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Qualitative analysis of two different pesticides by using certain ground sprayers for measuring spray contamination on the applicator body during controlling squash field against sucking insects at New Salheia District

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Key words: Applicator, Contamination, Protective clothes, Imidaclopride, Buprofezin, Residues, LV, HV, Equipment, Squash cop, Sucking insects.

Abstract

Field experiments were carried out on squash field during two successive seasons of 2017 & 2018 respectively, at the New Salheia district. Qualitative analysis of three different application spray volumes by applying two pesticides against controlling sucking insects on squash field, and received spray contamination on an applicator body through putting water sensitive paper cards at head, chest (right, lift) and also on legs, during spraying operations. Data indicated that, four factors affecting the rate which an applicator were contaminated; as follows, sprayer type, spraying period, application method and ambient spraying conditions. Also, dada illustrated that, conventional ground motor sprayer (330L/fed) was the highest total contamination surfaces sprays received on the applicator body, followed by mist blower oleomac (42.7L/fed). The third machine was electric battery hand held sprayer with flat fan nozzle Ss-83 with spray angle (80º), followed by the same sprayer with hollow cone nozzle Tx-6 with spray angle (65º). The least total spray contamination surface was ULV sprayer (18.4L/fed), i.e. (CDA). Data found that increasing operational pressure increase both of spray angle of nozzle and contamination rate. Data also revealed that, contamination occurring during the normal application of sprays is of minimal significance when compared with contamination caused by leaking and damaged sprayers.

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I. Introduction

Squashes plant (*Cucurbita pepo*) is one of the most important vegetables in Egypt, Although it at all conditions, still not widely used by the food industry, Squashes are consumed worldwide. Fruits are consumed as vegetables or dessert (pie), seeds as nuts and, to a lesser extent, as cooking oil **Lazos, (1986, 1992)**. *Aphis gossypii* (Glover.) and the tomato whitefly, *Bemisia tabaci* (Genn.), are considered the most common and dangerous insect pests which causing serious damage to squash plants, leading to great reduction in the final yield **Hanafy (2004)**. The main aim of this work was determined the spray contamination with pesticides on the applicator body during spraying operation as an important problem which depends on the performance of used technique, misapplication of chemical control and other important factors. The relative hazards of exposure routes need to be evaluated with different operational procedures and special protective clothes. Hence, there are many investigations concerned with an operator contamination measuring exposure to and absorption of pesticides by worker involved in their use, such as that, of **lee etal (1985). Stone etal (1986), Abbott etal (1987), Ames etal (1989), yeary etal (1993), Archi balkd, etal (1994), Thornhill etal (1996a) and El-Zemaity (2002)**.

Also, **El- Gendy (2000)**. Modified our assisted sprayer with horizontal plastic tube distributer reduced the environmental pollution, increased spray swath width and field capacity. He evaluated the performance of three ground spraying equipment on wheat against. These spraying equipment were Knapsack motor sprayer (Kubota), Cp-3 sprayer and Conventional motor sprayer. Results showed that, all of the tested spraying equipment gave good coverage on wheat plant, no contamination spray was observed on the head of applicator, while the contamination spray was recorded on legs only.

So, this work was studied the effect of certain ground sprayers with various spraying rates, with two recommended pesticides which controlling squash field against sucking insects, and evaluated the level of

contamination which occurred on applicator body from the utilizing each tested spraying equipment during two successive seasons 2017, 2018 respectively.

II. Materials And Methods

1. Materials

1.1. Equipment Used

a- Hand held ULVA sprayer. (CDA)
b- Knapsack motor sprayer (Oleo MAC 180).
c- Electric battery hand held sprayer with two nozzles (Tx-6) and (Ss-83).
d- Conventional ground motor sprayer.

1.2. Pesticides used

a) Buprofezin (Applaud 25% SC with recommended rate 600cm/fed.
b) Imidacloprid (Avenue 70% WG) with recommended rate 120gm/fed.

1.3. Protective clothes

Overall one piece, cap, glasses, mask, long gloves and boot.

