J. Plant Production, Mansoura Univ., Vol. 8 (4): 521 - 527, 2017

Effect of Sprayer Nozzle Selection on Improving Weed Control by Maister Power Herbicide and Maize Crop Productivity

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ABSTRACT

During the last three decades pre-emergence soil acting herbicides were used widely for weed control in maize, but for the role of some of them in environmental pollution, world tended to use new chemical group as post emergence herbicides at reduced rates to limit herbicide inputs in environment as alternatives to such mentioned herbicides. For this reason two field experiments were conducted at Mallawy agriculture research station – El-Minia Governorate, Egypt, during 2014 and 2015 summer seasons, to evaluate three spray volumes using two nozzle types and four Maister power as a new post emergence herbicide rates to control weeds in maize field and their effects on maize productivity. Each experiment included twenty four combination treatments arranged in split-split plot design where spray three volumes i.e. 200, 150, 100 litre/faddan were located in the main plots, two nozzle type i.e. TK1 and flat fan nozzles were located in sub-plots and three Maister power herbicide rates i.e. 500 as recommended rate and reduced rates of 400 and 300 cc/faddan as reduced rates as well as untreated check were located in sub sub-plots. The main findings showed that spray Maister power herbicide by 150 L/faddan water carrier is good from view point of total annual weed control which were reduced by 11.2 and 12 % in 2014 and 2015 seasons, respectively, as compared with 200L/faddan. Spray volume can be increased to 200 L water/faddan in case of grassy weeds dominance in flora composition which existedin experimental fields without any harmful effect on maize plants. TK1 nozzle is preferable than flat fan nozzle type which characterized by its good distribution of herbicide spray solution droplets which reflected in improving weed control by 21.6 and 6.6% and increasing maize grain yield per faddan by 3.5 and 7.87% in 2014 and 2015 seasons, respectively, than the case of flat fan nozzle. Using Maister power at reduced rate of 400 cc/faddan was equal with 500cc/faddan without any significant difference in their control of annual weeds or maize productivity in case of the dominance of *Xanthium strumarium* L., *Euphorbia geniculata* L., *Corchorus olitorius* L. and *Portulaca oleracea* L. as annual broad–leaved weeds. *Echinochola colonum* L.and *Brachiaria reptans* as annual grassy weed species. The correlation between weeds and maize yield (ardab/faddan) as well as its components was negative. Thus, the final conclusion indicated that the best alternative for weed control in maize by spraying Maister power herbicide at rate of 400 cc/faddan with 150 L/faddan spray volume. Using TK1 nozzle can improve the efficacy of herbicide application to reduce its rate as compared with recommended rate of this herbicide and, cost and decreasing environmental pollution.

Keywords: Maize, *Zea mays* L., weed control, TK1, Flat fan, Maister power herbicide and spray volumes.

INTRODUCTION

Maize is the third major cereal crop grown in Egypt after wheat and rice. Weeds are considered to be the most important factor which is responsible for decreasing maize productivity. Weed compete strongly with maize plants for space, light, moisture, nutrients and carbon dioxide, especially in early growth stages which reduced the yield, grain quality and hinder harvest operations and increase the cost of production Rutta *et al.,* (1991). Del Pino and Covarelli (1999) reported that a weed-free duration of 2 - 3 weeks after crop emergence is enough to provide acceptable grain yield. The presence of weeds in maize field cause significant yield losses, up to 30% in the case of renunciation of any kind of protection and herbicide application either pre or post emergence Dogan *et al.,* (2004). Nowadays, post-emergence herbicides can be used as alternative to pre-emergence and soil acting herbicides which causing environmental pollution in China the performance of pre-emergence herbicides is not good due to the adoption of non-tillage techniques in maize production. Maister power (formasulfuron sodium + iodosulfuron methyl-sodium+ thiencarbazone-methyl 4.53 % OD) herbicide as a new post-emergence herbicide used at rate of 500 cm^3/faddan for weed control on maize. For minimizing herbicide rate and spray volume nozzle types which give a good distribution of spray droplets can play a role in this situation. Post emergence herbicide at reduced doses is one of the most important tools to limit herbicide input into the environment according to the integrated weed management system Swanton and Weise (1991). High input of herbicides results in environmental pollution and the development of weed resistance, in addition to the high cost for weed control too. An effective way to reduce the side effect of the herbicide was to apply the lowest dose needed for biologically effective weed control Kudsk and Streibig (2003). Pannacci (2016) found that dose of foramsulfuron can be reduced below recommended dose depending on weed species and growth stage. Foramsulfuron showed a good crop selectivity and without negative effect on maize yield. It is well known that droplet size significantly affects herbicide efficacy Jensen (2006) mentioned that the combinations of herbicides, nozzle type and application parameters (spray volume, droplet size, etc.) can lead to increase of herbicides efficacy against some weed species Sikkema *et al*., (2008). Lešnik *et al*., (2005) also demonstrated that certain combinations of herbicides, nozzles and application parameters (spray volume, droplet size, etc.) can lead to reduction of herbicide efficacy against some weed species. Lešnik *et al*., (2012) showed that the response of different weed species to herbicide application parameters (spray volume, droplet size, etc.) was not uniform, spray volume did not have any significant effect on the efficacy, droplets and higher spray volume decreased the efficacy of the tested herbicide mixtures against grass weeds and increased the efficacy against broad-leaved weeds. In order to maximize herbicidal efficacy, a certain coverage of droplets per unit area of leaf surface must be attained Bode (1987). In general large spray droplets have been shown to provide less area coverage per unit volume compared to smaller spray droplets Spillman (1984). Piggot and Matthews (1999) mentioned that nozzle manufacturers have been designing new types of fan

