analysis of sorghum amended soil revealed the presence of several phenolic compounds (Table 7) .Chlorogenic, caffeic, gallic, protocatechuic, syringic, p-coumaric, ferulic, vanillic and sinapic acids were identified in residue of Sin Altheeb cultivar. Beside these compounds, catechol and terpinol were also present. Clorogenic, gallic, syringic, p-coumaric and ferulic were released in appreciable amounts during the first 2-week of

decomposition period and reached their peaks at 4-week of decomposition period, then declined peak during subsequent decomposition periods until vanished at 8-week of decomposition period. Other compounds such as catechol started to release at the beginning and reached their peak at 2-week and 4-week of decomposition and declined sharply at 6-week the increase again at 8-week of decomposition. Sinapic acid exhibited inconsistent decomposition pattern with peak value (15.9) at 2-week of decomposition.

Dynamics of release, decomposition and degradation of allelochemicals into the soil was quite interesting as different compounds exhibited differential behavior for these processes. Overall quantity of allelochemicals started to increase after 2 weeks of decomposition and peaked at 4-week of decomposition (180.1 ppm) then declined sharply in their quantities thereafter.

The differential allelopathic potential between the tested cultivars against weed suggest was further confirmed by quantitative analysis of phytotoxins in the residues of the test sunflower species. Sin Altheeb cultivar showed higher phenolics content in the residues compared with Shumoose. Variation in the allelopathic potential of cultivars of different allelopathic species including sunflower has been reported by several workers (3,34).

Table 6: Isolation and quantification of phenolic acids from residues of shumoose and Sin Altheeb sunflower cultivars

Compounds	Concentration µg/ml	
	Shumoose	Sin Altheeb
chlorogenic acid	62.4	69.3
caffeic acid	22.5	18.7
gallic acid	17.4	30.7
protocatechuic acid	22.5	23.2
syringic acid	28.4	27.5
coumaric acid	16.5	8.9
ferulic acid	16.6	16.2
vanillic acid	18.6	23.2
Catechol	16.0	29.0
sinapic acid	14.4	33.7
Terpinol	15.6	75.3
Total	250.9	355.5

Table 7: Isolation and quantification of phenolic acids in soil amended with sunflower residue of Sin Altheeb cultivar at different periods of decomposition

Compounds	Concentration (µg/ml)				
	Weeks				
	0	2	4	6	8
chlorogenic acid	9.5	14.3	21.5	4.8	0.0
caffeic acid	7.7	11.4	10.6	0.0	3.0
gallic acid	1.9	18.2	37.3	0.0	5.6
protocatechuic acid	0.0	9.8	0.0	4.5	0.0
syringic acid	0.0	17.7	27.0	12.7	0.0
coumaric acid	1.8	12.7	19.8	3.9	0.0
ferulic acid	4.0	12.9	17.4	7.7	3.6
vanillic acid	11.3	15.5	14.7	3.6	3.6
Catechol	7.8	15.8	17.9	2.2	15.3
sinapic acid	5.7	15.9	2.0	6.4	12.7
Terpinol	8.9	21.3	12.0	8.1	0.0
Total	58.7	165.5	180.1	53.9	43.8

REFERENCES

1- Ali, M. (1992). Weeds are a great threat to kharif pulses. *Indian Farming* 42: 27–30 (Field crop Absts; 46: 3616).

2- Alsaadawi, I. S.; A. Khaliq; N. R. Lahmod and A. Matloob (2013). Weed management in broad bean (*Vicia faba* L.) through allelopathic *Sorghum bicolor* (L.) Moench residues and reduced rate of a pre-plant herbicide. *Allelopathy Journal* 32(2): 203-212.

3- Alsaadawi, I. S.; A. Khaliq; A. A. Al-Temimi and A. Matloob (2011). Integration of sunflower (*Helianthus annuus* L.) residues with a pre-plant herbicide enhances weed suppression in broad bean (*Vicia faba* L.) fields. *Planta Danninah,* 29: 849-859.

4- Ampong-Nyarko, K. and S. K. De Datta (1991). A handbook for weed control in rice. Institute Rice Research Industry, Manila, Philippines ,384.

5- Azania, A. A. P. M.; C. A. M. Azania; P. L. C. A. Alives; R. Palaniraj; H. S. Kadian; S. C. Sati; L. S. Rawat; D. S. Dahiya and S. S. Narwal (2003). Allelopathic plants. 7. Sunflower (*Helianthus annuus* L.). Allelopathy J., 11:21–34.

