Trends in

Applied Sciences Research

ISSN 1819-3579

Academic Journals Inc.

www.academicjournals.com

Trends in Applied Sciences Research 3 (2): 142-153, 2008
ISSN 1819-3579

Chemical Fertilizers Could Offer a Real Solution for Minimizing over Consumption of Herbicides for Controlling Weeds in Faba Bean (*Vicia faba* L.)

Tarek A. El-Shahawy
Department of Botany, National Research Center, Dokki, Cairo, Egypt

Abstract: This experiment was designed to study the suspected effect of the different fertilizers on enhancing the herbicidal efficacy of certain herbicides for controlling weeds in faba bean. Two greenhouse trials were conducted in this regard. Two herbicides (bentazon and fluazifop-P-butyl) and three fertilizers (urea, diammonium phosphate and super phosphate) were my tools of the study. The two herbicides were applied subsequently in combination with the different fertilizers at different rates of concentration (0.288, 0.403 and 0.576 kg a.i. ha^{-1} bentazon; 0.151, 0.300 and 0.451 kg fluazifop-P-butyl). The fertilizers were in 0.75 and 1% of the total solution at the basis of NP active composition. Applying the two herbicides alone at the recommended doses was good enough for controlling both types of weeds, broad and narrow leaved ones. However, using both of them in combination with the different fertilizers (i.e., urea and diammonium phosphate) was much more effective. The 1% addition was almost the best. Applying bentazon and fluazifop-P-butyl in combination with urea gave, to a large extent, similar results to those applying under diammonium phosphate addition, either for controlling weeds or increasing yield productivity. Super phosphate-fertilized herbicides were the lowest in comparison; virtually not recommended as in opinion of mine. The crop growth was positively affected in response, recording the best results with applying the two herbicides in combination with urea and diammonium phosphate too. The seed content of NPK elements was also significantly increased. In conclusion, using herbicides in aid of fertilizers is highly recommended and 1% addition is to be the best. To be used precisely at the moderate concentration and in combination with urea or diammonium phosphate is the best chosen overall not only for controlling weeds and increasing yield productivity, but also for preserving our health and environments from overdoses of herbicides consumption.

Key words: Faba bean, fertilizers, herbicides, synergistic effect, weed control

INTRODUCTION

Using pesticides has become an obligatory matter for saving our life from famine and diseases. However, the associated hazards either on health or environments have raised many questions about our reliance on such chemicals. The sounds calling stop dealing with using pesticides doesn't offer the real solution of the problem, but the work on re-managing the strategies and techniques of using pesticides and increasing farmer's awareness towards the misusing of such agrochemicals is the way that should be dealing with the problem.

Herbicides are the leading group of synthetic pesticides. About 45% of world consumption of pesticides is from herbicides. The expected problems are then to be the worst comparing to the others in terms of the huge quantities been used. Working on reducing over consumption of synthetic herbicides has taken several ways of attempts. Using adjuvant and others of synthetic or natural amendments were the most popular practices and still to be a matter of great concern. Today, minds are going beyond chemistry and chemical utilization. Searching for new alternative sources of the chemical herbicides is the real challenge during this epoch of time. Natural products and their potential uses as natural herbicides are the one that have received considerable attention in this regard (Duke, 1992; Duke *et al*., 2002). Numerous compounds with phytotoxic action have already been discovered, but those with great ability to be developed for commercial utilization were very limited (Lydon and Duke, 1989; Duke, 1991). Camphene and 1,8 cineole are two of such ambitious examples that successfully exploited to generate two of the most popular natural herbicides already sold under the trade names toxaphene and cinmethylin (Sherman *et al*., 1983; Grayson *et al*., 1987).

It is a common knowledge that to say fertilizers are acting on increasing herbicides efficacy for controlling weeds. There is a considerable amount of research that dealing with this point and many of them have given special attention to nitrogen fertilizers especially, urea and ammonium sulphate (Kumar *et al*., 1986; Yaduraju and Ahuja, 1990). Results given in this regard are numerous, but all have the same conclusion that nitrogen fertilizers have led to minimizing the herbicidal doses to a minimum with keeping herbicides efficiency as much as the same of commercial rates. Metwally and Hassan (2001), for example, found that using compete 50%, sinal 10 SC and arelon 50% herbicides at 0.1, 0.04 and 0.375 g Fed^{-1}, respectively (e.g., half of the recommended dose) in combination with 1% urea or ammonium sulphate gave an equal efficiency as entirely as being used at the recommended doses for controlling weeds in wheat. Several assumptions have been made about the mechanism of nitrogen fertilizers' mode of action. The synergistic effect between the two molecules is one potential theory of what actually could be happened (Suwunnamek and Parker, 1975). Most arguing is that related to increasing herbicides permeability; of that the plant died due to overdoses of the herbicides upon the site of action (Turner, 1985). Yet, the mechanism of action still to be unclear and is a matter of great inquiring.

Minimizing the herbicidal doses for controlling weeds in faba bean (*Vicia faba* L.) is the matter of the current study. Using bentazon and fluazifop-P-butyl in aid of urea, diammonium phosphate and super phosphate fertilizers is my tools for achieving that goal. The economic importance of faba bean in Egyptian community is well- known. It is considered the master of dishes for all Egyptian peoples. The work on increasing yield productivity and seed quality of such crop was then in great focusing of all sectors of the country.