nozzles in order to achieve a coarser spray while maintaining good droplet distribution in order to maximize herbicidal efficacy. Moshtohry and Ammar (2007) found that TK1, flat fan, deflector yellow nozzles can reduce spray volume without any reduction in the weed control efficacy of herbicides compared with hollow cone nozzle. Zaremohazabieh and Ghadiri, (2011) found that maximum weed biomass reduction and the highest maize grain yield were obtained with foramsulfuron herbicide. The use of this herbicide offers the opportunity for a new mode of action for weed management in maize Baghestani *et al.* (2007). Among post-emergence herbicides in maize, foramsulfuron is a sulfonylurea that exerts its herbicidal activity by inhibiting acetolactate synthase also known as acetohydroxy acid synthase and provides control of grass, perennial and some broadleaved weeds with a good selectivity to the maize Bunting *et al*., (2005). Pannacci (2016) used MDRE (minimum dose requirement for a satisfactory efficacy of weed control) by optimizing foramsulfuron dose for post-emergence weed control in maize, he found that the herbicide can be reduced depending on floristic composition.

For these reasons, the aim of this investigation was to compare and optimize the efficacy of Maister power rates by the use of two nozzle types (flat-fan and TK1) with the use of various water carrier volumes against weeds associated with maize crop and maize yield and its components.

MATERIALS AND METHODS

Two field experiments were conducted at Mallawy Research Station at El-Minia Governorate, Egypt, during 2014 and 2015 summer seasons. Each experiment included combinations of twenty four treatments. The preceding winter crop was sugar beet in both seasons. The soils of this study were silt clay loam texture with 7.99 and 8.14 sand, 53.32 and 54.35 silt and 36.69 and 37.51 clay, pH were 8.01 and 8.14 and organic matter (%) were 1.14 and 1.18 during 2014 and 2015 seasons, respectively. The experimental design was split-split-plot with four replicates was. The main plots included three spray volumes of water, the sub-plots were assigned by two nozzle types, while, four Maister power herbicide rates were assigned in sub-sub-plots as follows:

A- Water carrier volume(spray volumes):

1-200 litre/faddan.
2-150 litre/ faddan.
3-100 litre/ faddan.

B- Nozzle type: (The two nozzle obtained from *Teejet*™)

1. Flat fan (TP 8515).
2. TK1

C- Three Maister power rates: (formasulfuron sodium + iodosulfuron methyl-sodium+ thiencarbazone-methyl 4.53 % OD) known commercially as Maister power applied at 2-6 maize leaves stage as compared with unweeded control check as follows:

1-500 cm^3/ faddan.
2-400 cm^3/ faddan.
3-300 cm^3/ faddan.
4-Unweeded check.

Plot area was 10.5 m^2 (3.5 m length 3.0 m width). Maize hybrid (single cross 128) was planted in both seasons with seed rate of 10 kg/ faddan in hills at 25 cm distance and ridges of 70 cm apart in the first week of June in both seasons. Herbicides treatments were sprayed post-emergence after 15 days from maize planting. A knapsack sprayer (battery sprayer with constant pressure of 5 bar) equipped with one nozzle boom was used. The normal cultural practices for growing maize were applied as recommended for the region (i.e. fertilization, irrigation, pest and diseases control. During growing seasons, the following data were recorded:

A- Weed assesment:

Weeds were hand pulled from one square meter chosen randomly from each plot at 45 days after sowing and weed species identified according to Tackholm (1974), the dry weight of annual broad-leaved, grassy and total annual weeds (g/m^2) was estimated.

