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THE INFLUENCE OF SOME SUGARBEET VARIETIES AND NEMATICIDE ETHOPROP (MOCAP) ON THE ROOT-KNOT NEMATODE– *FUSARIUM* WILT DISEASE COMPLEX AT ISMAILIA AND NUBARIYA REGIONS

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ABSTRACT: *Two trials were carried out in Ismailia and Nubariya regions, throughout two seasons of 2009/2010 – 2010/2011 to evaluate the effect of six sugarbeet varieties with and without nematicide Ethoprop (Mocap) on the severity of the root-knot nematode–Fusarium wilt disease complex in sugarbeet fields with low sugarbeet production. A randomized complete block design with a split-plot arrangement of treatment was used with sugarbeet varieties as the main plots and nematicide treatments as the subplots. The recorded data for the two studied seasons were combined for analysis of variance. Results in Ismailia and Nubariya region were similar in their tendency. The effect of varieties × nematicide application expressed as maintaining relatively higher plants population than in untreated plots. Baraka, Lola and Samba sugarbeet varieties were the most positively influenced by this interaction.*

The overall mean of increase percentage in roots yield tons/ fed for Ethoprop treated plots was about 51%. The highest value of sugar yield (3.270 tons/ fed) was obtained by Monte Bianco variety in the treated plots and the lowest went to Baraka variety (0.845 tons/ fed) in the untreated plots. Also, Monte Bianco sugarbeet variety had the highest value of T.S.S. % (22.4). There was different response of sugarbeet varieties as location varied. In treated plots in both studied regions, Ismailia and Nubariya, the tested sugarbeet varieties attained average percentage of increase in sucrose than the untreated plots. Monte Bianco sugarbeet variety was superior for sucrose % under nematicide application in both localities. There was significant enhancement took place in purity % character for the all tested sugarbeet varieties in plots received nematicide, Ethoprop.

Reduction in galls number/ root system, gall ratings, egg-masses numbers/root system, eggs/ egg-mass was associated with Ethoprop plots. As well great reduction in the number of juveniles/ plant, juvenile/ 200 g soil and mature females' number/ roots system was associated with application of Ethoprop , The Ras Poly variety was the most steady one as affected by Ethoprop × varieties interaction whereas, it recorded 2 juveniles/ plant in the two tested regions.

Ethoprop application × varieties interaction affected root-knot nematode build-up sharply. Baraka and H Poly sugarbeet varieties were the most benefited from Ethoprop application × varieties interaction in wilt ratings than the other varieties. The application of Ethoprop at planting reduced the severity of the roots knot nematode–Fusarium wilt disease complex in sugarbeet and maintained good rate of survival plants/fed., this consequently improved roots yield, sucrose percentage, and sugar yield. Monte Bianco followed by H Poly variety the most suitable for poor production areas in Ismailia. While, Barak sugar beet followed by Monte Bianco then H Poly variety are best suited for the Nubariya under the same conditions.

Key words: *varieties, locations, effect, roots yield, sugar yield, root-knot, Meloidogyne incognita, severity, sugarbeet, Fusarium wilt, Ethoprop, nematicide, disease complex, juvenile, galls, , sucrose, purity, in furrow.*

INTRODUCTION

The root -knot nematodes (*Meloidogyne* spp.) are sedentary endoparasites and are among the most damaging agricultural pests, attacking a wide range of crops including sugarbeet (Altman and Thomson, 1971 and Gohar and Maareg, 2005). The infection starts with roots penetration of second stage juveniles (J2) hatched in soil from eggs encapsulated in egg masses laid by the females on the infected roots (Barker *et al*., 1985). Wilt fungus (*Fusarium* spp.), deutromycetous fungus, and causes wilting of the infected plant that leads to death. Yield loss due to this fungus had been reported on various crops (Agrios, 1983). Management of disease complexes appears to less straightforward than one might anticipate. The most obvious solution is to use chemical methods to control one of the interacting organisms and thus prevent the disease complex from occurring. However, it is fundamental to have awareness of the interaction involved, as even low densities of fungi or nematode can result in a disease complex of significant importance (Bowers *et al*., 1996).

