THE ADVERSE EFFECT OF CERTAIN PESTICIDE ON GST ACTIVITY AND GROWTH OF WHEAT PLANT IN PRESENCE OF SOME NATURAL ADDITIVE MATERIALS

SALAMA, DAWLAT A. [1], B. M. A. ABDEL WAHAB[1], A. S. MARZOUK[2] and MARWA M. M. Ali[2]

1. Biochemistry Dept., Faculty of Agriculture, Ain Shams Univ., Cairo, Egypt
2. Central Agricultural Pesticide Lab., ARC, Dokki, Giza

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Abstract

A greenhouse experiment was carried out 2006/2007 and 2007/2008 growing seasons to study the effect of some natural additive materials, sugarcane bagasse, rice straw and gypsum on tribenuron methyl herbicide and cadusafos nematicide side effects on Glutathione S-transferase activity (GST) activity of wheat plant and growth.

The results showed that rice straw significantly increased GST during the 1st and 2nd growing seasons compared with the untreated plant. Also, sugarcane bagasse and rice straw showed its peak at the rate of 160 kg/fed., at the 1st season (109.86 and 146.32 IU/mg protein) and 2nd season (158.13 and 305.67 IU/mg protein) growing season, respectively. In the contrary, gypsum treatment effect was decreased gradually with increasing dose, reaching its peak at the rate 40 kg/fed.

Results of fresh weight showed that all additive materials treatments affected the fresh and dry weight of wheat plant during the two growing seasons significantly.

From the above mentioned results it could be concluded that rice straw reduce the side effects of TBM and cadusafos pesticides and significantly increased GST activity and showed the highest increasing effect on fresh weight and dry weight.

Key words: Adverse effect, Wheat plant, Pesticide, GST, Sugarcane bagasse, Rice straw, Gypsum.

INTRODUCTION

Approximately 90% of agricultural pesticide application never reaches its target organisms but is, instead, dispersed through the air, soil and water (Moses *et. al.,* 1993). In addition, many soil-applied pesticides (herbicide and nematicide) are also intentionally introduced into the soil environment for the control of weeds, soil borne pests and pathogens, which results in the accumulation of their residues and metabolites in soil at unacceptably high levels (Redondo *et. al.*, 1997, Gamo´n *et. al.*, 2003).

Concern pesticide adverse effect, chlorinated hydrocarbon pesticides are bio-accumulative and relatively stable (can persist for long periods in the eco-system). In this respect, many workers tried different removal, degradation, bioremediation and physicochemical methods for organic contaminants elimination from soil. Many reports are mentioned to many adsorbent materials which are used to remove different pollutants. For example, pure-form ashes of wheat and rice residues and fly ash were highly effective adsorbents of the herbicides diuron (Yang and Sheng, 2003), and metribuzin (Majumdar and Singh, 2007), respectively. Also, sugarcane bagasse fly ash was affective materials to remove 1,1- dichloro-2,2-dichlorophenyl ethane (DDD) and 1,1-dichloro-2,2-dichlorophenyl ethylene (DDE) from wastewater (Gupta and Ali, 2001), and can accelerate lindane degradation by microbial activity, (Abhilash and Nandita, 2008). In addition, gypsum can be cost-effective way to improve soil pH or structure. Calcium in gypsum improves soil structure by replacing sodium on the exchange surfaces of clay (Pluske, 2005), and can reduce soil pH which allow a more rapid dissipation of pesticides (Williams, 1998).

On the other hand, many reports illustrated that some natural additive materials showed some adverse effect on the treated plants. For example, Chutichudet *et al*, 2009, reported that lettuce plants treated with gypsum with 50 mg/kg^{-1} soil had the maximal fresh weight and had the maximal chlorophyll content at 40 days from application. Also, plants treated with 100 mg/kg soil reduced polyphenol oxidase activity at 3 weeks after application (Chutichudet *et al*, 2009).

Therefore the present work was conducted to determine the side effect of some the additive materials on GST and plant growth activities.

MATERIALS AND METHODS

A greenhouse experiment was carried out 2006/2007 and 2007/2008 growing seasons. The experiment was conducted in the greenhouse to evaluate the side effects of some soil additive materials, sugarcane bagasse, rice straw and gypsum applied in combination with tribenuron methyl herbicide and cadusafos nematicide on GST activity and dry / fresh weights of the grown plants.

The two soil types, sandy clay and sandy soil collected from Nahya, Giza governorate. Collected soil were air dried, grounded, and passed through a 2 mm sieve to remove rocks, plant residues, and other large particles. Classification and some chemical, physical properties and organic matter content (O.M.) of the collected soils are presented in Tables 1 and 2.

1. Additive materials

1. The sugarcane bagasse, (the fiber of the stalk of the plant) was collected from El-Hawamdia local sugar factory, Giza governorate. The material was treated with hydrogen peroxide for 24 h to remove the adhering matter. The resulting material was then washed with deionized water, dried at 70 °C, ground and sieved to unify the size before use.
2. Rice straw was collected at harvest stage from rice field, dried at 70 °C, ground and sieved to unify the size before use.
3. Gypsum 80% SO_4 as (Ca_2SO_4. $2H_2O$) was obtained from El-Mohsen factory.