Controlling weeds is always the matter of researchers' concern due to its incredible damaging effect on crop yield and its quality. Crop losses due to weed infestation in faba bean plants were estimated in between 30 to 44% annually (Hassan, 1987). Faba bean herbicides agenda is containing much, varied from pre- to post-emergence herbicides. Bentazon and fluazifop-P-butyl are two of such most ambitious herbicides. The first is a broadleaf- selective herbicide; meanwhile, the latter is more specific for narrow leaves (Herbert *et al*., 1996; Zaciragic and Grabo, 2003). Bentazon is wider applied not only for controlling weeds infested faba bean, but also in many cereals as different as wheat, barely, rice and maize (Semenov, 1987; El-Kholi and Metwally, 2001; Metwally, 2002; Sharara *et al*., 2005). Due to its function in inhibiting acetyl-coenzyme A carboxylase (ACCase) in susceptible grasses, the fluazifop-P-butyl herbicide is then more compatible for controlling grassy weeds in broad-leaved crops including faba bean (Walker *et al*., 1988 a, b). Harwood (1991) in this regard mentioned that most grasses are susceptible to fluazifop-P-butyl whereas broad-leaved plants and monocotyledonous species other than grasses are resistant. The reason as established before is hanging on the susceptibility or insusceptibility upon the site of action (e.g., ACCase). It is also important to mention that fluazifop-P-butyl is a member of graminicide herbicides where they all have the same trend of action (Shildrick *et al*., 1982). Fluazifop-P-butyl can be, therefore, used to control annual and perennial grasses in cotton, soybeans, stone fruits, asparagus, carrots, etc. (Anonymous, 1994).

So, studying the potential effect of urea, diammonium phosphate and super phosphate fertilizers on enhancing the herbicidal activity of bentazon and fluazifop-P-butyl herbicides for controlling weeds and increasing faba bean productivity was the main goal of the present study. Minimizing the herbicidal doses to a minimum with keeping toxicity as much as the same of recommended doses was the main task all behind that. It is, therefore, a comparative study for the best of such additives for being used practically and for more valuable reason that is related to protect our health and media from overdoses of herbicides consumption.

MATERIALS AND METHODS

Two greenhouse experiments were performed in this regard at the screening house of National Research Center, Egypt during the winter seasons of 2004-2005 and 2005-2006. Faba bean (*Vicia faba* L., cv. Giza 2) seeds were obtained from Agriculture Research Center, Ministry of Agriculture, Egypt. The seeds were sown on the 1st week of November each season at rates of 8 seeds per pot. One hundred twenty pots were used in total (30×40 cm each^{-1}) with a sandy loam soil consists of 40.4% sand, 28.8% silt and 30.8% clay. The pots were infested in the same number with certain broad and narrow-leaved weeds (e.g., beet, *Beta vuligaris* L. and oat, *Avena fatua* L., respectively) simultaneously with sowing crop seeds. The weed seeds naturally occurring in the soil such as sweetclover, *Melilotus indica* L.; lambsquarter, *Chenopodium album* L.; sowthistle, *Sonchus oleraceus* L; ryegrass, *Lolium temulentum* L. and canarygrass, *Phalaris minor* L. were also considered. After germination, the plants were received all necessary care of watering and fertilization. At twenty one days old, the plants were subjected to foliar application by bentazon (48%) and fluazifop-P-butyl (25%) herbicides. The two herbicides (e.g., 0.288, 0.403 and 0.576 kg a.i. ha^{-1} bentazon and 0.151, 0.300 and 0.451 kg fluazifop-P-butyl) were applied subsequently in combination with 0.75 and 1% urea (46.5% N), diammonium phosphate (18% N; 45% P_2O_5) and super phosphate (15.5% P_2O_5). The reason of applying the two herbicides subsequently (not in tank mixture) was to avoid any synergistic, antagonistic or even additional effect could be achieved on the main target crop. More in details of the two herbicides are shown in Table 1. In their calculation, the percentage of fertilizers' addition was estimated at the basis of NP active composition. The experiment was laid out in a completely randomized design with six replicates been used for each treatment. An extra twelve pots were used as a control; six free of any treatment other than weedy infestation and the other six were sprayed with bentazon and fluazifop-P-butyl only at the rates of recommendation.

After 15 days of foliar application, the data on weeds as well as faba bean growth were collected thoroughly. Weed samples were taken by hand pulling of all grown weeds in each treatment (3 pots only/each). The weeds were classified into two groups (e.g., broad and narrow leaves) and then subjected to fresh and dry weights (g pot^{-1}) determination. More of fresh and dry weights of shoot biomass in weeds, the data on plant height (cm) were also estimated of faba bean growth using the three remainder pots at 4 plants/each. The data on yield (g seeds/plant) and its components including number of pods/plant, weight of pods/plant (g), number of seeds/pod, number of seeds/plant and weight of 100 seeds/plant (g) were estimated at the harvest stage.

Table 1: The two herbicides object of the study

Common name	Trade name	Chemical name	Selectivity	Sort of application
Bentazon	Basagran (48%)	3-(1-methylethyl)-(1*H*)-2, 1, 3-benzothiadiazin-4(3*H*)-one 2,2-dioxide	Broad leaf- selective herbicide	Post-emergence
Fluazifop-P-butyl	Fusilade (25%)	(*R*)-2-[4-[[5-(trifluoromethyl)-2-pyridinyl]oxy]phenoxy] propanoic acid	Narrow leaf-selective herbicide	Post-emergence

The seed yield of NPK components was estimated in the treated and untreated plants according to the methods of AOAC (1980).

The data obtained throughout were subjected to standard analysis of variance at LSD 5% according to the statistical methods of Gomez and Gomez (1984).