B- Yield and yield components:

At harvest, samples of ten maize plants were randomly taken from central area of each plot to study: plant height (cm), ear length (cm), ear diameter (cm), no. of rows ear^{-1}, number of grain ear^{-1}, ear weight (g), grains weight ear^{-1} (g) and 100- grain weight (g). In addition, grain yield (ardab $feddan^{-1}$) was estimated from each whole plot.

Data were subjected to analysis of variance as described by Gomez and Gomez (1984). Least significant difference (LSD) test at 0.05 level was used to compare between means of treatments.

RESULTS AND DISCUSSION

Weed assessment show that, existed weed species in the experimental site in both seasons were *Xanthium strumarium* L., *Euphorbia geniculata* L., *Corchorus olitorius* L. and *Portulaca oleracea* L. as annual broad–leaved weeds. *Echinochola colonum* L.and *Brachiaria reptans* L. as annual grassy weeds.

I- Effect of spray volume of Maister power on:

1. Fresh weight of annual weeds g/m^2

Data in Table 1 show that the effect of spray volume i.e. 200, 150 and 100 l/ fed. of Maister power herbicide solution were not statistically significant in concern of their effects on weight of total annual weeds (g/m^2), but arrived to level of significance on grassy weeds in 2014 and 2015 seasons and for broad-leaved weeds in 2015 season only. Both 200 and 150 l spray volumes of Maister power herbicide decreased grassy weeds weight (g/m^2) significantly by 22.7 and 20.8 % respectively, in 2014 season and 13.5 and 17.7 % respectively, in 2015 season as compared to 100 l/fed. This mean that spray volume increase the efficacy of weed control depending on flora composition in experimental fields either monocot or dicot weed species which may be attributed to spray solution volume interception by grassy weed leaves are lower than broad-leaved weeds because its leaves are erect and leaf blade is narrow that need more solution to be retained in leaf surface. These results are in agreement with those obtained by (Lešnik *et al*., 2012) they suggested that the optimum water carrier volume depended on weed species specific.

Table 1. Effect of spray volume on fresh weight of grassy, broad-leaved and total annual weeds g/m^2 in 2014 and 2015 seasons.

Spray volume (l/fed)	Grassy weeds (g/m^2)		Broad leaved weeds (g/m^2)		Total annual weeds (g/m^2)	
	2014	2015	2014	2015	2014	2015
200	79.19	107. 7	481.4	426.4	560.6	534.1
150	81.19	102.4	416.1	365.6	497. 9	468.0
100	102.5	124.5	404. 8	355.2	507.3	479.7
LSD at $_{0.05}$	17.95	19.23	NS	70.43	NS	NS

In contrary grassy weeds with low spray volume (100 L/fed.) tended to decrease broad leaved-weeds weight (g/m^2) than the other two spray volumes in both seasons and arrived to the level of significance by 16.7% in 2015 season only.

2-yield and yield components:

Concerning yield and its components data in Table 2 cleared that spray volume of herbicide solution didn't affect significantly maize yield/faddan and its components, except with ear weight and grain weight (g)/ear in 2014 season and grain weight (g)/ear and 100-grain weight (g) in 2015 season.

Table 2. Effect of spray volume of Maister power herbicide on maize yield and its components in 2014 and 2015 seasons.

Spray volume (l/fed.)	Plant height (cm)	Ear length (cm)	Ear diameter (cm)	No. of rows/ ear	No. of grains/ ear	Ear weight (g)	Grain weight /ear (g)	100-grain weight (g)	Grain yield (ardab/ fed.)
2014 season									
200	282.2	20.45	4.59	13.93	592.9	259.9	229.6	271.5	20.33
150	278.1	20.43	4.59	13.83	592.2	269.5	230.7	270.1	20.31
100	278.4	20.55	4.58	13.80	590.9	258.2	221.5	268.1	20.03
LSD at $_{0.05}$	NS	NS	NS	NS	NS	10.70	8.45	NS	NS
2015 season									
200	270.1	19.84	4.33	13.93	576.3	271.5	259.9	229.6	17.82
150	270.8	19.75	4.40	13.91	576.5	270.1	269.5	230.7	18.08
100	269.3	20.01	4.36	13.83	571.1	268.1	258.2	221.5	17.59
LSD at $_{0.05}$	NS	NS	NS	NS	NS	NS	10.70	8.45	NS

II- Effect of nozzle type on:

1. Fresh weight of annual weeds g/m^2:

It seemed from Table 3 that the average effects of nozzle types on weed control by Maister power herbicide can be varied from one type to another on different weed categories. TK1 was superior on its effect on weed control by Maister power as compared with flat fan nozzle and reached to the level of significance on their effect on broad-leaved weeds and total annual weeds (g/m^2) in 2014 season which decreased by 23.4 and 21.7%, respectively, whereas in 2015 season fresh weight of grassy weeds reached to the level of significance and was decreased by 15.5% the in the case of flat fan nozzle. This may be due to TK1 nozzle gave small droplet with good distribution of herbicide solution droplets on treated leaf surface. Figure1 show the droplet size and distribution on water-oil sensitive paper. The figure show that TK1 distribution of spray solution was better than flat-fan nozzle.