2. Pots preparation

Five kg from the air dried soil was sub-divided and placed in polyethylene bags (pots) and then the additive materials were added as follows:

The additive materials sugarcane bagasse and rice straw were applied individually on pots at the rate of 2, 3 and 4 g/ pots (Equal 150, 225 and 300 kg/fed.) respectively, and mixed thoroughly with the top soil. Gypsum was added at the rate of 0.5, 1.0 and 2.0 g/pot (Equal 40, 80 and 160 kg/fed.) respectively.

Each treatment and rate was replicated 6 times, as well as the un-treated check pots. The treated pots were divided into 2 groups (each group contained 3 replicate / treatment). First group represent blank treatment and second was kept for pesticide treatment.

3. Pesticide treatment

A weight of 0.1 mg of tribenuron-methyl (TBM) 75% DF and 265 mg of cadusafos 10% G formulated product were dissolved in 20 ml water and added individually to the soil surface in the polyethylene pots being the field application rate of 8 g/ fed., and 5 g/m^2, respectively.

4. Planting

Wheat plant, *Triticum aestivum* L. (Sakha 93) was seeded in winter season and thinned to 10 plants per pot after 21 day from seedling. Irrigation was practiced to keep soil almost at their field capacity for a period of growth season.

During the experiment, fertilizers (urea 46 %, and superphosphate 16 %) were added to the pots at the rate of 0.6 and 0.35 g/ pot. The amount of superphosphate fertilizer was added before planting, while urea quantity was spilt into two equal doses. The first dose was applied after 15 day while the second dose was added after 30 day.

5. Sampling

Wheat plants were collected at the vegetative stage after 3 day from application (DFA) for GST assay. Samples were transferred directly to the laboratory for GST assay. After 30 days from planting, fresh/dry weight were recorded.

6. Assay of glutathione S-transferase

6. 1. Extraction

One gram of wheat seedling was extracted after 3 days form application with 0.2 M phosphate buffer pH 6.8 using mortar for homogenizing. The extraction ratio was 4 ml buffer per each one gram of plant materials. Homogenate was centrifuged at 2500 rpm for 15 min, and supernatant was used for measuring the activities of enzymes and soluble protein.

6. 2. Determination activity

Glutathione S-transferase, GST (E.C. 2.5.1.18) activity was assayed following the procedure described by Habig *et. al.*, (1974) using CDNB (1-chloro-2,4-dinitrobenzene) as substrate. The reaction mixture contained 0.8 ml of 0.1M Na-Phosphate buffer pH 6.5, 50 µl of 20 mM reduced glutathione, that was prepared by dissolved 0.0123 g in 10 ml phosphate buffer, and 50 µl of 20 mM CDNB, which was prepared by dissolving 0.0051 g in 1 ml ethanol 96%, then 100 ml crude extract were added. The absorbance at 340 nm was monitored for 3 min at 25 °C. The blank was determined by using the same reaction mixture without the crude plant extract. The absorbance change at 340 nm was followed by using spectrophotometrically (Thermo Spectronic HeλIosα). The activity was calculated by measuring the absorbance changes at 340 nm per min. Unit of enzyme (IU) equal 0.01 ΔOD. min^{-1}. The specific activity expressed as (IU. mg^{-1} protein).

6. 3. Determination of soluble protein

The soluble protein in the enzyme crude extracts was measured according to Lowry *et al.,* (1951). The protein concentration was determined by using the standard curve of bovine serum albumin (BSA).

7. Fresh / dry weight

Fresh weight and dry mater content per one wheat plant was recorded.

8. Statistical analysis

Statistical analysis of all data was carried out using the "SAS" program.

RESULTS AND DISCUSSION

1. Glutathione S-transferase activity (GST) activity

Data presented in Table 1 showed no significant differences in GST activity in wheat plant treated with TBM after 3 DFA being 97.63 and 131.42 IU/mg protein, compared with the untreated plant (99.0 and 138.7 IU/mg protein) in the 1st and 2nd growing seasons respectively. Cadusafos reduced GST activity significantly recording 76.56 and 101.47 IU $.mg^{-1}$ protein during the 1st and 2nd growing seasons respectively.

Data presented in Table 1, illustrated that GST activity of wheat plant was significantly induced with sugarcane bagasse being 118.77 and 191.47 IU/mg protein, at the 1st and 2nd seasons respectively. When sugarcane bagasse was added to TBM it showed significant reduction in GST activity compared with the untreated control being 88.47 and 110.91 and 118.77 and 191.47 IU/mg protein at the 1st and 2nd seasons, respectively. Cadusafos in combination with sugarcane bagasse showed no significant differences in GST activity comparing with the plants treated with the nematicide alone in the 1st season being, 74.72 and 76.56 and 91.99 or 101.47 IU/mg protein in the second season respectively.