RESULTS

The effect on reducing weed growth was far clear with all weedy control treatments (Table 2). Applying the two herbicides alone was good enough for controlling wide range of broad and narrow-leaved weeds including beet, *Beta vuligaris* L.; oat, *Avena fatua* L.; sweetclover, *Melilotus indica* L.; lambsquarter, *Chenopodium album* L.; ryegrass, *Lolium temulentum* L. and canarygrass *Phalaris minor* L. They caused up to 90.23% inhibition in broad leaves and up to 86.51% in narrow one. However, using both of them in combination with the different fertilizers was mush more effective. The effect was increased as the fertilizers concentration increased and 1% addition was almost the best. Treatments containing urea and diammonium phosphate had the most significant results in this regard. They were, to a large extent, in similar position for controlling both types of weeds including their both categories, broad and narrow-leaved species infested faba bean plants. In general, treatments containing the highest and moderate concentrations of the herbicides were to be the best. Applying the two herbicides at the highest concentration (0.576 kg a.i. ha^{-1} bentazon; 0.451 kg fluazifop-P-butyl) in combination with the different fertilizers has caused the best results in this regard. They entirely eradicated all broadleaves and were in more than 80% efficient against grassy

Table 2: Herbicides efficacy on weeds growth in relation to different added fertilizers. (Combined analysis of two seasons)

		Broad leaves		Inhibition (%) of control		Narrow leaves		Inhibition (%) of control		Total weeds		Inhibition (%) of control	
Treatments	Rate (kg a.i. ha^{-1})	Fr. Wt. (g)	Dr. Wt. (g)	Fr. Wt.	Dr. Wt.	Fr. Wt. (g)	Dr. Wt. (g)	Fr. Wt.	Dr. Wt.	Fr. Wt. (g)	Dr. Wt. (g)	Fr. Wt.	Dr. Wt.
Bentazon+Fluazifop-P-butyl +													
Urea	0.288+0.151+7.752*	8.80	1.62	59.29	62.38	7.13	2.38	52.53	58.62	15.93	4.01	56.52	60.41
	0.288+0.151+10.320**	6.37	1.33	70.51	69.09	5.33	1.76	64.51	69.44	11.70	3.09	68.05	69.43
DAP	0.288+0.151+5.712	9.43	1.94	56.36	54.93	5.44	2.29	63.78	60.24	14.87	4.23	59.40	58.15
	0.288+0.151+7.608	8.76	1.88	59.45	56.40	5.23	1.93	65.18	66.43	14.00	3.81	61.80	62.30
SP	0.288+0.151+23.232	11.90	2.45	44.95	43.20	5.46	2.20	63.62	61.80	17.36	4.65	52.61	54.04
	0.288+0.151+30.960	9.61	2.04	55.51	52.58	5.26	2.17	64.95	62.26	14.88	4.22	59.39	58.30
Bentazon+ Fluazifop-P-butyl +													
Urea	0.403+0.300+7.752	2.95	0.61	ii	ii	3.78	1.06	ii	ii	6.74	1.68	81.60	83.35
	0.403+0.300+10.320	2.08	0.47	ii	ii	2.23	0.93	ii	ii	4.31	1.40	88.22	86.12
DAP	0.403+0.300+5.712	3.35	0.67	ii	ii	2.10	0.80	ii	ii	5.45	1.47	85.10	85.41
	0.403+0.300+7.608	2.19	0.51	ii	ii	1.43	0.63	ii	ii	3.62	1.15	90.10	88.64
SP	0.403+0.300+23.232	6.83	1.43	ii	ii	3.80	1.26	ii	ii	10.63	2.70	70.98	73.31
	0.403+0.300+30.960	5.37	1.01	ii	ii	2.30	0.80	ii	ii	7.67	1.80	79.05	82.13
Bentazon+ Fluazifop-P-butyl +													
Urea	0.576+0.451+7.752	nil	nil	100	100	1.11	0.46	92.57	91.89	1.11	0.46	96.95	95.39
	0.576+0.451+10.320	nil	nil	100	100	1.03	0.40	93.14	93.05	1.03	0.40	97.18	96.04
DAP	0.576+0.451+5.712	nil	nil	100	100	1.88	1.06	87.46	81.48	1.88	1.06	94.86	89.46
	0.576+0.451+7.608	nil	nil	100	100	1.56	0.50	89.57	91.31	1.56	0.50	95.72	95.06
SP	0.576+0.451+23.232	nil	nil	100	100	2.70	0.86	82.03	84.95	2.70	0.86	92.63	91.44
	0.576+0.451+30.960	nil	nil	100	100	1.80	0.76	88.02	86.68	1.80	0.76	95.08	92.42
Bentazon + Fluazifop-P-butyl (alone)													
	0.576+0.451	2.26	0.42	89.51	90.23	2.21	0.77	85.25	86.51	4.48	1.19	87.76	88.16
Weedy check control		21.62	4.32	--	--	15.03	5.76	--	--	36.65	10.09	--	--
LSD 5%		0.47	0.09	--	--	0.63	0.20	--	--	0.76	0.22	--	--

Diammonium phosphate, DAP/Super phosphate, SP; *: 0.75%; **: 1%; (ii) Presents in Fig. 1, b as the best treatment

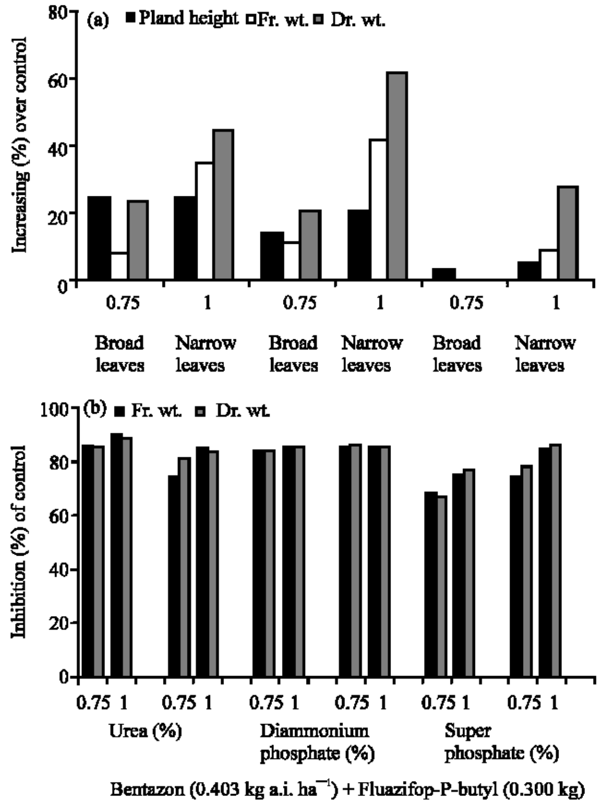

Fig. 1: Effect of applying the moderate concentration of the two herbicides in combination with the different fertilizers on the growth and development of faba bean (a) and its associated of weeds plant (b)

species. The only blame given for is that they adversely affected the growth of faba bean target plant. Using the moderate concentration of the two herbicides (0.403 and 0.300 kg a.i. ha^{-1}, respectively) under the same conditions of mixed application came after, causing in respect to control up to 90% growth inhibition. In term of no associated phytotoxic effect was appeared, these treatments could be considered the best all over the others (Fig. 1).