Table 3. Effect of nozzle type for herbicide spray solution on fresh weight of grassy, broad-leaved and total annual weeds g/m^2 in 2014 and 2015 seasons.

Nozzle type	Grassy weeds (g/m^2)		Broad-leaved weeds (g/m^2)		Total annual weeds (g/m^2)	
	2014	2015	2014	2015	2014	2015
Flat Fan	93.7	120.9	491.7	388.7	585.4	509.7
TK 1	82.0	102.1	376.5	376.1	458.1	478.2
LSD at $_{0.05}$	NS	15.70	69.10	NS	73.53	NS

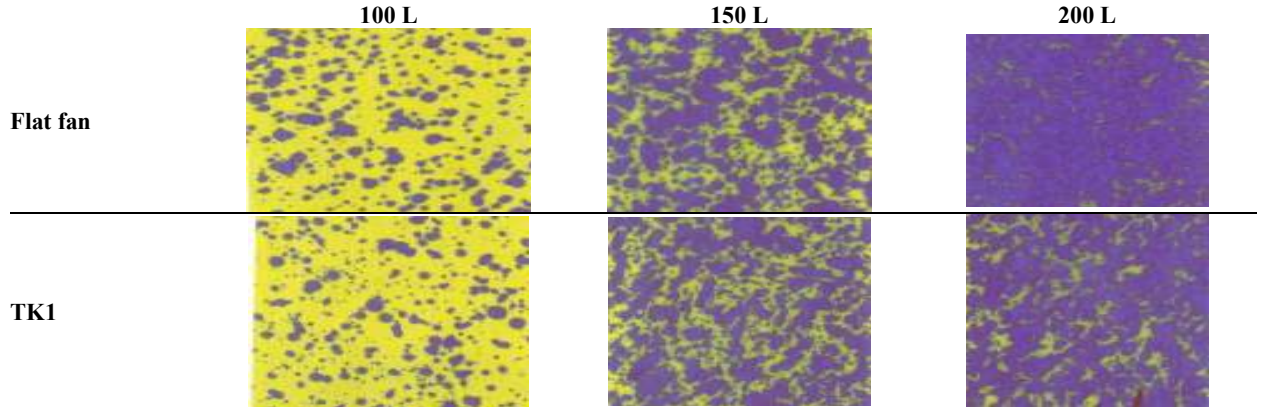

Figure 1. show the distribution and size of spray droplets and herbicide spray solution distribution on water oil sensitive papers.

2- Yield and its components:

Table 4 revealed that the average effect of nozzle types arrived to the level of significance on maize grain yield ardab/faddan and increased grain yield by 3.5 and 7.87 % in the first and second season, respectively. These increments in grain yield are attributed to significant increments in yield attributes (plant height and ear weight in the first season and ear length, no. of rows/ear, no. of grains/ear, ear weight, grain weight/ear and 100-grain weight in the second season), which may be due to the role of nozzle type in increasing herbicide efficacy of weed control.

Table 4. Effect of nozzle types on maize yield and its components in 2014 and 2015 seasons.

Nozzle type	Plant height (cm)	Ear length (cm)	Ear diameter (cm)	No. of rows /ear	No. of grains/ ear	Ear weight (g)	Grain weight /ear (g)	100-grain weight (g)	Grain yield (ardab/fed.)
				2014 season					
Flat Fan	274.5	20.5	4.6	13.8	588.7	254.8	225.6	39.9	19.9
TK 1	284.9	20.4	4.6	13.9	595.2	270.3	229.0	39.7	20.6
LSD at $_{0.05}$	4.43	NS	NS	NS	NS	8.73	NS	NS	0.58
				2015 season					
Flat Fan	268.8	19.69	4.36	13.79	561.3	262.9	194.0	37.24	17.15
TK 1	271.3	20.1	4.38	13.99	588.0	276.9	202.3	38.9	18.5
LSD at $_{0.05}$	NS	0.28	NS	0.17	17.43	6.79	5.80	0.86	0.55

III- Effect of Maister power rates on:

1-Fresh weight of weeds g/m^2:

Table 5 and figure 2 show the average effect of Maister power herbicide rates on fresh weight of both grassy and broad-leaved weeds and their total (g/m^2) in both 2014 and 2015 seasons. Increasing herbicide rates caused significant and consistent decrease gradually in weight of various weed categories. The rate of 500 cm^3/faddan rates reduced grassy, broad-leaved and total annual weeds by 89.8, 92.1 and 91.7% in the 2014 season and 86.0, 90.2 and 89.3% in 2015 season. While 400 cm^3/faddan reduced grassy, broad-leaved and total annual weeds by 87.2, 89.6 and 89.2% in the 2014 season and 83.0, 87.1 and 86.3%, respectively, in 2015 season. This may be due to the susceptibility of these three main predominant weeds (*Xanthium strumarium, Euphorbia geniculate* and *Echinochola colonum*) to Maister power herbicide which shows that the minimum effective dose was 400 cm^3/faddan and gave the similar weed control efficacy to the recommended rate.