Data presented in Table 1, showed that rice straw alone or in combination with TBM or cadusafos induced GST activity significantly compared with the untreated plant (120.08 and 254.38 IU/mg protein), (123.34 and 187.99 IU/mg protein) and (107.24 and 124.59 IU/mg protein) at the 1st and 2nd seasons, respectively.

Moreover, gypsum treatment or gypsum in combination with TBM or cadusafos treatment showed no significant differences in wheat GST activity during the 1st and 2nd seasons recording 101.55 and 144.82 IU/mg protein, (94.87 and 117.49 IU/mg protein, and 79.42 and 107.80 IU/mg protein, respectively.

From the results (Table 1) it could be concluded that sugarcane bagasse and gypsum additive materials showed no significant effect on GST activity of the treated plant, being 93.99 and 131.46 IU/mg protein and 91.95 and 123.37 IU/mg protein comparing to the untreated plant (91.06 and 123.86 IU/mg protein). Rice straw significantly increased GST activity during the 1st and 2nd growing season reaching 116.89 and 188.99 IU/mg protein, respectively, compared with the untreated plant. Also, sugarcane bagasse and rice straw reached its peak at 3.0 g/pot at the 1st season (109.86 and 146.32 IU/mg protein) and 158.13 and 305.67 IU/mg protein in the 2nd growing season, respectively. On the contrary, Gypsum treatment effect on the enzyme activity decreased gradually with increasing dose rate, reaching its peak at

0.5g/pot being, 106.03 and 145.18 IU/mg protein during the 1st and 2nd growing seasons respectively.

From the foregoing results it could be concluded that the increase in GST activity in plant treated with TBM proved higher than cadusafos, that was in agreement with (Oztetik, 2010) who illustrated that the induction of selected wheat and barley plants with tribenuron methyl may intensify the metabolic detoxification of this herbicide through stimulation of the direct synthesis of both GST and GSH. In addition, *Triticum aestivum* L.cv treated with a triazinyl sulfonylurea herbicide, tribenuron-methyl was found to be the most induced by comparing to other varieties.

Even the reason of that mechanism is still not very well known but it is possible to suggest that the reason could be either by a direct activation of existent GST isoenzyme (s) or possibly by the induction of newly produced isoenzyme (s), due to herbicide treatment, at the protein level, (Oztetik, 2010).

Also, it could attributed that GST activity was found to be increased by most herbicide (Marrs, 1996). A similar result was obtained by (Ivanov, *et. al.*, 2003) who found that the sub-herbicide concentration of 2,4 D raised the enzyme activities and the effect was better expressed in relation to catalase and GST.

Table (1): Effect of different additive materials on Glutathione S-transferase activity of wheat plant (*Triticum aestivum L.*).

Additive materials	Additive dose. (g/pot)	2007 season Specific Activity (IU/mg protein)			Mean	2008 season Specific Activity (IU/mg protein)			Mean
		TBM	Cadusafos	untreated pesticide		TBM	Cadusafos	untreated pesticide	
Untreated Additives	---	97.63	76.56	99.00	91.06	131.42	101.47	138.70	123.86
Sugarcan Bagasse	2.0	81.46	77.82	92.38	83.89	122.49	83.67	161.53	122.56
	3.0	93.59	81.15	154.85	109.86	138.47	113.82	222.10	158.13
	4.0	90.37	65.19	109.07	88.21	71.78	78.49	190.78	113.68
Mean		88.47	74.72	118.77	93.99	110.91	91.99	191.47	131.46
Rice Straw	2.0	107.45	85.86	118.70	104.00	97.24	87.84	222.74	135.94
	3.0	150.80	140.60	147.55	146.32	321.59	207.02	388.39	305.67
	4.0	111.78	95.25	94.00	100.34	145.15	78.92	152.01	125.36
Mean		123.34	107.24	120.08	116.89	187.99	124.59	254.38	188.99
Gypsum	0.5	98.94	84.08	135.06	106.03	144.14	135.22	156.17	145.18
	1.0	95.80	80.13	113.00	96.31	117.34	109.70	148.22	125.09
	2.0	89.88	74.04	56.58	73.50	91.00	78.47	130.08	99.85
Mean		94.87	79.42	101.55	91.95	117.49	107.80	144.82	123.37
Materials Treatment & dose. LSD		3.48	3.48	3.48		20.95	20.95	20.95	
Pesticide Treatment LSD			2.69				16.23		
Materials*pesticide*conc. LSD			8.513				51.31		