1.4. Squash crop

The recommended variety of Squash in Egypt is (yara) variety which used in this study which cultivated in ridges, the distance between each ridge was 80cm and row spacing between the plants was 50cm. The experiment area divided into ten plots, the area of each plot was 1056m² (44x24m). Spray operations were carried at 37 days after the sowing and 39 days during seasons 2017 and 2018 respectively.

1.5. Instrument for calibration field tests as follows:

Tape, Stop watch, Graduated Cylinder, Water Sensitive Paper, Dwyer's anemometer, STRUBIN® lens (X15), Thermometer and Hydrometer.

2. Methods

2.1. Calibration and adjustment of the tested equipment under laboratory conditions.

To fulfill the technical needs of the required field tests, the program of calibration tests for ground spraying equipment suggested by (Gabir, 1995) was applied as follows:- Q= T.R.W. Vo/252

Where:-

Q= flow rate (L/min) T= Spraying volume (L/fed.)
Rw= Effective swath width (m) Vo= Working speed (Km/h)
252= Constant value

All technical data, spray parameters of the tested ground sprayers under laboratory conditions was presented in Table (1).

Table (1): The technical data spray parameters of the tested ground sprayers under laboratory conditions.

Tested sprayer / Technical Data	ULVA sprayer	Knapsack motor Sprayer Oleo mac (AM 180)	Electric Battery Sprayer		Conventional motor Sprayer
			hollow cone nozzle (Tx-6)	flat fan nozzle (Ss-83)	
Atomization type	Rotary	Pneumatic	Hydraulic		
Source of power	5 Batteries 1.5 volt	Petrol engin 5 h.p.	D.C. Battery 12 volt		Petrol engin 7 h.p.
Motor speed rpm	7000		3000		
Operating pressure (bar)	-	-	3.0 (Diaphragm pump)		30 (Piston pump)
Spray tank (L).	10	14	20		600
Flow rate, (l/min.):	0.175	2.03	0.52	0.85	2.36
Rate of application, (l/fed.):	18.4	42.7	73.5	89.3	330
Spray height, (m)	0.50 in all treatments				
Swath width, (m)	1.0	5.0	0.75	1.0	0.75
Working speed, (Km/h.)	2.4 in all treatments				
Spray angle (º)	-	-	65º	80º	70 º
Type of spray used	Target spray in all treatments				

* motor sprayer speed 7000 (r.p.m.) measured by Vibra tag instrument (during spraying operations)
** flow rate repeated three times and calculate the average value.
All calibration testes carried out by water under laboratory Conditions.

2.2. Distribution of water sensitive paper on the applicator before spraying operations.

Water sensitive paper cards (16x26mm) were fixed on the applicator, both head and thorax was put one card; abdomen and legs (right and left) were put 4 sensitive cards for measuring spray contamination deposit. During seasons 2017, 2018.

2.3. Determination of spray contamination on the applicator after spraying in squash field.
All sensitive cards which hanged on applicator body were collected, numbered and transferred carefully to the laboratory for measurement and calculation mean droplets number's/cm^2 and surface mean diameter for blue droplet stains to calculate the total area of droplets. Surface spray contamination which fallen on the applicator according to **Gabir and Sawicki, (1978)**, as shown
(D_2o) Surface mean diameter

$$2\sqrt{\frac{\sum_{i=1}^{n} (ni\,.\,xi)^2}{\sum_{i=1}^{n} ni}}$$

Nomenclature
x diameter of spray droplet, µm. x_i droplet diameter for a given size class (i)
b_i number of droplet sampled in a single size class N number of droplet size class
The measurements were carried out with a special scaled monocular (Strubin®) lens, with a magnification of (X15). This was a hand lens which gives a direct measurements because it magnifies both the droplets spots and its numbers at scale with the same rate, scales 6mm in 60 parts, and diameter 7mm, according to **(Abu Amer, 2005)**.

2.4. Weather conditions:
Table (2) showed the meteorological conditions during the experimental periods at 2017 and 2018 seasons respectively both on laboratory and field. Meteorological measurements would be taken by the method described by **(Barry 1978).**

Table (2): Meteorological conditions recorded during two experimental seasons.

