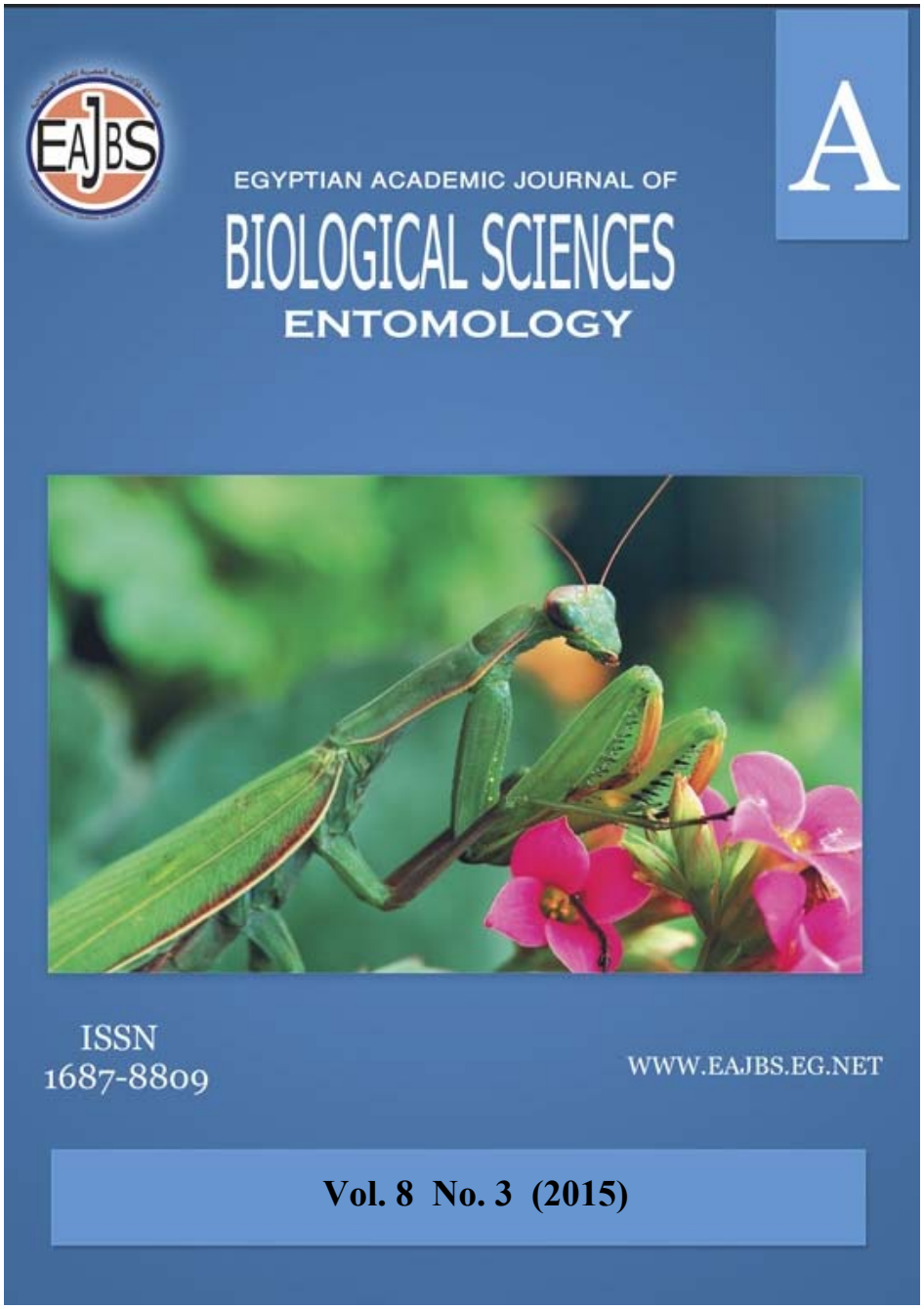

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Effect of Water Dilution Types on The Physico-Chemical Properties and Bio-efficacy of Some Insecticides Against Potato Tuber Worm, *Phthorimaea operculella* (zeller) at Field.