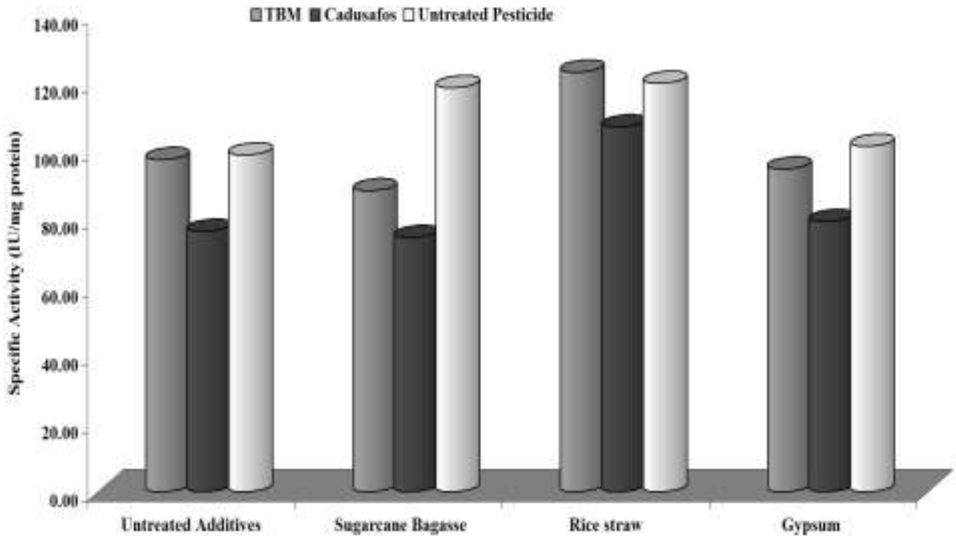

Fig. (1): Effect of different additive materials on Glutathione S-transferase activity of wheat plant (*Triticum aestivum* L.) during 2007 season.

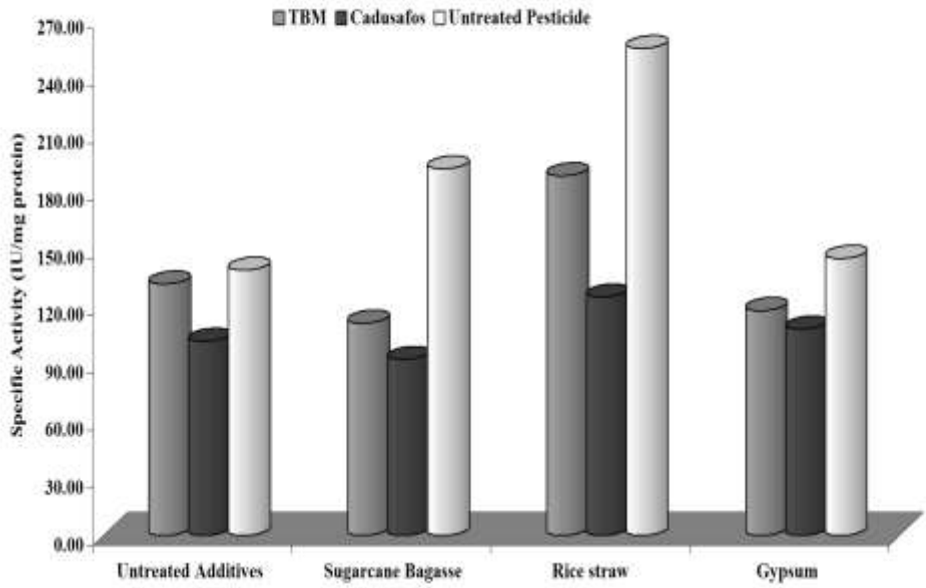

Fig. (2): Effect of different additive materials on Glutathione S-transferase activity of wheat plant (*Triticum aestivum* L.) during 2008 season.

2. Fresh weight

The effect of different treatments on fresh weight is presented in Table 2 and Fig$_s$ 3 & 4.The results showed that almost treatments significantly influenced wheat fresh weight according to the applied pesticide, additive material and dose during the two growing seasons.

Table 2 showed that, sugarcane bagasse treatment increased fresh weight significantly at the 1st and 2nd seasons, being 6.25 and 5.58 g/plant comparing with the untreated plant (4.35 and 3.35g/plant), respectively. In addition, sugarcane bagasse in combination with TBM or cadusafos decreased fresh weight significantly after 21 DFA reaching 5.02, and 4.9 g/plant at the 1st season, and 2.92 and 3.6 g/plant at the 2nd season, respectively, compared with TBM and cadusafos treatment.

After 21 DFA, rice straw alone or in combination with TBM or cadusafos, increased fresh weight significantly comparing with the untreated, reaching, 6.12, 5.68 and 5.57 g/plant at the 1st season and 6.30, 4.6 and 4.28 g/plant at the second season, respectively.

When wheat was treated with gypsum, the results in Table 2, showed that fresh weight increased in the 1st and 2nd seasons when applied alone or in combination with TBM, or cadusafos. No significant effects were observed between the untreated plant, or TBM, cadusafos / gypsum reaching 5.84, 5.60 and 4.65 g/plant, while significant increase was observed in the 2nd season recording 3.8, 4.1 and 3.8 g/plant, respectively.