Applying the two herbicides at the lowest concentration plus the different fertilizers has caused no more than 70.51% growth reduction and this wasn't bad at all if compared with the individual application of the two herbicides (Table 2).

Of faba bean growth, seem to be the results have taken similar trend as much as the effect on weed growth (Table 3). A little deviation is that, applying the two herbicides alone wasn't in the same proficiency of their effects on weeds growth. They increased plant height by 16.85% and fresh and dry weights by 32.77 and 36.48%, respectively as compared with control. Incomparable results were obtained with applying the fertilized herbicides. Using them under the highest levels of the two herbicides was the best over-all. Even some toxicity was appeared; but they still in advanced position of the others since the plants were fully recovered within three weeks of the treatments. Albeit good, the moderate concentration of applying bentazon (0.403 kg a.i. ha^{-1}) and fluazifop-P-butyl (0.300 kg) under the same conditions of mixed application was much more better (Fig. 1). No toxicity was appeared at all and excellent growth was yielded. They caused plant height increased by up to 24%

Table 3: Faba bean growth in response to the different fertilized- herbicide treatments. (Combined analysis of two seasons)

Treatments	Rate (kg a.i. ha^{-1})	Plant height (cm)	Increasing (%) over control	Fresh weight (g)	Increasing (%) over control	Dry weight (g)	Increasing (%) over control
Bentazon + Fluazifop-P-butyl +							
Urea	0.288+0.151+7.752*	37.00	9.92	5.84	nil	1.40	10.23
	0.288+0.151+10.320**	36.66	8.93	6.55	nil	1.46	15.48
DAP	0.288+0.151+5.712	36.00	6.95	5.64	nil	1.31	3.67
	0.288+0.151+7.608	36.33	7.94	5.54	nil	1.43	12.86
SP	0.288+0.151+23.232	33.33	nil	5.26	nil	1.11	nil
	0.288+0.151+30.960	36.33	7.94	5.52	nil	1.33	4.98
Bentazon + Fluazifop-P-butyl +							
Urea	0.403+0.300+7.752	41.83	ii	7.72	ii	1.57	ii
	0.403+0.300+10.320	42.00	ii	9.62	ii	1.83	ii
DAP	0.403+0.300+5.712	38.33	ii	7.94	ii	1.53	ii
	0.403+0.300+7.608	40.50	ii	10.14	ii	2.06	ii
SP	0.403+0.300+23.232	34.66	ii	6.94	ii	1.16	ii
	0.403+0.300+30.960	35.33	ii	7.80	ii	1.61	ii
Bentazon + Fluazifop-P-butyl +							
Urea	0.576+0.451+7.752	38.83	15.36	7.88	10.10	1.61	27.29
	0.576+0.451+10.320	48.50	44.08	9.26	29.42	1.90	49.60
DAP	0.576+0.451+5.712	39.66	17.84	8.68	21.32	1.71	35.17
	0.576+0.451+7.608	44.00	30.71	9.54	33.24	1.88	48.29
SP	0.576+0.451+23.232	37.16	10.41	7.43	3.86	1.61	27.29
	0.576+0.451+30.960	41.83	24.28	8.28	15.64	1.71	35.17
Bentazon + Fluazifop-P-butyl (alone)							
	0.576+0.451	39.33	16.85	9.50	32.77	1.73	36.48
Weedy check control		33.66	--	7.16	--	1.27	--
$LSD_{5\%}$		3.34	--	1.01	--	0.15	--

Diammonium phosphate, DAP/Super phosphate, SP; *: 0.75%; **: 1%; (ii) Presents in Fig. 1,a as the best treatment

and fresh and dry weights by up to 80%. Using bentazon and fluazifop-P-butyl in combination with the different fertilizers at the lowest rates (0.288 and 0.151 kg a.i. ha^{-1}, respectively) was the inferior one and is no longer recommended (Table 3).

The effect on yield and its components is given in Table 4. Using the two herbicides in combination with the different fertilizers was definitely the best if compared with the individual application of both of them. Comparison made between such treatments outweighed herbicides been used at the highest and moderate concentrations to be in top (Fig. 2). Treatments containing urea and diammonium phosphate fertilizers are amongst them have gained the best results. Yet, those with super phosphate fertilizer were ranked down. Up to 160.26% increasing was obtained on yield and its components with applying bentazon and fluazifop-P-butyl at 0.576 and 0.451 kg a.i. ha^{-1} and up to 162.09% with applying both of them at 0.403 and 0.300 kg. Meanwhile, the percentage of increasing was about 3.5 to 60.16% with using the lowest concentration of the two herbicides. Applying bentazon and fluazifop-P-butyl alone was so far good, but coming after fertilized herbicides. The treatment caused reasonable increasing in plant yield as well as its components which was estimated by up to 76.54 and 100.69%, respectively (Table 4).