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ABSTRACT

The work was conducted in zagazig district, Sharkia governorate on potato plants (Kara variety) during summer plantation in 2014 and 2015 seasons. The present work aimed to study the impact of water dilution type (Nile and ground water) on physico-chemical properties, residual effect and bio- efficacy of insecticides against potato tuber worm *Phthorimaea operculella* (Zeller).The results showed that effect of Nile water on emulsion stability, wherever Roxy diluted with Nile water gave cream layer 2 ml equal acceptable limits while with ground water gave cream layer 5 ml above limits. On the other hand, Malathate with two water types not gave any separation and creaming layer. The addition of Nile water increased surface tension in case of spray solution of Malathate, Runner, Roxy, Tracer, Penny and Proklame compared with ground water. Also, addition Nile and ground water to different insecticides increased foam volume with Proklame and Roxy amounted 53 and 49 cm and 8 , 17 cm , respectively, while other treatments gave lowest foam volume. The PH values lie between very acidic in case of Roxy with N. water and G water (2.3 and 2.5) respectively and Malathate (3.9 with N water and 5.5 with G water). On the other hand , Runner and Penny recorded PH value ranged between 7.1 to 8.0 but Proclame and Tracer recorded slightly basic (8.9 , 8.7) and (8.1, 8.1) with Nile water and ground water, respectively compared with Nile water and ground water alone without insecticides 7.4 and 8.0. The suspensibility percentage, viscosity increasing with ground water compared with Nile water but density increasing with Nile water than ground water. Concerning the efficacy of the tested insecticides in controlling *P. operculella* larvae differed significantly . Concerning effect of Nile and ground water on efficiency of insecticides on corrected mortality % on *P. opercullela* larvae after two application. The results illustrated that corrected mortality percentage in treatments sprayed with pesticides mixed with nile water was higher (about two fold) than pesticides mixed with ground water in the two seasons, where proklame, Tracer, Pinny, Roxy proved to be the most effective materials. This reduction due to the high decrease of surface tension in ground water than Nile water. Also foam was high for proklame with Nile water and ground water represented by 53 cm and 49 cm respectively. In addition suspensibility percentage increased in Nile water than ground water, PH affected when addition Nile and ground water.

The obtained data concluded to preferred use Nile water in binary mixture with tested insecticides only and prevent use ground water.

INTRODUCTION

Potato, *Solanum tuberosum* L. is among the most important food crops in Egypt, especially for exportation.

Egypt ranks among the world's top potato exporters in 2013, exported more than 380,000 tons of fresh potato and 18,000 tons of cooling potato products. In 2013, total potato production reached 250,000 tons according to the recorded data obtained from the Department of Agricultural Economics and Statistics, Ministry of Agriculture and Land Reclamation (Alaa El-Din, 2008). In Egypt, potatoes are liable to be attack by many insect pests in the field and stores, which reduce yield quantity and quality. Potato tuber moth, *Phthorimaea operculella* (Zeller) (Lepidoptera: Gelechiidae) is considered to be one of the most serious insect. The pest infesting family Solanaceae such as potato, tomato, aubergine and pepper either in filed or in stores (Sarhan, 2004; Mandour *et al*., 2012). The rate of infestation increases in the summer crops and causes a severe damage in the field, addition to the high infestation and the high damage occur in the stored potato tubers (Shedeed, 2001)..The potato tuber moth *P.operculella* is one of the most important pests on potatoes (Bennet *et al*., 1999; Kroshel, 2006, Vuuren *et al*., 1998). Over the last few years, the potato tuber moth has been annually at a long year. The control over this species is very difficult owing to its high reproductive capacity, its poly volatility and adaptability towards the seasonal changes of the weather conditions. (Fenemore, 1988; Das; Gilboa and Podoler 1995; Coll *et al*., 2000; Keller, 2003; Broodryk, 1971). Damage is caused by larvae living inside the tuber or foliage. Foliage mining larvae create transparent leaf blisters and may also mine the petioles, often resulting destroy of the plant. Tuber mining larvae usually enter through the eye of the tuber and make slender, dirty -looking tunnels mounding frays at the entrance of tunnel. Foliar damage to the potato crop usually does not result in significant yield losses (Graft, 1917) but infested tubers may have reduced market ability and losses in storage may be up to 100% especially in non -refrigerated systems (Arnone *et al*., 1998 and Joshi, 1989). This pest has become invasive and is today reported in more than 90 countries (Kroschel and Sporleder, 2006). It occurs in almost all tropical and subtropical potato production systems in Africa, Asia and Central and South America and is considered the most damaging potato pest in the developing world (Cisneros and Gregory, 1994). The present study aimed to study the impact of water dilution type (Nile and ground water) on physico-chemical properties, residual effect and bio- efficacy of insecticides used on *P. operculella* larvae under field conditions .