It is concluded that all additive material treatments increased the fresh weight during the two growing seasons significantly. Rice straw was the most effective treatment showing the highest increasing effect at 4.0 g/pot (7.0 and 5.52 g/plant) followed by sugarcane bagasse at 3.0 g/pot (6.25 and 4.78 g/plant) and gypsum was the lowest showing the highest effect when applied at rate of 0.5 g/pot (5.97 and 4.53 g/plant) at the first and second season, respectively.

Table (2): Effect of tribenuron-methyl, cadusafos and different additive materials on wheat plant (*Triticum aestivum* L.) fresh weight (mg/plant).

Additive materials	Additive dose. (g/pot)	2007 season weight (g/plant)			Mean	2008 season weight (g/plant)			Mean
		TBM	Cadusafos	Untreated Pesticide		TBM	Cadusafos	Untreated Pesticide	
Untreated Additives	---	5.60	5.25	4.35	5.07	3.40	3.70	3.35	3.48
Sugarcane Bagasse	**2.0**	4.65	4.90	5.00	4.85	3.25	4.80	4.05	4.03
	3.0	5.80	5.05	7.90	6.25	2.75	3.95	7.65	4.78
	4.0	4.60	4.75	5.85	5.07	2.75	2.05	5.05	3.28
Mean		5.02	4.90	6.25	5.39	2.92	3.60	5.58	4.03
Rice straw	**2.0**	4.65	4.90	5.40	4.98	5.25	3.85	3.75	4.28
	3.0	5.20	5.40	5.55	5.38	7.05	4.75	4.35	5.38
	4.0	8.50	6.75	5.75	7.00	6.60	5.20	4.75	5.52
Mean		6.12	5.68	5.57	5.79	6.30	4.60	4.28	5.06
Gypsum	**0.5**	6.35	6.40	5.15	5.97	4.75	4.80	4.05	4.53
	1.0	5.95	5.45	4.36	5.25	3.60	3.35	3.50	3.48
	2.0	5.23	4.95	4.45	4.88	3.05	4.15	3.85	3.68
Mean		5.84	5.60	4.65	5.37	3.80	4.10	3.80	3.90
Materials Treatment & dose. LSD		0.40	0.40	0.40		0.40	0.40	0.40	
pesticide Treatment LSD			0.31				0.31		
Materials*pesticide*conc. LSD			0.29				0.29		

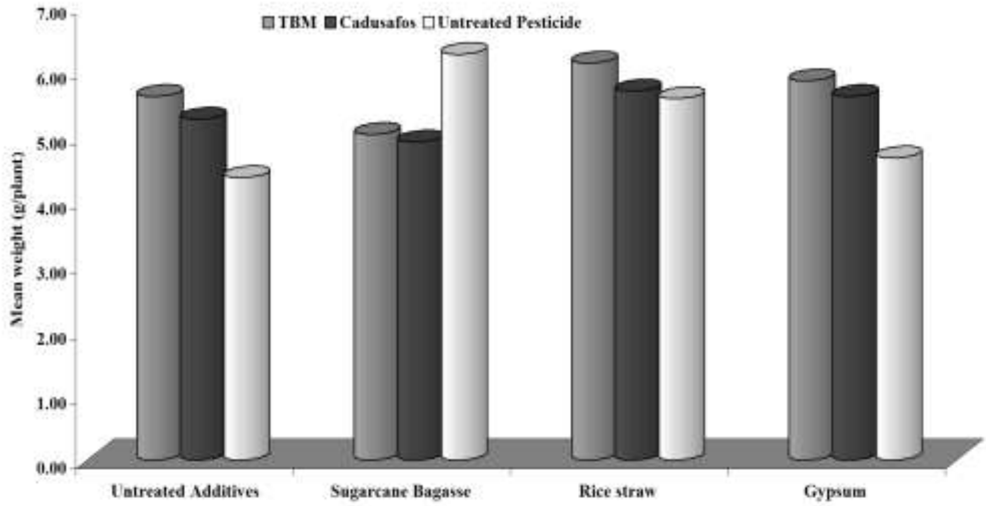

Fig. (3): Effect of different additive material in combination with TBM and cadusafos on wheat fresh weigh during 2007 growing season.