Table 5. Effect of Mayster power rates on fresh weight of grassy, broad-leaved and total annual weeds g/m^2 in 2014 and 2015 seasons.

Herbicide rate cm^3/fed	Grassy weeds (g/m^2)		Broad leaved weeds (g/m^2)		Total annual weeds (g/m^2)	
	2014	2015	2014	2015	2014	2015
500	24.0	39.1	97.1	99.3	121.1	138.4
400	30.3	47.1	127.4	131.1	157.7	178.2
300	60.73	81.6	285.1	281.0	345.9	362.6
Untreated check	236.3	278.3	1226.7	1018.2	1463.0	1296.4
LSD at $_{0.05}$	20.72	22.02	97.7	81.3	104.0	82.9

Xanthium strumarium *Euphorbia geniculata*

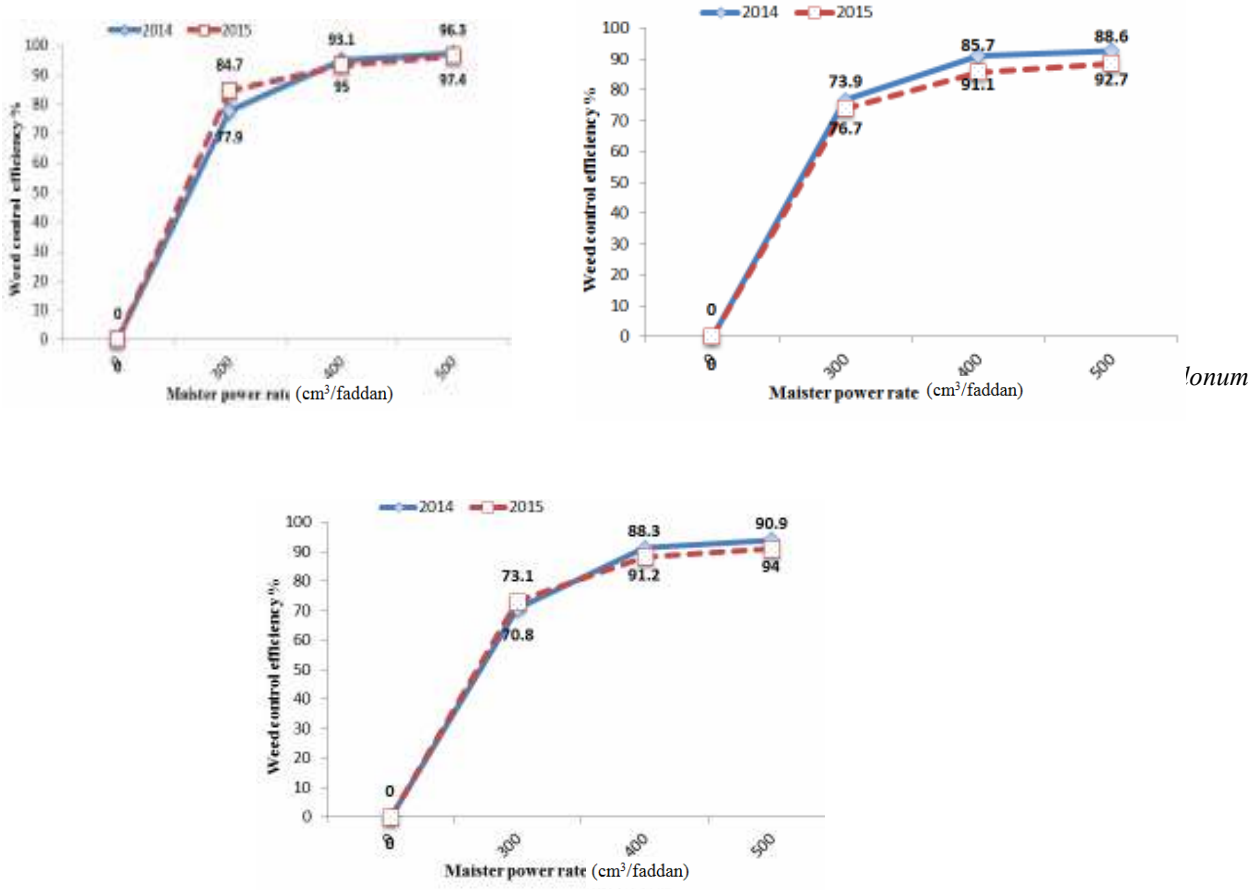

Figure 2. response of the most dominant weed species in the experiment to different Maister power rates (*Xanthium strumarium L.*, *Euphorbia geniculata* *Echinochola colonum*)