MATERIALS AND METHODS

The tested insecticides were as shown in Table (1)

Table 1: The tested insecticides.

Trade name	Common name	Formulations	Concentration of A. I.	Rate of application
Runner	Methoxyfenozide	SC	24%	37.5 cm / 100 LW
Malathate	Malathion	EC	57%	1L/100 LW
Roxy	Novaluron	EC	10%	150 cm/100 LW
Penny	Emamectin benzoate + Indoxacarb	SC	1.5 + 7.5%	100 cm/ 100 LW
Tracer	Spinosad	SC	24%	30 cm/100LW
Procliam	Emamectin benzoate	WG	5%	30 gm /100 LW

Laboratory testing:

Physico-Chemical properties of the tested insecticides

Emulsification stability, foaming, surface tension (dyne/cm), suspensibility percentage were evaluated, and PH value, surface tension and viscosity were measured using PH meter Orion model 410 A, Tensiometer, and Ostwald Viscometer, respectively according to (W. H. O., 1973).

experimental Field:

The experiment area was one feddan cultivated by potato (kara, variety) was performed under the field conditions , the experimental field was selected at a private farm at Shepa elnakaria village, Zagazig district, Sharkia governorate.

The potato tubers were planted in the first week of Feb. 2014 and 2015 season. Monitoring of the dynamics of the larvae of the potato tuber moth was examined till infestation percent was 5%. Two applications per season of insecticide sprays, the first one was applied 77 days after planting and the second one-ten days after the first spray. The insecticides were distributed in randomized complete block design. Treatments were sprayed using a dorsal motor sprayer and used two types of water (nile and ground water) as insecticides dilution for the first and the second sprays. The control treatment was sprayed with water alone (Nile or ground water), each treatment was repeated three times. Ten leaves were collected randomly /replicate /ten plants, before spray and ten days after 1st and 2nd spray. The leave samples were put in paper bag then transferred to laboratory and examined under binocular to count and recorded the number of larvae on all leaves. The results are presented as the average number of larvae per 30 plants of each treatment, corrected mortality percentage was calculated according to the equation adapted by Henderson and Tilton (1955). Data was subjected to test and analysis of variance (ANOVA) and means were separated by Duncan's, (1955) multiple range tests.

RESULTS AND DISCUSSION

Physico – chemical properties

The data in Table (2) revealed that inclusion of both water types (Nile and ground water) in spray solution of insecticides greatly affect on physic- chemical properties. The results showed that effect of Nile water on emulsion stability ,wherever Roxy diluted with Nile water gave cream layer 5 ml above acceptable limits while with ground water gave slight cream layer 2 ml. On the other hand, Malathate with two water types (N. and G. water) not gave any separation and creaming layer. Some factors influencing emulsion stability are volume concentration of internal phase, polarity and chemical constituents of continuous phase and electrolyte concentration in aqueous media (Soliman, 2004). In case of Runner, Penny and Tracer was capsule suspension the Formula and Proklame is prepared WG not prepare as emulsion . Surface tension in dyne/cm. were intensified as a result of adding Nile and ground water to tested insecticides .The addition of Nile water caused decreased of surface tension in case of spray solution Malathate, Runner, Roxy, Tracer, Penny and Proklame compared with Nile water alone. Surface tension values (dyn/cm) were 29.8,32.2, 34.9, 37.1, 43.7 and 72 dyn/cm, respectively.