Regarding the effect on NPK components, still treatments containing urea and diammonium phosphate fertilizers are in the precedence. Applying bentazon and fluazifop-P-butyl in combination with the three fertilizers at the highest and moderate concentrations gave the best results in this regard. They generally caused up to 30.02% increasing in comparison with control. Using the two herbicides at the lowest concentration and under the same conditions of fertilization by the different fertilizers has caused no positive influence of either of any studied criteria. Appling bentazon and fluazifop-P-butyl alone was also effective. It is located in a moderate position of applying the different fertilized herbicides, causing up to 24.28% increasing in comparison with control (Table 5).

Table 4: Effect of the different treatments on yield and its components. (Combined analysis of two seasons)

Treatments	Rate (kg a.i. ha^{-1})	No. of pods/ plant	Wt. of pods/ plant (g)	No. of seeds /pod	Wt. of 100 seeds (g)	Yield/ plant (g)	Increasing (%) over control No. of pods/ plant	Wt. of pods/ plant	No. of seeds /pod	Wt. of 100 seeds	Yield/ plant
Bentazon + Fluazifop-P-butyl +											
Urea	0.288+0.151+7.752*	5.33	7.25	3.00	74.14	22.54	60.16	39.48	50.00	3.35	13.60
	0.288+0.151+10.320**	5.33	8.05	3.00	82.25	24.70	60.16	54.87	50.00	14.65	24.52
DAP	0.288+0.151+5.712	4.00	7.06	3.00	75.11	24.33	20.12	35.89	50.00	4.69	22.64
	0.288+0.151+7.608	4.00	7.61	3.00	92.42	25.22	20.12	46.41	50.00	28.83	27.15
SP	0.288+0.151+23.232	4.00	6.70	2.50	76.26	23.41	20.12	28.97	25.00	6.30	18.01
	0.288+0.151+30.960	4.00	7.19	2.50	81.30	24.31	20.12	38.33	25.00	13.32	22.54
Bentazon + Fluazifop-P-butyl +											
Urea	0.403+0.300+7.752	6.66	12.08	3.42	88.45	40.12	ii	ii	ii	ii	ii
	0.403+0.300+10.320	7.33	13.06	3.63	104.78	47.07	ii	ii	ii	ii	ii
DAP	0.403+0.300+5.712	5.33	11.37	3.50	91.08	30.73	ii	ii	ii	ii	ii
	0.403+0.300+7.608	8.00	13.00	3.70	111.66	52.00	ii	ii	ii	ii	ii
SP	0.403+0.300+23.232	4.66	8.67	2.50	78.39	25.04	ii	ii	ii	ii	ii
	0.403+0.300+30.960	5.33	9.42	3.00	88.17	26.88	ii	ii	ii	ii	ii
Bentazon + Fluazifop-P-butyl +											
Urea	0.576+0.451+7.752	7.33	10.04	3.29	80.66	36.69	ii	ii	ii	ii	ii
	0.576+0.451+10.320	7.33	12.94	3.48	81.27	47.40	ii	ii	ii	ii	ii
DAP	0.576+0.451+5.712	6.66	11.70	3.37	83.10	39.01	ii	ii	ii	ii	ii
	0.576+0.451+7.608	8.66	11.81	3.61	98.67	50.86	ii	ii	ii	ii	ii
SP	0.576+0.451+23.232	4.66	6.95	2.50	78.64	23.08	ii	ii	ii	ii	ii
	0.576+0.451+30.960	6.00	7.89	3.17	74.67	23.68	ii	ii	ii	ii	ii
Bentazon + Fluazifop-P-butyl (alone)											
	0.576+0.451	6.00	9.12	3.50	100.69	35.02	80.18	75.38	75.00	40.35	76.54
Weedy check control		3.33	5.20	2.00	71.74	19.84	--	--	--	--	--
LSD 5%		1.05	1.20	0.49	5.27	2.31	--	--	--	--	--

Diammonium phosphate, DAP/Super phosphate, SP; *: 0.75%; **: 1% ; (ii) Presents in Fig. 2 a,b as the best treatment

Table 5: Effect of the different treatments on the NPK components of yielded seeds (Means of two seasons)

Treatments	Rate (kg a.i. ha^{-1})	N (%)	Increasing (%) over control	P (%)	Increasing (%) over control	K (%)	Increasing (%) over control
Bentazon + Fluazifop-P-butyl +							
Urea	0.288+0.151+7.752*	5.63	8.06	0.297	nil	1.270	nil
	0.288+0.151+10.320**	6.02	15.54	0.303	nil	1.300	1.56
DAP	0.288+0.151+5.712	4.62	nil	0.358	nil	1.356	5.93
	0.288+0.151+7.608	5.88	12.85	0.251	nil	1.280	nil
SP	0.288+0.151+23.232	4.62	nil	0.305	nil	1.300	1.56
	0.288+0.151+30.960	5.61	7.67	0.359	nil	1.540	20.31
Bentazon + Fluazifop-P-butyl +							
Urea	0.403+0.300+7.752	5.87	12.66	0.429	12.01	1.488	16.25
	0.403+0.300+10.320	6.64	27.44	0.469	22.45	1.456	13.75
DAP	0.403+0.300+5.712	5.92	13.62	0.452	18.01	1.544	20.62
	0.403+0.300+7.608	6.50	24.76	0.488	27.41	1.608	25.62
SP	0.403+0.300+23.232	5.32	2.11	0.329	nil	1.408	10.00
	0.403+0.300+30.960	6.10	17.08	0.406	6.00	1.464	14.37
Bentazon + Fluazifop-P-butyl +							
Urea	0.576+0.451+7.752	5.62	7.86	0.436	13.83	1.444	12.81
	0.576+0.451+10.320	6.30	20.92	0.429	12.01	1.488	16.25
DAP	0.576+0.451+5.712	5.82	11.70	0.487	27.15	1.420	10.93
	0.576+0.451+7.608	6.56	25.91	0.498	30.02	1.556	21.56
SP	0.576+0.451+23.232	5.40	3.64	0.400	4.43	1.440	12.50
	0.576+0.451+30.960	5.66	8.63	0.416	8.61	1.500	17.18
Bentazon + Fluazifop-P-butyl (alone)							
	0.576+0.451	5.94	14.01	0.476	24.28	1.524	19.06
Weedy check control		5.21	--	0.383	--	1.280	--