6-Batish, D.; P. Tung; H. Singh and R. Kohli (2002).Phytotoxicity of sunflower residues against some summer season crops. J. of Agro. and Crop. Sci., 188:19-24.

7- Bhadoria, P. B. S. (2011). Allelopathy, a natural way towards weed management. American J. of Experimental Agric., 1:7-20.

8- Bhowmik, P. C.; Inderjit (2003).Challenges and opportunities in implementing allelopathy for natural weed management. Crop Protection, 22: 661–671.

9- Cheema, Z. A.; A. Khaliq and R. Hussain, (2003). Reducing herbicide rate in combination with allelopathic sorgaab for weed control in cotton. International J. of Agric. and Biology, 5:4–6.

10- Cheema, Z. A.; A. H. Khichi and A. Khaliq (2005). Feasibility of reducing herbicide dose in combination with sorgaab for weed control in transplanted fine rice (*Oryza sativa* L). International Journal of Agriculture and Biology, 7: 892–894.

11- Farooq, M.; K. Jabran; Z. A. Cheema; A. Wahid and K. H. M. Siddique (2011).The role of allelopathy in agricultural pest management. Pest Management Sci., 67:493–506.

12- Farooq, M.; K. Jabran; H. Rehman and M. Hussain (2008). Allelopathic effects of rice on seedling development in wheat, oat, barley and berseem. Allelopathy J., 22 (2):385–390.

13- Hartley, R. D. and H. Buchan (1979). High performance liquid chromatography of phenolic acid and aldyhide berived from plant or from the decomposition organic matter in soil. J. of chromatography, 180:139-143.

14- Holappa, L. D. and U. Blum (1991). Effects of exogenously applied ferulic acid, a potential allelopathic compound, on leaf growth, water utilization, and endogenous abscisic acid levels of tomato, cucumber, and bean. J. of Chemical Ecology 17: 865-886.

15- Iqbal, J.; Z. A. Cheema and M. N. Mushtaq (2009). Allelopathic crop water extracts reduce the herbicide dose for weed control in cotton (*Gossypium hirsutum*). *International Journal of Agriculture and Biology,* 11:360–366.

16- Jabran, K.; Z. A. Cheema; M. Farooq and M. Hussain (2010). Lower doses of pendimethalin mixed with allelopathic crop water extracts for weed management in canola (*Brassica napus* L.). International J. of Agric. and Biology, 12:335–340.

17- Keck, R. W. and T. K. Hodges (1973). Membrane permeability in plants: changes induced by hostspecific pathotoxins. Phytopathology ,63:226–230.

18- Khaliq, A.; A. Matloob and Y. Riaz (2012b). Bio-economic and qualitative impact of reduced herbicide usage in direct seeded fine rice through multipurpose tree water extracts. Chilean Jo. of Agric. Res., 72: 350-357.

19- Khaliq, A.; A. Matloob; M. A. Farooq; M. N. Mushtaq and M. B. Khan (2011). Effect of crop residues applied isolated or in combination on the germination and seedling growth of horse purslane (*Trianthema portulacastrum* L.). Planta Daninha , 29: 121-128

20- Khaliq, A.; A. Matloob; A. Tanweer and M. B. Khan (2012a). Naturally occurring phytotoxins in allelopathic plants helps reduce herbicide dose in wheat. Natural Products Res., 26:1156-1160.

21- Khanh, T. D.; M. I. Chung; T. D. Xuan and S. Twta (2005). The exploitation of crop allelopathy in sustainable agricultural production. J. of Agronomy and Crop Sci., 191:172-184.

22- Lahmod, N. R. (2012). Allelopathic effects of Sorghum *Sorghum bicolor* (L) Moench on companion weeds and subsequent crop. Ph. D. Dissertation: College of Agric., Baghdad University.

23- Matloob, A.; A. Khaliq; M. Farooq and Z. A. Cheema (2010). Quantification of allelopathic potential of different crop residues for the purple nutsedge suppression. Pakistan J. of Weed Sci. Res.,16:1-12.

24- Olmsted, C. E. and E. L. Rice (1970). Relative effects of known plant inhibitors on species from first two stages of old field succession. *Southwestern Naturalist* 15:165–173.