Ground water cause a high shortage in surface tension values compared spray solution (Nile water alone , in binary mixture with insecticides and ground water alone), surface tension value were Malathate 25.2, Runner 28.8, Roxy 29.6, Penny 31.5, Tracer 33.6 , Proklame 42 and ground water 72 dyn/cm . Surface tension affect on droplet shape on treatment plant leaves, especially waxy surface. Water adheres

weakly to wax and strongly to itself. Surface tension gives droplets shape near-spherical shape, because a sphere has the smallest possible surface area to volume ratio, (Soliman 1998). These results were agreement with (Zdravko *et al.* 2007).

Table 2: Physico-chemical properties of insecticides with Nile and ground water during 2014 summer season.

Insecticides	Phisico-Chemical properties													
	Emulsion Stability (ml. cream		Surface tension (dyn.cm)		Foam		PH		Susbensibility %		Viscocity		Density g/cm	
	NW	GW	NW	GW	NW	GW	NW	GW	NW	GW	NW	GW	NW	GW
Roxy EC	5	2	34.9	29.6	8	17	2.3	2.5	-	-	12.6	13.9	0.94	0.98
Runner SC	-	-	32.2	28.8	-	1	7.6	8.0	108.43	106.65	12.9	13.5	0.95	0.96
Penny SC	-	-	38.2	31.5	2	3	7.1	7.2	108.65	107.32	13.1	13.8	0.95	0.97
Malathate EC	✓	✓	29.8	25.2	3	2	3.9	5.5	-	-	13.3	14.3	0.96	0.99
Proklame WG	-	-	43.7	42	53	49	8.9	8.7	104.65	97.77	14.3	15.1	0.95	0.98
Tracer SC	-	-	37.1	33.6	2	2	8.1	8.1	107.32	107.32	13.3	14.3	0.94	0.96
NW/ GW	-	-	72	72	-	-	7.4	8.0	-					

NW = Nile Water , GW= ground Water

In the same Table (2) results indicated that the addition Nile water and ground water to different insecticides increased foam volume with Proklame and Roxy (53, 49 cm) and (8,17 cm) increasing foam cause reduce efficiency, respectively. While other treatments gave the least increasing in foam volume (foam size not exceed 5ml).

In Table (2) the PH values of insecticides formulations with Nile and ground water solution were measured at WHO. The PH values lie between very acidic in case of Roxy with N. water and G water (2.3 and 2.5) respectively and Malathate (3.9 with N water and 5.5 with G water). On the other hand , Runner and Penny recorded PH value ranged between 7.1 to 8.0 but Proclame and Tracer recorded slightly basic (8.9 , 8.7) and (8.1, 8.1) with Nile water and ground water , respectively compared with Nile water and ground water alone without insecticides 7.4 and 8.0 in case of ground water. Similar results were obtained by Aioub (1998), reported that kz oil decreased the PH value of the profenofos spray solution and Soliman (1998, found that the PH value of three pesticides (Actellic, malathion and lannate) alone and in binary mixtures with Greenzite Npk lie between very slightly basic and very slightly acidic media and the foliar fertilizer solution have a very slightly.

The suspensibility percentage of Runner, Penny, Proklame and Tracer were affected with both Nile and ground water, where its increasing with nile water compared with ground water. Suspencibility % recorded (108.65,107.32), (108.43, 106.65), (107.32, 107.32) and (104, 97.77) with Penny , Runner, Tracer and Prokame, consecutive and passed the suspensibility test.