Diammonium phosphate, DAP/Super phosphate, SP; *: 0.75%; **: 1%

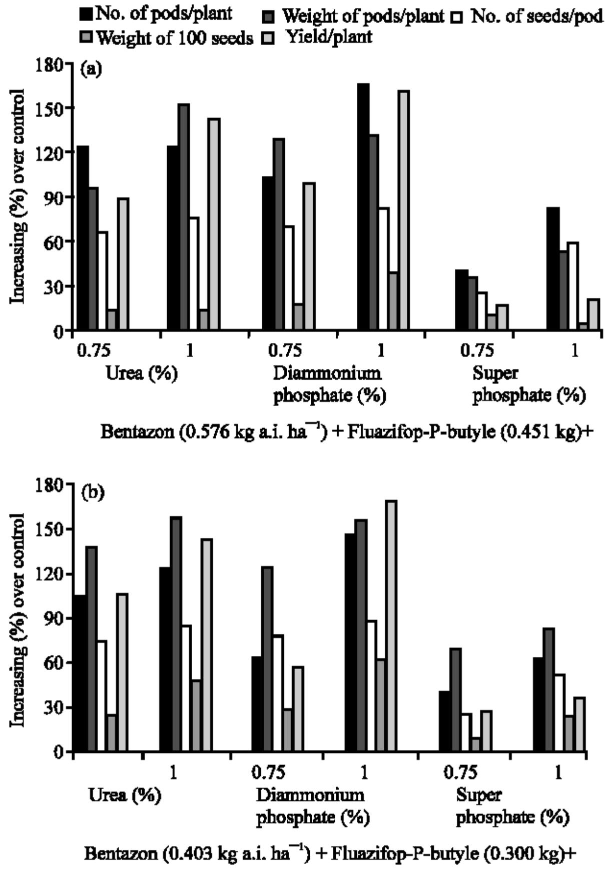

Fig. 2: Effect of applying the highest (a) and moderate (b) concentrations of the two herbicides in combination with the different fertilizers on yield and its components

DISCUSSION

Bentazon is a post-emergence herbicide for controlling broadleaf weeds. Fluazifop-P-butyl is most popular for grassy types. Using the two herbicides (alone) subsequently at the recommended doses (0.576; 0.451 kg ha^{-1}, respectively) has achieved the goal of using both of them for controlling both types of weeds. However, the relatively huge quantity and associated phytotoxic effect even it was temporary were discouraging. The research reports that dealt with the herbicidal efficiency of bentazon and fluazifop-P-butyl are numerous and evidences have accumulated that using both of them subsequently, as the results I have, or in combination as much as the others, is the most proper way to achieve entire weed control.

Reviewing the research reports about bentazon and its efficiency has revealed that the compound is common utilized in cereals (e.g., wheat, barley, maize), legumes and others of oilseed and fiber crops for controlling broadleaf weeds in particular (Ivantsov, 1984; Ngouajio and Daelemans, 1987; Popa *et al*., 1987; Zaciragic and Grabo, 2003; Sharara *et al*., 2005). The herbicide has essentially no positive effect on grasses and is to be the best at rates of 0.56-1.12 a.i. ha^{-1} (Anonymous, 1994). Of our crop concern (faba bean, *Vicia faba*), bentazon has also implicated in such strategy of combating weeds (Abdallah *et al*., 1991). In this context, Saad El-Din and El-Metwally (2003) estimated more than 90% efficient of the herbicide against broadleaf weeds infested faba bean; poor efficiency was noted on grasses. This was strongly coincided with the results I had of using bentazone (alone) in controlling broadleaf species.

On the other hand, fluazifop-P-butyl is wider applied as a grass controller. It has no activity on broad leaves. The herbicide is widely used in cotton, soybeans, coffee, asparagus, garlic, carrots, potato and peppers (Shehata *et al*., 1991). It has also a good impact for being used in legumes e.g., faba bean (Abdallah *et al*., 1991; Metwally, 2002). The results I had by using fluazifop-P-butyl alone were in conformity of those of the two mentioned authors. The good recommendation is to be applied at 0.053-0.21 kg a.i. ha^{-1} (Anonymous, 1994). The herbicide is also able to combine with the different amendments and others of selective herbicides such as bentazon. Saad El-Din (2003) and Saad El-Din and El-Metwally (2003) have confirmed of the reliability of bentazon/fluazifop-P-butyl combined applications to achieve the best results for controlling weeds infested faba bean. Using nonionic surfactant, oil adjuvant, ammonium sulphate, or 28% urea or ammonium nitrate was also advisable for the best results could be obtained with applying fluazifop-P-butyl (Anonymous, 1994). This is also a good point in confirming my opinion regarding using the different types of amending fertilizers to enhance herbicidal activity.

Obviously, using chemical fertilizers was an excellent tool for increasing herbicides efficiency all over the three types have been used. Even they are fluctuated in their efficiency; but they still have the same ability to increase herbicides activity. Urea and diammonium phosphate come in the precedence and 1% addition was almost the best. Super phosphate came after; virtually not recommended as in opinion of mine. This explaining in brightness that, the efficiency is not only belonging to nitrogen fertilizers as many researchers claim but also has a share with the phosphorous one. The research reports that dealt with the nitrogen fertilizers and their impacts as herbicide inducers are numerous. Urea and ammonium sulphate are amongst them have gained the great concern (Metwally and Hassan, 2001; Hassan *et al*., 2006). Yet, no data are available on phosphorous fertilizers.