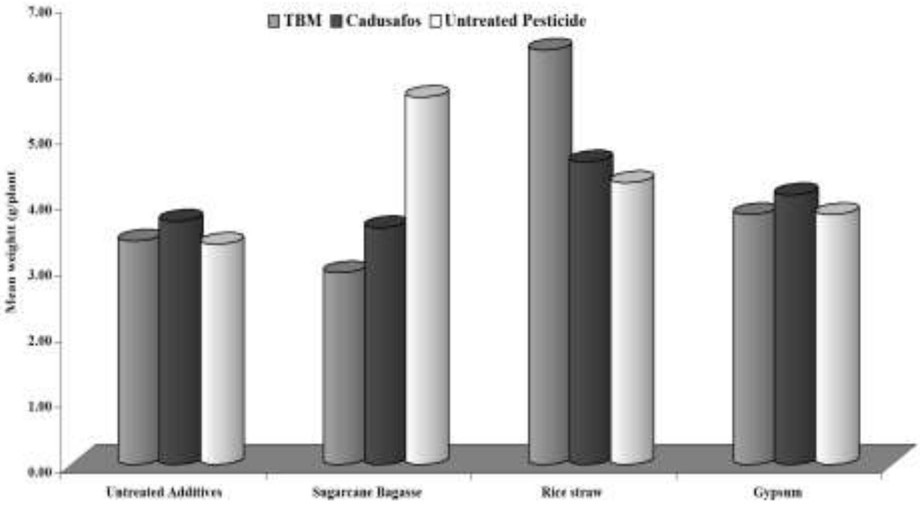

Fig. (4): Effect of different additive material in combination with TBM and cadusafos on wheat fresh weight during 2008 growing season.

3. Dry weight

Data presented in Tables 3 and Figs 5& 6 showed that TBM herbicide and cadusafos nematicide treatment increased wheat plant dry weight significantly more than the untreated plant, and TBM effect was significantly higher than cadusafos.

TBM and cadusafos treatment recorded 1.23 and 1.14 g/plant in the 1st season and 1.35 and 1.10 g/plant in the 2nd season, respectively.

Data presented in Table 3, illustrated that dry weight of wheat treated with sugarcane bagasse increased significantly compared to the untreated plant, being 1.65 and 1.77 g/plant at the 1st and 2nd season, respectively. Sugarcane bagasse when treated in combination with TBM or cadusafos decreased dry weight significantly compared with the untreated recording 0.97 and 0.82, and 1.24 and 0.75 g/plant at the 1st and 2nd season, respectively.

Data presented in Table 3, showed that rice straw alone or in combination with TBM increased dry weight significantly compared with the untreated plant reached 1.52 and 1.13g/plant, and 1.98 and 1.42 g/plant at the 1st and 2nd seasons, respectively. On the contrary, when rice straw was combined with cadusafos a significant reduction in wheat dry weight was observed recording 0.82 and 0.90 g/plant at the 1st and 2nd season, respectively, compared with cadusafos treatment.

Table (3), showed that gypsum had no significant effect on wheat dry weight in the 1st and 2nd seasons recording 0.95, 0.80 g/plant respectively. When gypsum was applied in combination with TBM, or cadusafos, the dry weigh decreased significantly, recording 1.13 and 1.03 g/plant, and 1.02 and 0.91 g/plant at the 1st and 2nd season, respectively.

Table (3): Effect of tribenuron-methyl, cadusafos and different additive materials on wheat plant(*Triticum aestivum* L.) dry weight (mg/plant).

Additive materials	Additive dose. (g/pot)	2007 season weight (g/plant) TBM	Cadusafos	Untreated Pesticide	Mean	2008 season weight (g/plant) TBM	Cadusafos	Untreated Pesticide	Mean
Untreated Additives	---	1.23	1.14	1.00	1.12	1.35	1.10	0.85	1.10
Sugarcane Bagasse	**2.0**	1.05	0.85	1.90	1.27	1.55	0.80	2.05	1.47
	3.0	0.95	0.80	1.60	1.12	1.18	0.75	1.75	1.23
	4.0	0.90	0.80	1.45	1.05	1.00	0.70	1.50	1.07
Mean		0.97	0.82	1.65	1.14	1.24	0.75	1.77	1.25
Rice straw	**2.0**	1.00	0.75	1.00	0.92	1.65	0.75	1.15	1.18
	3.0	1.40	0.75	1.10	1.08	2.00	0.60	1.15	1.25
	4.0	2.15	0.95	1.30	1.47	2.30	1.35	1.95	1.87
Mean		1.52	0.82	1.13	1.16	1.98	0.90	1.42	1.43
Gypsum	**0.5**	1.25	1.15	1.00	1.13	1.15	1.20	1.15	1.17
	1.0	1.15	1.05	1.00	1.07	0.95	0.87	0.70	0.84
	2.0	1.00	0.90	0.85	0.92	0.95	0.65	0.55	0.72
Mean		1.13	1.03	0.95	1.04	1.02	0.91	0.80	0.91
Materials Treatment & dose. LSD		0.08	0.08	0.08		0.08	0.08	0.08	
pesticide Treatment LSD			0.06				0.06		
Materials*pesticide*conc. LSD			0.29				0.29		