In the same Table (2) ground water and Nile water increased viscosity values but ground water cause increasing in viscosity than Nile water. Solution density slightly increasing with Nile water than ground water, this may be due to Nile water contain silt and other organic materials. The data in Table (2) revealed that inclusion of Nile water and ground water in spray solution of insecticides greatly affect on physico- chemical properties of insecticides.

Bio efficacy of insecticide used against potato tuber worm in the field in 2014 and 2015 summer plantation in Sharkia governorate:

Table (3) showed the effect of adding Nile and ground water to pesticides on population of potato tuber worm in 2014 and 2015 seasons. The corrected mortality

percentage in treatments sprayed with pesticides mixed with Nile water was higher (about two fold) than pesticides mixed with ground water in the two seasons.

Concerning the mean corrected mortality percentage when pesticides mixed with nile water in 2014 season, Proklame, Tracer, Pinny, Roxy proved to be the most effective materials gave 88.03 %, 87.27%, 87.28 and 85.27 % respectively. On the other hand when the same pesticides mixed with ground water the corresponding data were 27.69 , 39.44, 40.56 and 33.61 respectively.

In 2015 season the same trend was noticed except Tracer which gave the least effect in reduction when mixed with Nile water which amounted 76.03%. Proklame, Pinny and Roxy were the most effective pesticides when mixed with Nile water and the corrected mortality percentage represented by 82.05, 82.32 and 82.63 respectively. The corresponding data when these pesticides mixed with ground water was 28.07, 44.46 and 33.53 respectively.

Table 3: Effect of Nile and ground water on bio-efficacy of tested insecticides against *Phtorimaea operculella* (zeller) larvae infesting potatoes plants during 2014 and 2015 summer seasons in Sharkia governorate.

Insecticides	Nile water												General mean reduction % during 2014/2015
	No. of larvae before spray		First spray				Second spray				Mean reduction %		
			Reduction percentages after indicated days										
			No. of larvae after 10 days		% reduction after 10 days		No. of larvae after 10 days		% reduction after 10 days				
	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015	
Ranner	30	36	11	12	76.59e	73.98c	16	18.5	78.08d	78.07c	77.34	76.03	76.69
Malathate	33	39	15	13	70.98f	73.98c	21	15	73.84e	83.58b	72.41	78.78	75.60
Roxy	35	37	11	11	79.93d	76.79b	8	10	90.60a	88.46a	85.27	82.63	83.95
Pinny	35	35	3	5	94.52a	87.80a	17	19	80.03c	76.83d	87.28	82.32	84.80
Tracer	38	36	10	16	83.20c	65.31d	8	10	91.34a	88.14a	87.27	76.73	82.00
Proklame	41	37	7	11	89.10b	76.79b	13	11	86.96b	87.31a	88.03	82.05	85.04
	Ground water												
Ranner	29	35	19	21	32.14j	33.57f	9.5	22	44.11g	45.87f	38.13	39.72	38.93
Malathate	32	38	17	19	44.97g	44.46e	10	23	46.69f	47.88e	45.83	46.17	46.00
Roxy	34	36	23	23	29.93k	29.26g	12.5	26	37.28i	37.80g	33.61	33.53	33.57
Pinny	34	34	19	17	42.12h	44.64e	12	22	39.79h	44.28f	40.96	44.46	42.71
Tracer	37	35	23.5	21	34.21i	33.57f	12	26	44.67g	36.03h	39.44	34.8	37.12
Proklame	40	36	29.5	25	23.61l	23.11h	16	28	31.76j	33.02i	27.69	28.07	27.88
Control NW	30	32	47	41	-	-	73	75	-	-	-	-	-
GW	29	31	28	28	-	-	17	36	-	-	-	-	-
LSD 0.05					1.67	1.67			1.67				

Generally pesticides mixed with ground water did not give satisfactory Control against potato tuber worm. Statistical analysis showed highly significant differences between the tested pesticides during the two seasons. These results agreement with Binyam (2015).