2- Maize yield and its components:

Results in Table 6 showed that the average grain yield of maize (ardab/faddan) and its components were affected significantly by Maister power herbicide rates in both growing seasons where it is tended to increase than untreated check.

Plant height (cm) increased significantly with treating plots by Maister power rates at 500, 400 and 300 cm^3/faddan by 9.37, 7.82 and 3.43% in 2014 and 18.23, 12.52 and 5.26% in 2015 season, respectively, compared to unweeded check.

Table 6. Effect of Maister power rate on maize yield and its components in 2014 and 2015 seasons.

Herbicide rate cm^3/fed	Plant height (cm)	Ear length (cm)	Ear diameter (cm)	No. of rows/ ear	No. of grains/ ear	Ear weight (g)	Grain weight /ear (g)	100-grain weight (g)	Grain yield (ardab/ fed.)
				2014					
500	290.8	21.76	4.75	14.49	652.9	301.8	259.0	42.74	25.32
400	286.6	21.53	4.66	14.31	644.7	293.1	254. 6	41.86	24.63
300	275.0	20.24	4.58	13.75	567.8	255.3	220.9	39.59	21.03
Untreated	265.8	18.38	4.34	12.88	502.6	199.9	174.7	35.17	9.09
LSD at $_{0.05}$	6.26	0.49	0.07	0.22	15.49	12.35	9.76	1.17	0.81
				2015					
500	297.9	21.4	4.73	14.45	668.4	306.9	229.3	41.43	21.58
400	283.5	21.12	4.62	14.3	650.3	300.6	225.0	40.58	20.99
300	265.2	19.58	4.3	13.78	549.7	266.9	195.9	38.53	17.82
Untreated	251.9	17.38	3.81	13.04	430.1	206.3	142.5	31.74	10.94
LSD at $_{0.05}$	4.27	0.38	0.14	0.24	24.65	9.60	8.20	1.22	0.78

Ear length (cm), ear diameter (cm), number of rows/ear number of grains/ear and grain weight/ear had been affected by Maister power herbicides rates, whereas the highest values obtained from Maister power herbicides at rate of 500 and 400 cm^3/faddan in both seasons without significant effect.

Grain weight (g)/ear increased significantly by increasing Maister power herbicide rates. The rate of 500 and 400 cm^3/faddan increased grain weight (g)/ear by 48.27 and 45.75%, respectively, in 2014 season and 60.93 and 57.9 %, respectively, in 2015 compared with unweeded check.

Data in Table 6 indicated that 100-grain weight (g) affected significantly by Maister power herbicide rates. The highest values obtained from 500 and 400 cm^3/faddan which were 42.74 and 41.86 (g), respectively, in 2014 season and 41.43 and 40.58 (g), respectively, in 2015 season without any significant difference between these two rates.

Maize grain yield (ardab/faddan) exceeded significantly under all Maister power herbicide rates compared to untreated check by 178.55, 170.96 and 131.35% at rates 500, 400 and 300 cm^3/faddan, respectively, in 2014 season, whereas these respective rates increased grain yield by 137.4, 130.9 and 96.04% in 2015 season. The difference between 500 and 400 cm^3/faddan didn't reach the level of significance in both seasons. These increases are owing to the role of this herbicide in minimizing weed competition under the severe level of infestation in untreated check (1463.0 and 1296.4 g/m^2) in both seasons respectively, or equal 6.144 and 5.44 ton/faddan which owing to increases in ear weight (g), grain weight/ear (g) and 100-grain weight (g). such results indicated that the mixture of mentioned weed species dominant in experimental field can be controlled easily with reduced rates of Maister power herbicide (400 cm^3 /feddan). Silmilar results were obtained by Pannacci (2016).

IV- Effect of interaction between spray volumes and nozzle types on weeds, maize grain yield and its components.

Results indicated that the effect of mentioned interaction didn't arrive to the level of significance at 5% on weeds, maize grain yield and its components, which meaning that the two studied factors act independent.