Season	Location	Air Temperature (º)	Relative Humidity (%)	Wind Speed (m/sec)
2017	Laboratory	24	68	-
	Field	31	71	4
2018	Laboratory	27	68	-
	Field	34	73	4

III. Results And Discussions

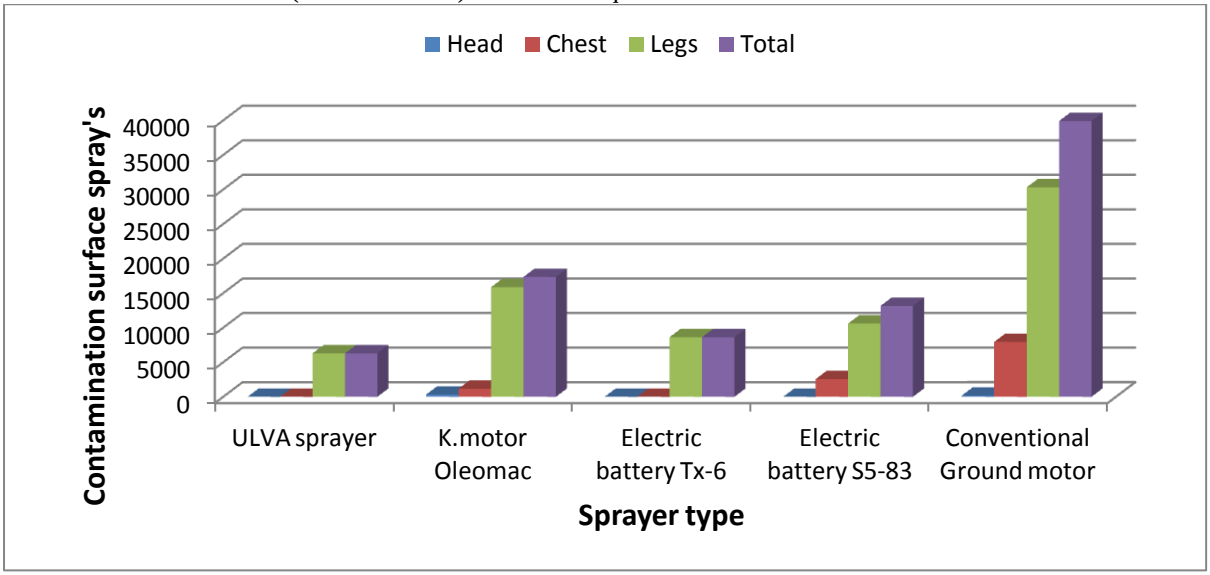
Data in Table (3) and fig. (1), illustrated that, contamination of spray operators was assessed by using five water sensitive paper's were put on head, chest and legs on the applicator during spraying squash field with insecticide Imidaclopride 70% WG. against sucking insects during (2017 and 2018) seasons by using five different application volumes, ranging from 18.4 to 330.0 L/fed, were used with a variety of sprayers types of lever-operated knapsack sprayer, a mist blower knapsack motor sprayer, a Spinning disc ULVA sprayer and Conventional ground motor sprayer. Total operator contamination during operations on squash field was found to be dependent on the type of sprayer, pressure used, nozzle, spray angle and application volume used. The highest droplets stains deposited on water-based high volume sprays (330L/fed) applied by conventional ground motor sprayer where total surfaces sprays contamination was 39909µm. received on the applicator.

Table (3): Applicator's spray contamination of produced by different spraying volumes with Avenue 70% WG (Imidacloprid) during (2017 and 2018) seasons.