Mean reduction of the tested insecticides against potato tuber worm in the field during 2014 and 2015 and some chemical properties of the type of water:

Data in Fig. (1) Showed the mean reduction of the pesticides in 2014 and 2015 season against potato tuber worm and some chemical properties of the type of water adding to these pesticides. When the Nile water mixed with pesticides, the mean reduction of the two season were 85.04, 84.8, 83.95and 82.0% for Proklame, pinny, Roxy and Tracer which gave the highest reduction represented by 75.6% and 76.69. Concerning adding ground water to these pesticides, Malathate and pinny gave the

highest reduction represented by 46.0 and 42.71% respectively. Proklame gave the least effect amounted 27.88%. Generally pesticides mixed with the ground water gave Significantly low mortality compared with the same pesticides with Nile water. This reduction due to the high decrease of surface tension in ground water which ranged between 25.2 dyn. Cm for Malathate and 42 dyn. Cm for Proklame. Also foam was high for Proklame with Nile water and ground water represented by 53 cm and 49 cm respectively. In addition suspensibility percentage increased in Nile water than ground water on the other hand viscosity increased in ground water than Nile water, Shelton *et. al*. 1981. Larvae and adults of *P. operculella* in potato foliage were effectively controlled by commercial applications of azinphosmethyl and acombination of methomyl and methamidophos, but eggs and pupae were not significantly affected, Soliman, 2004, represented that Profenofos recommended rate (R) with Emulgator was the most efficiency against *Bemisia tabaci* (Genn.), Profenofos 1/2 R with Emulgator the best in control *Liriomyza trifolii* (*Burg.*) and carbosulfan 1/2 R with Emulgator was the superior insecticides against *Empoasca decipiens* (Paoli).

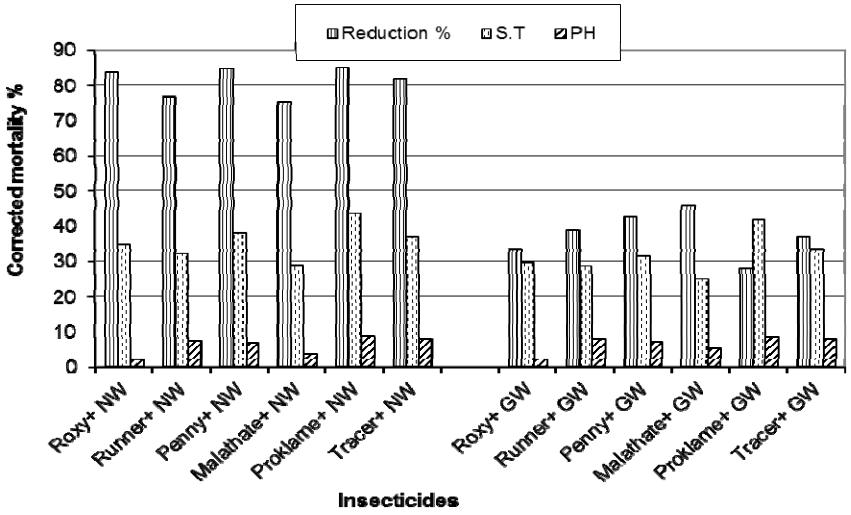

Fig. 1: Comparison between impact adding Nile or ground water to insecticides on mean corrected mortality% of *Phtorimaea operculella* larvae, Surface tension and PH.