25- Poehlman, J. M. (1991). The Mungbean Culture, pp: 121-2. West view press, San Francisco, Oxford.

26- Rice, E. L. (1984). Allelopathy, Second Edition edition. Academic Press, Inc., Orlando.

27- Roberts, H. A. and W. Bond (2006). Combined treatments of propachlor and trifluralin for weed control in cabbage. Weed Res.,15:195-198.

28- Ross, M. A. and C. A. Lembi (2009). Applied Weed Science. 3rd edition. Prentice-Hall, ISBN 0137540035, Upper Saddle River, NJ, USA.

29-Sa´nchez-Moreiras, A. M., Weiss, O. and M. J. Reigosa-Roger (2004). Allelopathic dence in the Poaceae. Botanical Review 69:300–319.

30- Santos, B. M. (2009). Drip-applied metam potassium and herbicides as methyl bromide alternatives for Cyperus control in tomato. Crop Protection 28:68–71.

31- Singh, H. P.; D. R. Batish and R. K. Kohli (2003). Allelopathic interactions and allelochemicals: new possibilities for sustainable weed management. Critical Reviews of Plant Sciences, 22: 239-311.

32- Steel, R. G. D.; J. H. Torrie and D. Dickey (1997). Principles and Procedures of Statistics: A Biometrical Approach (3rd ed.). McGraw Hill Book Co. Inc., *New York*, USA. ,172-177.

33- Weir, T. L.; S. W. Park and J. M. Vivanco (2004). Biochemical and physiological mechanisms mediated by allelochemicals. *Current Opinion in Plant Biology*, 7:472-479.

34- Weston, L.; I. S. Alsaadawi and S. C. Baerson (2013). Sorghum allelopathy from ecosystem to molecule. J. of Chemical Ecology, 39:142–153.

استخدام الجهد الاليلوباثي لمخلفات صنفين من زهرة الشمس مع جرعة منخفضة من مبيد الادغال التريفليرالين للسيطرة على ادغال الماش

اروى عبد الكريم توفيق ابراهيم شعبان السعداوي

الملخص

اجريت دراسة حقلية للتعرف على مدى استجابة الادغال ومحصول الماش في الترب المعاملة بمخلفات زهرة الشمس مع جرعة منخفضة من المبيد المستعمل قبل الزراعة بهدف تقليل الاعتماد على المبيدات الكيميائية. استخدمت مخلفات صنفين من زهرة الشمس شموس وسن الذيب بالتركيزين 3,2 و6,4 طن هـ$^{-1}$ بصورة منفردة او مع إضافة 50% من الجرعة الموصى بها من مبيد التريفليرالين (1.2 لتر هـ$^{-1}$).استخدم المبيد بالتوصية كاملة (2,4 لتر هـ$^{-1}$) ومعاملة السيطرة (المدغلة) والمعاملة الخالية من الادغال للمقارنة. بينت النتائج ان استعمال مخلفات سن الذيب مع 50% من المبيد اعطت اعلى نسبة اختزال في عدد الادغال ووزنها الجاف مقارنة باستعمال مخلفات سن الذيب لوحدها ومن استخدام مخلفات الصنف شموس لوحده او مع الجرعة المنخفضة من المبيد، وقد انعكس الاختزال الحاصل في كثافة الادغال ونموها بشكل ايجابي على حاصل الماش ومكوناته، إذ سجلت معاملة مخلفات سن الذيب مع الجرعة المنخفضة (50%) من المبيد حاصلاً اعلى بنسبة 64% من معاملة المبيد بكامل التوصية. وقد اظهرت نتائج التحليل الكروماتوكرافي لمخلفات الصنفين وفي التربة الحاوية على مخلفاتهما وجود عدد من المركبات المعروفة بقدرتها الاليلوباثية مع تفوق واضح في كميتها في مخلفات الصنف سن الذيب على مخلفات الصنف شموس، وقد تبين ان اقصى تركيزاً لهذه المركبات كان متزامنا مع افضل تثبيطاً للأدغال النامية في الحقل مما يفسر دور هذه المركبات في القضاء على الادغال. وقد تمت مناقشة الدور الايجابي لهذه الطريقة في ادارة الاغال وتحسين الانتاج وتحسين خصائص التربة الفيزيائية والكيميائية بصورة موجزة.

كلية العلوم– جامعة بغداد– بغداد، العراق.