Equipment	Spray Volume (L/fed)	SMD on Head, µm	No. droplets/ cm^2 on head	Total surface spray	SMD on right chest, µm	No. droplets/cm^2 on right chest	Total surface spray	SMD on lift chest, µm	No. droplets/ cm^2 on lift chest	Total surface spray	SMD on right Leg, µm	No. droplets/ cm^2 on right leg	Total surface spray	SMD on lift Leg, µm	No. droplets/ cm^2 on lift leg	Total surface spray
ULVA sprayer	18.4	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	73	35	2555	93	40	3720

Knapsack motor Sprayer Oleo mac (AM 180)		42.7	63	5	315	67	7	469	54	13	702	101	72	7272	113	68	7684
Electric Battery Sprayer	Tx-6	73.5	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	84	57	4788	96	40	3840
	Ss-83	89.3	0.0	0.0	0	96	11	1056	75	20	1500	110	53	5830	106	45	4770
Conventional motor sprayer		330	79	21	1659	85	32	2720	90	58	5220	520	28	14560	525	30	15750

Fig. (1) Applicator spray contamination by certain equipment with using Imidaclopride Avenue 70% during (2017 and 2018) seasons on squash field at Salheia district.



***T.S.S.= Total Surface spray *SMD= Surface Mean Diameter *1ml.= 1000µm.**

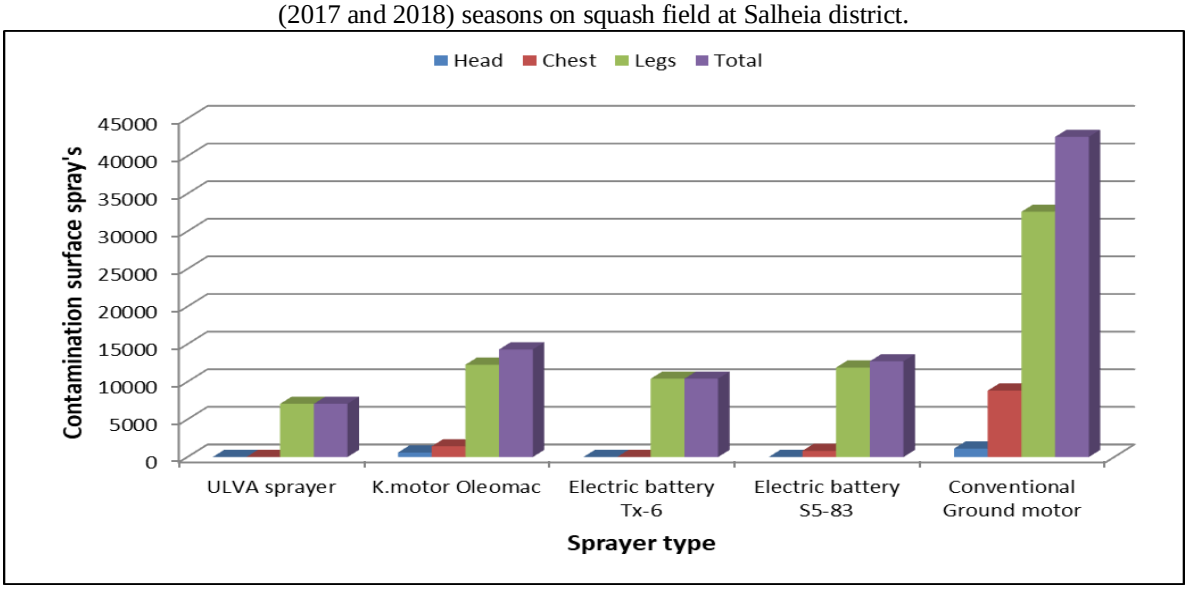
The second sprayer was knapsack mist-blower Oleo mac sprayer, the total surfaces spray was 17346µm. followed by hand held electric Battery sprayer with nozzle Ss-83 which have spray angle 80º, the total surfaces spray was 1315µm., but the Tx-6 nozzle which have spray angle 65º mounted on the same previous sprayer, the total surfaces spray was 8626µm., and the lowest spray contamination fallen on an applicator was ULVA sprayer which revealed total surfaces spray 6275µm. The distribution on contamination over an applicator's protective clothes varied with sprayer type: The motorized sprayers (Conventional ground motors and knapsack motor sprayer oleo mac was the most heavily affected area (head, chest, and legs) but with ULVA sprayer and electric Battery sprayer with Tx-6 nozzle spray contamination was on the legs only, the total surfaces spray were 6275 and 8628µm. respectively. From another hand, electric battery sprayer with Ss-83 with spray angle 80º, both chest and legs were contaminated with 2556, 10600µm. respectively.