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ARABIC SUMMERY

دراسة تأثير نوع الماء المستخدم في محلول الرش على الخواص الطبيعية – الكيميائية والفعل البيولوجي لبعض المبيدات الحشرية على يرقات فراشة درنات البطاطس في الحقل

محمد حسن عبد الرحمن سليمان - عبد الله على عبد الصمد - هبه محمد النجار
معهد بحوث وقاية النباتات - مركز البحوث الزراعية – دقي - جيزة- مصر

تم تنفيذ التجربة في مركز الزقازيق - محافظة الشرقية على نباتات البطاطس صنف كارا في العروة الصيفي 2014، 2015. يهدف هذا العمل إلى دراسة تأثير نوع الماء (ماء النيل والماء الأرضي) المستخدم في تخفيف المبيدات على الخواص الطبيعية - الكيميائية للمبيدات، والتأثير المتأخر والفعل البيولوجي للمبيدات المختبرة على دودة درنات البطاطس.

أوضحت نتائج الدراسة تأثير ماء النيل على ثبات المستحلب حيث أن إضافة ماء النيل إلى مبيد روكسى أعطى طبقة كريميه 2 سم مساوية للحد المسموح به بينما إضافة الماء الأرضي الى مبيد روكسى أعطى طبقة كريميه 5 سم وهى فوق الحد المسموح به. على الجانب الأخر، وجد ان الملاثيت لم يعطى اى راسب او طبقة كريميه بإضافة نوعى الماء. وبخصوص التوتر السطحي وجد أن إضافة ماء النيل أدت الى زيادة في التوتر السطحي للملاثيت والرنر والروكسى والتريسر والبينى والبروكليم مقارنة بإضافة الماء الأرضي . كما أن إضافة نوعى الماء للبروكليم والروكسى سببت زيادة في حجم الرغوة قدرها (53 ، 54 سم)، (8 ، 17سم) على التوالي، بينما انخفض حجم الرغوة في باقي المعاملات . وبخصوص الرقم الهيدرجينى PH وجد أن الرقم الهيدروجينى يقع بين الحموضة العالية في حالة الروكسى مع ماء النيل والماء الأرضي (2.3 ، 2.5) على التوالي، الملاثيت (3.9 مع ماء النيل ، 5.5 مع الماء الأرضي) ، كما أن الرنر والبينى سجل رقم يتراوح بين 7.1 ، 8.0 ، لكن البروكليم والتريسر سجلو قلوية منخفضة (8.9 ، 8.7)، (8.1 ، 8.1) مع ماء النيل والماء الأرضي على التوالي مقارنة برقم ال PH لماء النيل فقط والماء الأرضي (7.4 ، 8.0).

كما أوضحت النتائج أيضا أن نسبة التعلق واللزوجة لمحلول الرش قد زادت مع الماء الأرضي مقارنة بماء النيل بينما الكثافة قد زادت مع ماء النيل بالمقارنة مع الماء الأرضي . وبخصوص فعالية المبيدات المختبرة على دودة درنات البطاطس بينت النتائج وجود اختلافات معنوية بين المبيدات المستخدمة حيث أثرت إضافة ماء النيل والماء الأرضي إلى المبيدات المستخدمة على النسبة المئوية للخفض في متوسط تعداد دودة درنات البطاطس بعد تطبيق رشتين.

أوضحت النتائج أن نسبة الموت المصححة للمعاملات المرشوشة مع المبيدات المخلوطة مع ماء النيل كانت أعلى (حوالي ضعفين) من المبيدات المخلوطة مع الماء الأرضي في الموسمين، حيث أن البروكليم والبينى والروكسى يعتبروا من أفضل المبيدات تأثيرا على الآفة وان الخفض في الفعالية عند إضافة الماء الأرضي إلى المبيدات يرجع إلى النقص العالي في التوتر السطحي مقارنة بماء النيل كما أن حجم الرغوة كان عالي في حال البروكليم مع ماء النيل والماء الأرضي مسجلا (53 سم ، 54 سم) على التوالي وأن النسبة المئوية للتعلق زادت في حالة ماء النيل عن الماء الأرضي كما تأثرت قيم ال PH للمبيدات بإضافة نوعى الماء .

التوصية : يوصى البحث باستخدام ماء النيل مع المبيدات في مخلوط الرش ويمنع استخدام الماء الأرضي مع المبيدات .