V- Effect of interaction between nozzle type and Maister power herbicide rates on

1- Weeds fresh weight (g/m^2):

Table 7 show that the effect of aforementioned interaction on weeds were not statistically significant on grassy, broad-leaved and total annual weeds in 2014 season and grassy weeds in 2015 season, except with broad-leaved and total annual weeds in 2015 season. Spraying Maister power herbicide at rate of 500 or 400 cm^3/faddan using TK1 nozzle exhibited the highest reduction on broad-leaved and total annual weeds weight(g/m^2) for this reason TK1 nozzle can be recommended to spray post-emergence Maister power herbicide with 400 cm^3/faddan to control weeds in maize field wiyh out any significant differences from the recommended rate (500 cm^3/faddan) .

Table 7. Effect of interaction between nozzle type and Maister power herbicide rate on fresh weight of grassy, broad-leaved and total annual weeds g/m^2 in 2014 and 2015 seasons.

Nozzle type	Herbicide rate cm^3/fed	Broad leaved weeds	Total annual weeds
		2015	2015
Flat Fan	500	129.7	180. 9
	400	157.3	219.1
	300	326.4	414.8
	Untreated Check	941.7	1223. 8
TK 1	500	69.0	95. 9
	400	104.9	137.3
	300	235.6	310.4
	Untreated Check	1094.7	1369.1
LSD at $_{0.05}$		67.8	69.1

2-Maize grain yield and its components:

Results showed that the effect of previous interactions on maize grain yield and its components didn't arrive to the level of significance at 5% level- except plant height in 2015 season, meaning that the two studied factors act independent.

VI- Effect of interaction between spray volume and herbicide rate on weeds and maize grain

Data indicated that the effect of previous interactions on weeds, maize grain yield and its components were statistically significant at 5% level.

VII- Effect of interaction among spray volumes, nozzle type and Maister power herbicide rates:

Results indicated that the effect of interaction between spray volumes, nozzle type and Maister power herbicide rates on weeds or maize crop yield didn't differ significantly in both seasons, but in general spray Maister power herbicide at 400 cm3/faddan using TK1 nozzle with 150 litre/faddan extended highest reduction in total weeds.

VIII- correlation analysis:

Data in Table 8 showed that the correlation analysis between studied weed characteristics and maize yield components characteristics. Results indicated that grain yield ardab/fed. were positively and highly significantly at 0.05 level correlated with maize yield and its components namely plant height (cm), ear length (cm), ear diameter (cm), No. of rows/ear, No. of grains/ ear, ear weight (g), grain weight /ear (g) and 100-grain weight (g) while it was negatively and significantly correlated with broad leaved weeds, narrow leaved weeds and total annual weeds. These cleared that weed population in experimental field exhibited severe effects of competition to maize crop.

Table 8. Correlation analysis between weeds, maize yield and its components in 2014 and 2015 seasons.

Characters	Broad leaved weeds (g/m^2)	Total annual weeds (g/m^2)	Plant height (cm)	Ear length (cm)	Ear diameter (cm)	No. of rows/ ear	No. of grains/ ear	Ear weight (g)	Grain weight /ear (g)	100-grain weight (g)	Grain yield (ardab/ fed.)
					2014						
Grassy weeds (g/m^2)	0.882**	0.916 **	- 0.576 **	- 0.751 **	- 0.662 **	- 0. 804**	- 0.811 **	- 0.774 **	- 0.771 **	- 0.714 **	- 0.897 **
Broad leaved weeds (g/m^2)	--	0.997 **	- 0.529 **	- 0.789 **	- 0.685 **	- 0.774 **	- 0.777**	- 0.814 **	- 0.820 **	- 0.780 **	-0.901 **
Total annual weeds (g/m^2)		--	- 0.545 **	- 0.795 **	- 0.693 **	- 0.791 **	-0. 795 **	- 0.821 **	- 0.825 **	- 0.781 **	-0.915 **
Plant height (cm)			--	0.617 **	0.573 **	0.598 **	0.639 **	0.599 **	0.639 **	0.586 **	0.591 **
Ear length (cm)				--	0.731 **	0.741 **	0.850 **	0.781 **	0.829 **	0.754 **	0.818 **
Ear diameter (cm)					--	0.751 **	0.746 **	0.695 **	0.780 **	0.704 **	0.741 **
No. of rows/ear						--	0.881 **	0.753 **	0.801 **	0.708 **	0.851 **
No. of grains/ ear							--	0.788 **	0.847 **	0.786 **	0.850 **
Ear weight (g)								--	0.764 **	0.703 **	0.871 **
Grain weight /ear (g)									--	0.864 **	0.843 **
100-grain weight (g)										--	0.781 **
					2015						
Grassy weeds (g/m^2)	0.860**	0.910 **	- 0.744 **	- 0.813 **	- 0.759 **	- 0.697 **	- 0.827 **	- 0.839 **	- 0.827 **	- 0.841 **	- 0.905 **
Broad leaved weeds (g/m^2)	--	0.994 **	- 0.717 **	- 0.828 **	- 0.754 **	- 0.760 **	- 0.810 **	- 0.839 **	- 0.842 **	- 0.811 **	- 0.882 **
Total annual weeds (g/m^2)		--	- 0.740 **	- 0.845 **	- 0.773 **	- 0.765 **	- 0.833 **	- 0.860 **	- 0.859 **	- 0.837 **	- 0.908 **
Plant height (cm)			--	0.789 **	0.719 **	0.733 **	0.803 **	0.758 **	0.783 **	0.695 **	0.807 **
Ear length (cm)				--	0.764 **	0.732 **	0.827 **	0.847 **	0.850 **	0.818 **	0.868 **
Ear diameter (cm)					--	0.744 **	0.798 **	0.790 **	0.784 **	0.819 **	0.799 **
No. of rows/ear						--	0.828 **	0.761 **	0.777 **	0.756 **	0.783 **
No. of grains/ ear							--	0.830 **	0.837 **	0.832 **	0.880 **
Ear weight (g)								--	0.898 **	0.849 **	0.906 **
Grain weight /ear (g)									--	0.836 **	0.889 **
100-grain weight (g)										--	0.871 **