It was concluded that contamination occurring during the normal application of sprays is of minimal significance when compared with contamination caused by leaking and damaged sprayers during spraying operations.

Table (4): Spray contamination of applicator produced by different spraying volumes with Applaud 25 % SC (Buprofezin) during (2017 and 2018) seasons.

Equipment		Spray Volume (L/fed)	SMD on Head, µm	No. droplets/ cm² on head	Total surface spray	SMD on right chest, µm	No. droplets/cm² on right chest	Total surface spray	SMD on lift chest, µm	No. droplets/ cm² on lift chest	Total surface spray	SMD on right Leg, µm	No. droplets/ cm² on right leg	Total surface spray	SMD on lift Leg, µm	No. droplets/ cm² on lift leg	Total surface spray
ULVA sprayer		18.4	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	85	44	3740	90	37	3330
Knapsack motor Sprayer Oleo mac (AM 180)		42.7	75	8	600	86	7	602	75	11	825	107	57	6099	98	63	6174
Electric Battery Sprayer	Tx-6	73.5	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	94	66	6204	117	36	4212
	Ss-83	89.3	0.0	0.0	0	0.0	0.0	0	75	11	825	125	48	6000	100	59	5900
Conventional motor sprayer		330	75	15	1125	78	33	2574	92	68	6256	513	31	15903	506	33	16698

Fig. (2): Applicator spray contamination by certain equipment with using Buprofezin Applaud 25% during (2017 and 2018) seasons on squash field at Salheia district.



Data in table (4) and Fig. (2), it has been found that, four primary factors affecting the rate which sprayer operator were contaminated. Sprayer type, spraying period, application method and ambient spraying conditions. The data, revealed that, conventional ground motor sprayer (330 L/fed.) was the highest total surfaces contamination sprays 42556µm. received on the applicator body. About 33.6% from ground motor the knapsack mist blower oleomac revealed 14300µm. the third machine was Electric battery hand held sprayer with flat fan nozzle Ss-83 its spray angle 80º revealed 30% from total surfaces spray contamination of ground motor i.e. 12725µm. followed by the same sprayer with Tx-6 nozzle with spray angle 65º with about 24.5% from total surfaces contamination of ground spray motor i.e. 10416µm. The least total surface contamination was ULVA sprayer 18.4L/fed. (CDA) i.e. controlled droplet application. Revealed 16.0% from total surfaces spray contamination from ground motor sprayer i.e. total surfaces spray contamination was 7070µm. where spray contamination on applicator in legs area only. This result was agreed with **Thornhill et al (1995)**. Also, data revealed that, both ground motor sprayer and knapsack motor sprayer oleomac were made spray contamination in all sensitive cards on applicator but the hand held sprayer ULVA and electric battery hand held spray with Tx-6 nozzle the total surface spray contamination was in legs area of operator only. These results were agreed with **El-Zemaity (2002)**.

IV. Conclusion

This study was carried out on squash field during two successive seasons of 2017 and 2018 respectively at the New Salheia district. Qualitative analysis of three different application spray volumes by applying two pesticides against controlling sucking insects attacking squash fields, and received spray contamination on an applicator body through putting water sensitive paper cards at head, chest and legs during spray operations. Data showed that, contamination patterns and levels varied according to the crop type and its height, the application method; spray type, spraying period and ambient spraying conditions. Also, data illustrated that increasing spraying volume (L/fed.) for any target spray increase the highest total contamination surfaces sprays. Also, the power engine machines sprayer's were more contaminated drift spraying than manual pump in hand held sprayers. The least total spray contamination surface was revealed by ULVA sprayer which given controlled droplets application (CDA) which resulted from rotary spraying spinning disc. Data also, illustrated that, contamination occurring during the normal application of sprays is of minimal significance when compared with contamination caused by leaking and damaged sprayers or used an expired nozzles, i.e. nozzles which used more than 500.0 spraying hour's. from another hand, increasing operational pressure increases both of sprays angle of used nozzles and increase contamination rate.

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