There is absolutely a strong correlation between adding fertilizers and increasing herbicides efficacy. The explaining theories are limited and all turned around the same point of that increasing the herbicides permeability is main point all behind that (Turner, 1985). The synergistic effect between the two molecules is another possible theory of action (Suwunnamek and Parker, 1975). It is important to mention in this regard that all of these suggestions were built upon nitrogen fertilizers only causing beneficial effect; nothing else. Two facts are then led to the belief of another mechanism of action could be involved. The first fact is that, the promoting effect was a common case in nitrogen-containing fertilizers as well as the phosphorous one (data deduced from the present study). Secondly, it is not necessary for fertilizer molecules to come in close contact with their equivalent of herbicides (e.g., in the same tank mixture) to obtain such efficacy, but they may applied separately (as in soil fertilization) and achieving the same promising results (data deduced from several of others). In several cases of studying the herbicides efficiency in relation to the ordinary agricultural practices of adding fertilizers via soil application, the data revealed of magnificent results of increasing herbicides potency either for controlling weeds or increasing yield productivity (Hussein, 1997; Sultan *et al*., 1999).

Improving crop growth was the other positive side of using such weed control treatments. It is absolutely an obligatory matter of removing weed competitive organs. Such encouragement role was obtained with all weedy control treatments used in the study, irrespective of their types or concentrations. It is well-known that crop and weed are always in retardant relationship. Conceivably, as weed growth controlled, crop growth will dramatically increase. It is something related to the nutrients and the high competition upon it. To be available in enough quantity for crop consumption is the point all behind that and this is what already occurred with removing or controlling weedsaccompanying plants. This fact was strongly supported by several other researchers not only with the two herbicides or crop object of the study, but also in many cases of studying herbicides- combating weeds (Mekky, 2001; El-Metwally, 2002).

The nutrient role of added fertilizers couldn't also be disregarded (Uyanoz, 2007). They definitely have a positive role in increasing crop growth and hence its productivity beside their direct role on increasing herbicidal activity. However, the question is to be answered why such promoting effect wasn't noticed on weeds growth as the same in crop growth? Simply because the activity is based in all at the herbicides selectivity and adding fertilizers doesn't change any of such ability. May be the efficiency passed over the required particularly at the highest concentration of the two herbicides, but still the selectivity as much as the same since the plants were fully recovered within 3 weeks of the treatment. These two points (controlling weeds and nutrient role of added fertilizers) could be created a reasonable reason of what actually could be happened with increasing crop growth.

Increasing seed yield was the ultimate stop of using weed control treatments. The NPK contents were also increased in response. This, undoubtedly, good in term of increasing the nutrient value of faba bean seeds, which meaning much in developing countries in particular Egypt where the crop is considered the main daily basic source of nutrient for the majority of people there.

We may in conclusion several points by end. The first is turn around the objective of the study which seems to be perfectly achieved. Minimizing herbicidal doses and hence saving our health and environments from overdoses of herbicides consumption are those of the main task. An important finding is that related to weed management cost which positively affected in response. Using bentazon and fluazifop-P-butyl subsequently at rates <recommended dose (i.e., 0.403 and 0.300 kg a.i. ha^{-1}) in combination with 1% urea or diammonium phosphate is to be the best and is then highly recommended for practical utilization under field conditions.

REFERENCES

Abdallah, M.M., F.I. El-Bastawesy, A.R. Sharaf, A.H. El-Asdoudi and S. Abdel-Ghany, 1991. Effects of mechanical cultivation, hoeing, single and combined treatments on weed control in faba bean. Egypt. J. Agron. (Special Issue), the Egyptian Society of Crops Science, Academy of Scientific Research and Technology (NIDOC), Egypt, pp: 9-16.

Anonymous, 1994. WSSA Herbicide Handbook. 7th Edn., Ahrens, W.A. (Ed.). Weed Science Society of America, West University Avenue, Champaign, Illinois, USA, pp: 32-34, 129-131.

AOAC, 1980. Official Methods of Analysis, 13th Edn. Washington, DC.

Duke, S.O., 1991. Plants Terpenoids as Pesticides. In: Handbook of Natural Toxins, Toxicology of Plant and Fungal Compounds. Keeler, R.F. and A.T. Tu (Eds.). Marcel Dekker Inc., New York, 6: 269-295.

Duke, S.O., 1992. Natural products as herbicides. In: Proceedings of the First International Weed Control Congress, Melbourne, pp: 302-305.

Duke, S.O., F.E. Dayan, A.M. Rimando, K.K. Schroder, G. Aliotta, A. Oliva and J.G. Romagani, 2002. Chemicals from natural for weed management. Weed Sci., 50: 138-151.

El-Kholi, H.M. and G.M. Metwally, 2001. The indirect effect of some weed control treatments on wheat grain yield and some soil physical properties. Bull. NRC, Egypt, 26: 357-370.

El-Metwally, I.M., 2002. Performance of some wheat cultivars and associated weeds to some weed control treatments. Zagazig J. Agric. Res., 29: 1907-1927.

Gomez, K.A. and A.A. Gomez, 1984. Statistical Procedure for Agricultural Research. John Willey and Sons. Inc., New York.

Grayson, B.T., K.S. Williams, P.A. Freehauf, S.R. Pease, W.T. Ziessel, R.L. Sereno and R.E. Reinsfelder, 1987. The physical and chemical properties of the herbicides cinmethylin (SD 95481). Pestic. Sci., 21: 143-153.

Harwood, J.L., 1991. In: Target Sites for Herbicide Action'. Kirkwood, R. (Ed.). Plenum Press, New York, pp: 57-94.

Hassan, S.M., 1987. Faba bean growth, yield characteristics and accompanied weeds as influenced by plant population and pre-emergence herbicide application. Egypt. J. Agron., 12: 47-56.

Hassan, A.A., T.A. El-Shahawy and G.M. Metwally, 2006. Annual and perennial weed control in citrus orchard. Bull. NRC, Egypt, 31: 77-86.