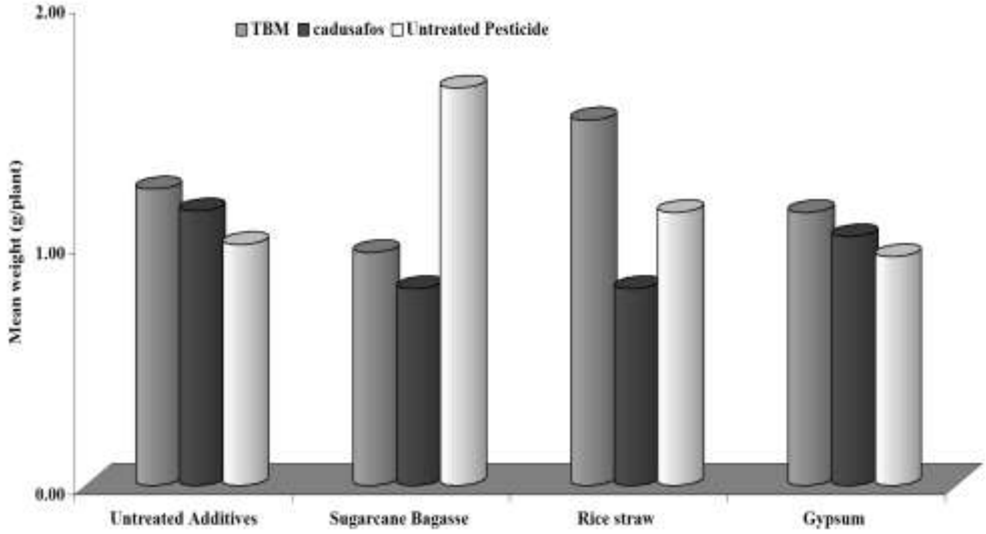

Fig. (5): Effect of different additive material in combination with TBM and cadusafos on wheat dry weight during 2007 growing season.

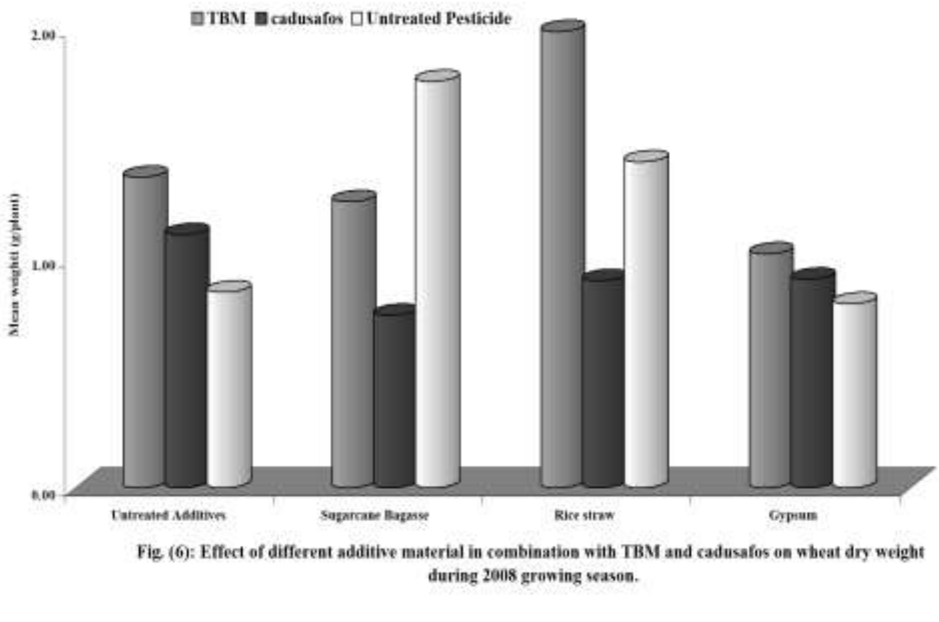

Fig. (6): Effect of different additive material in combination with TBM and cadusafos on wheat dry weight during 2008 growing season.

Finally, all additive material showed significant effect on treated plant dry weight during the two growing seasons. Rice straw showed the highest increasing effect reaching its peak at 4.0 g/pot (1.47 and 1.87 g/plant) followed by sugarcane bagasse at 2.0 g/pot (1.27 and 1.47 g/plant) and gypsum when applied at 2.0 g/pot (0.92 and 0.72 g/plant) at the first and second season, respectively.

Increasing of wheat fresh and dry weight after TBM treatment than the untreated could attributed to that TBM phenylurea herbicide might be active in the chloroplast, electron-transport system and disturb the photosynthesis of the treated plant, (Song *et. al.,* 2007). Also, the obtained data indicated that total dry weight/m^2 recorded at 60 days from wheat sowing significantly lower with Sids cultivars than with Sakha 69, where Sids 8 surpassed all cultivars in this respect. Moreover, decreasing of wheat dry weight than TBM treatment was in harmony with Abdul Rehman *et. al.*, 2006 who mentioned that Rugby10% G, gave maximum increase in sunflower plant height, maximum reduction in fresh and dry weight of root.

The results of dry and fresh weights of wheat were increased as a result of rice straw treatment as compared to sugarcane bagasse or the untreated which may be due to the higher levels of organic matter and nutrients in the rice straw, (Bader El-Din *et al.*, 2000).