CONCLUSION

To maximize the efficiency of post-emergence Maister power herbicide against annual weeds in maize field and reduce its rate by 20% of the recommended rate it could be concluded that using TK1 nozzle for spray the herbicide with good distribution of small droplets and using 150 litre water/faddan as herbicide carrier.

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تأثير إختيار بشبوري الرشاشة علي تحسين مكافحة الحشائش باستخدام مبيد مايستر باور وانتاجية محصول الذرة الشامية

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المعمل المركزي لبحوث الحشائش- مركز البحوث الزراعية- الجيزة- مصر

تم إقامة تجربتان حقليتان بمحطة البحوث الزراعية بملوي- محافظة المنيا خلا الموسمين الصيفيين 2014-2015 بهدف تقييم فاعلية مبيد مايستر باور بإستخدام حجوم محلول رش مختلفة وبشابير معينة علي مكافحة الحشائش وانتاجية محصول الذرة الشامية ومكوناته. اشتملت كل تجربة علي عدد 24 معاملة في تصميم قطع منشقة مرتين عبارة عن التوافيق بين ثلاث معدلات من حجم محلول الرش للمبيد وهي 200، 150 و 100 لتر ماء/فدان في القطع الرئيسية ونوعين من البشابير وهما TK1 و Flat fan في القطع الشقية الاولي وأربع معدلات مبيد مايستر باور 500، 400 و 300 سم^3/فدان ومعاملة الكنترول في القطع الشقية الثانية لدراسة تأثير ذلك علي مكافحة الحشائش وإنتاجية محصول الذرة الشامية. وكانت أهم النتائج كما يلي:- أن أنسب حجم لمحلول الرش لمبيد مايستر باور كان بمعدل 150 لترماء/فدان لمكافحة الحشائش الحولية العريضة الأوراق (الشبيط – الشربة- الرجلة- الملوخية) السائدة في حقول الذرة الشامية ويمكن زيادتها الي 200 لتر ماء/فدان في حالة سيادة الحشائش النجيلية (أبو ركبة- حشيشة الارانب).- يفضل إستخدام بشبوري TK1 عن بشبوري Flat fan لحسن توزيع قطيرات محلول رش المبيد والتي انعكست علي تحسين كفاءة المكافحة الكيماوية للحشائش في محصول الذرة الشامية بمقدار 21,6 و 6,6 % وزيادة محصول الذرة بنسبة 3,5، 7,87 % في موسمي 2014 و 2015 علي الترتيب.- يمكن استخدام مبيد مايستر باور في الذرة الشامية بمعدل منخفض (400 سم^3/فدان) بإستخدام بشبوري TK1 والتي تقترب من نسبة المكافحة الناتجة من استخدام 500 سم^3/فدان بدون حدوث فقد معنوي في نسبة المكافحة أومحصول حبوب الذرة الشامية مما يشير إلى ضرورة مكافحة الحشائش فى هذا المحصول.- اتضح من تحليل الإرتباط أن هناك ارتباط معنوي سالب بين صفات الحشائش وصفات المحصول وكذلك محصول حبوب الذرة الشامية. نستخلص من هذه الدراسة أن أفضل بدائل مكافحة الحشائش في الذرة الشامية هو الرش بمبيد مايستر باور بعد الإنبات بمعدل منخفض(400 سم^3/فدان) بإستخدام بشبورى TK1 بمعدل ماء 150 لتر ماء/فدان لخفض تكاليف عملية المكافحة وتقليل التلوث البيئى.