Herbert, D., D.J. Cole, K.E. Pallett and J.L. Harwood, 1996. Susceptibilities of different test systems from maize (*Zea mays*), *Poa annua* and *Festuca rubra* to herbicides that inhibit the enzyme Acetyl-Coenzyme A carboxylase. Pestic. Biochem. Physiol., 55: 129-139.

Hussein, H.F., 1997. Effect of the stimulative nitrogen-dose and weed control treatments on maize plants and associated weeds. Egypt. J. Applied Sci., 12: 8-22.

Ivantsov, N.K., 1984. Herbicides against resistant weeds in barley and fiber flax. Khimiya v Sel'skom Khozyaistve, 8: 36-39.

Kumar, A., S.J. Singh and S.S. Mishra, 1986. Studies on chemical weed control in late sown wheat. Ind. J. Agron., 13: 84-88.

Lydon, J. and S.O. Duke, 1989. The Potential of Pesticides from Plants. In: Herbs, Spices and Medicinal Plants-Recent Advances in Botany, Horticulture and Pharmacology. Cracker, L.E. and J.E. Simon (Eds.). Oryx Press, Phoenix, Arizona, 4: 1-41.

Mekky, M.S., 2001. Control of broadleaf weeds in maize (*Zea mays* L.). Minia J. Agric. Res. Develop., 21: 387-399.

Metwally, G.M., 2002. Influence of herbicidal weed control treatments on weed growth, nutrient uptake, yield and yield components of faba bean (*Vicia faba* L.). J. Agric. Sci. Mansoura Univ., 27: 2185-2196.

Metwally, G.M. and A.A. Hassan, 2001. Efficacy of adding urea or ammonium sulphate on herbicide efficiency in controlling weeds in wheat crop. J. Agric. Sci. Mansoura Univ., 26: 3435-3446.

Ngouajio, M. and A. Daelemans, 1987. Effect of fluazifop and bentazone tank-mixed on weeds and selected legume crops. Tropicultura, 11: 16-19.

Popa, F., N. Sarpe, I. Tapor and C. Beraru, 1987. Selectivity and efficiency of some herbicides in the control of annual and perennial weeds in oilseed flax grown on a slightly to moderately leached soil. Probleme de Agrofitotehine Teoretica si Aplicata, 9: 103-109.

Saad El-Din, S.A., 2003. Efficiency of some weed control treatments on growth, yield and its components of broad bean (*Vicia faba* L.). Egypt. J. Applied Sci., 18: 586-604.

Saad El-Din, S.A. and I.M. El-Metwally, 2003. Response of wheat and faba bean plants and their associated weeds to some weed control methods. J. Agric. Sci. Mansura Univ., 28: 5931-5944.

Semenov, V.D., 1987. Increasing herbicide efficacy in barley crops. Trudy Latviiskoi Sel'shokhozyaistvennoi Akademii, 237: 43-47.

Sharara, F.A., T.A. El-Shahawy and K.G. El-Rokiek, 2005. Effect of some novel herbicides on the controlling weeds associated with maize plants. J. Agron., 4: 88-95.

Shehata, S.A., S.F. El-Sayed and A.N. Fayad, 1991. Chemical weed control in potato fields. Egypt. J. Agron. (Special Issue), the Egyptian Society of Crops Science, Academy of Scientific Research and Technology (NIDOC), Egypt, pp: 103-116.

Sherman, M.E., L. Thompson and R.E. Wilkison, 1983. Sicklepod (*Cassia obtusifolia*) management in soybeans (*Glysine max*). Weed Sci., 31: 622-627.

Shildrick, J.P., P. Bowen and D. Soper, 1982. Weed Control in Sorts Turfs and Lawns. In: Weed Control Handbook-Principal. Roberts, H.A. (Ed.). The British Crop Protection Council/Blackwell Scientific Publications, Oxford, pp: 369-387.

Sultan, M.S., M.A. Badawi, A.M. Salama, S.A. Ahmed and I.M. El-Metwally, 1999. Effect of some herbicides and biofertilization on growth and yield components of wheat as well as associated weeds under different nitrogen fertilizer levels. In: Proceedings of the 2nd International Conference of Pest Control, 6-8 September, Mansoura, Egypt, pp: 445-460.

Suwunnamek, U. and C. Parker, 1975. Control of *Cyperus rotundus* with glyphosate: The influence of ammonium sulphate and other additives. Weed Res., 15: 13-19.

Turner, D.J., 1985. The effect of additives on the control of *Agropyron repens* with glyphosate. In: Proceedings of the Conference on Grass Weed in Cereals in the United Kingdom, pp: 167-175.

Uyanoz, R., 2007. The effects of different bio-organic chemical fertilizers and their combination on yield, micro and macro nutrients content of dry beans (*Phaseolus vulgaris* L.). Int. J. Argic. Res., 2: 115-125.

Walker, K.A., S.M. Ridley and J.L. Harwood, 1988 a. Effect of the selective herbicide fluazifop on fatty acid synthesis in pea (*Pisum sativum*) and barley (*Hordeum vulgare*). Biochem. J., 254: 811-817.

Walker, K.A., S.M. Ridley, T. Lewis and J.L. Harwood, 1988 b. Fluazifop, a grass-selective herbicide which inhibits acetyl-CoA carboxylase in sensitive plant species. Biochem. J., 254: 307-310.

Yaduraju, N.T. and K.N. Ahuja, 1990. Effect of time and methods of isoproturon application on weed control in wheat. Ind. J. Agron., 35: 353-356.

Zaciragic, C. and D. Grabo, 2003. Herbicides of BASF-AG company with emphasis on the protection of major crops wheat and maize. In: Proceedings of the 2nd Weed Conference, 6-7 June, Sarajevo, Bosnia and Herzogovina, Herbologia, 4: 213-219.