Gypsum treatment resulted in an increase in wheat fresh weight than the untreated, that was in similar to foundation of (Chutichudet *et al.,* 2009) who showed that lettuce treated with gypsum showed the maximum fresh weight after 40 DFA. This implied that fertilization with gypsum improved only fresh weight (Grslerod, 1999). (Ritchey and snuffer, 2002) reported that gypsum is a readily available calcium amendment that is sufficiently soluble to move rapidly into the soil when surface-applied. (EPA, 2008) reported that gypsum has been recognized as a nutrient source of sulfur, which is essential for many crops.

From the above mentioned results it could be concluded that rice straw significantly increased GST activity and showed the highest increasing effect on fresh weight and dry weight.

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التأثير الجانبى لبعض المبيدات على نشاط إنزيم جلوتاثيون اس ترانسفيريز ونمو نبات القمح فى وجود بعض المواد الطبيعية المضافة

دولت علي سلامة[1] ، بدر محمد السعيد عبدالوهاب[1] ، علاء سعد مرزوق[2] ، مروة محمد محمود علي[2]

1. *قسم الكيمياء الحيوية – كلية الزراعة – جامعة عين شمس – القاهرة – مصر*
2. *قسم سمية المبيدات للنباتات– المعمل المركزي للمبيدات– مركز البحوث الزراعية – الدقي – الجيزة – مصر.*

تم إجراء تجربة الصوبة الزراعيه خلال موسمي 2007/2006، 2008/2007 لدراسة مدى قدرة بعض المواد الطبيعية المضافة (مصاصة قصب السكر، قش الأرز، الجبس الزراعي) علي خفض التأثير الضار لبعض المبيدات المعاملة (مبيد الحشائش تراى بنيورون ميثيل، والمبيد النيماتودى كاديوسافوس) على نشاط إنزيم الجلوتاثيون أس ترانسفيريز، ونمو نبات القمح.

أظهرت نتائج معاملة المواد المضافة (مصاصة قصب السكر والجبس الزراعي منفردة أو مضافة إلى تراي بينيورون ميثيل أو الكاديوسافوس) خلال موسمي النمو الأول والثاني تأثيرات غير معنوية علي نشاط انزيم الجلوتاثيون اس ترانسفيريز بالنبات المعامل ليصل إلى 93.99، 131.46 وحدة دولية/ ملجم بروتين و 91.95، 123.37 وحدة دولية/ ملجم بروتين مقارنة بالنبات الغير معامل (91.06، 123.8 وحدة دولية/ ملجم بروتين) بعكس المعاملة بقش الأرز الذي أدى إلى حدوث زياده معنويه في نشاط انزيم الجلوتاثيون اس ترانسفيريز خلال موسمي التجربة ليصل إلى 116.89، 188.99 وحدة دولية/ ملجم بروتين على التوالي مقارنة بالنباتات غير المعامله. أيضا ارتفع نشاط الانزيم ووصل اقصاه عند جرعة 150 كجم/ فدان للمعاملة بمصاصة قصب السكر وقش الأرز في موسم النمو الأول (109.86، 146.0 وحدة دولية/ ملجم بروتين) وأيضاً موسم النمو الثاني (158.13، 305.67 وحدة دولية/ ملجم بروتين) علي التوالي بالمقارنه بمعاملة الجبس الزراعي التي أظهرت انخفاض تدريجي لنشاط الانزيم مع زيادة معدل الاستخدام ليصل إلى أقصاه عند معدل 40 كجم/ فدان (106.3، 145.18 وحدة دولية/ ملجم بروتين) أثناء موسمي النمو علي التوالي.

أدت كل المواد المضافة إلى حدوث زيادة معنوية فى الوزن الرطب خلال موسمي النمو وكان قش الأرز الأكثر تأثيرا عند معدل 300 كجم/ فدان (7.0، 5.52 جم/ نبات) يليه مصاصة قصب السكر بمعدل 225 كجم/ فدان (6.25، 4.78 جم/ نبات) ثم الجبس الذى أظهر أفضل تأثير عند معدل 40 كجم/ فدان (6.25، 4.78 جم/ نبات) خلال موسمي النمو على التوالي.

أظهرت جميع المواد المضافة تأثيرات معنوية على الوزن الجاف للنبات المعامل خلال موسمي النمو وكان قش الأرز الاكثر قدرة على زيادة الوزن الجاف محققاً أعلى تأثير عند معدل 300 كجم/ فدان (1.47، 1.87 جم / النبات) يليه مصاصة قصب السكر عند معدل 225 كجم/ فدان (1.27، 1.47 جم / نبات) وأخيراً الجبس الزراعي عند معدل 40 كجم/ فدان (0.92، 0.72 جم / نبات) خلال موسمي النمو على التوالي.

ومن النتئج السابقة يمكن استخلاص أن المعاملة بقش الأرز أدت إلى خفض التأثير السام لمبيدات الترايبنيورون ميثيل والكاديوسافوس وأدت إلى زيادة نشاط إنزيم جلوتاثيون أس ترانسفيريز معنوياً وأظهرت أعلى زيادة فى الوزن الرطب والوزن الجاف لنبات القمح.