Root knot nematodes may interact with other soil-inhabiting plant pathogens to form disease complexes in which case the resulting disease is much more severe than components of the complex would cause alone. *Meloidogyne* species are known to interact with both *Verticillium* and *Fusarium* species, which cause wilt diseases of pepper, tomatoes, potatoes, and other plants (Back *et al.,* 2002).

Mai and Abawi (1987) observed that *Fusarium* wilt of cotton was more severe in the presence of root-knot nematodes *(Meloidogyne* spp.). *Meloidogyne-Fusarium* interaction has been described on several hosts (Powell, 1979). The presence of root-knot nematodes increases the incidence, rate of development, and/or the severity of wilt on *Fusarium-susceptible and Fusarium-tolerant* crop cultivars (Agrios, 1997). In most interactions involving fungi, the nematode usually assisted the fungus by altering the incidence and speed of the development of the pathogen and thus the severity of disease it caused. In certain situations, the nematode has been responsible for breaking disease resistance to *Fusarium* wilt.

Specific control for this disease complex in sugarbeet have not been developed nor management involves rotations that avoid susceptible crops such as potato, sweet potato, cabbage, peanut, clover and alfalfa and control of weed hosts. The present investigation was thus undertaken by investigate the application of chemical method throughout two successive seasons of 2009/2010 – 2010/2011 in the areas with low sugarbeet production (average tonnage ≤ 10.0/fed.) in Ismailia and Nubariya, to prevent disease complex the master key of reduced production from occurring. Allowing for sustainable sugarbeet production in such areas, whereas, without this injury, the roots yield and percent sucrose values will positively influenced. With these increases, producers will have potential gains in gross return per fed, allowing for potential of production income.

MATERIALS AND METHODS

The experiments were conducted in 2009/2010 and repeated in 2010/2011 over two locations the first was at North Sinai region (Ismailia Governorate) and the second was at West Nubariya District (Behira Governorate). Both locations naturally had a contaminated soil with root-knot nematode, *Meloidogyne incognita* and history with roots rot disease that after primitive soil survey to detect the objective nematode.

The soil of first locality (Ismailia) is extremely sandy with slight percent of organic matter 0.50 %) and pH of 7.91, with average percentage for particle sizes 82.3% sand, fine sand 7.4 %, silt 5.3 %, and 5.0% clay. % . As well, the soil of the second site (West Nubariya) was sandy soil containing distinctly low percentage of organic matter (0.37 %), with a pH of 8.05. The average particle size distribution was 88.2 % sand, 5.5 % fine sand, 2.0 % silt and 4.3 % clay. Ismailia locality had soluble cations (Ca^{2+}, Mg^{2+}, Na^{+}, and K^{+} with values 21.60, 7.70, 19.04 and 0.48 meq L^{-1} , respectively) , and anions (CO_3^{-2}, HCO_3^{-}, CL^{-} and SO_4^{-2} with values of 0.00, 2.45, 20.60 and 25.77meq L^{-1}, respectively). The soil had electrical conductivity of 4.5 ds/m. Also; it had relatively low N, P and K with values of 45.00, 14.75 and 89.70 ppm, respectively. Whereas, Nubariya locality characterized by relatively lower soluble cations (Ca^{2+}, Mg^{2+}, Na^{+}, and K^{+} with values of 2.76, 1.90, 4.35 and 0.82 meq L^{-1}, respectively) and anions (CO_3^{-2}, HCO_3^{-}, CL^{-} and SO_4^{-2} with values of 0.01, 1.71, 7.09 and 1.15 meq L^{-1}, respectively). The soil had electrical conductivity of 0.94 ds/m. Also, it had 9.74% $CaCO_3$, and relatively low N, P and K with values of 32.09, 3.13 and 79.50 ppm, respectively.

Historically, sugarbeet planted at these locations has experienced a high frequency of roots rot associated with root-knot nematode infection. Prior to the initiation of this study, the population density of *M. incognita* was increased through non rotation with continuous sowing sugarbeet alternatively with peanut an excellent host for the root-knot nematode. Experimental design was a randomized complete block with a split-plot arrangement of treatments with four replications. Main plots, which were twelve rows (50 cm spacing) by 3.5 m in length (6 m×3.5 m = 21.0 m^2 i.e. 1/200 Fed), were sugarbeet varieties and subplots, which were six rows (50 cm spacing) by 3.5 m in length (3 m×3.5 m = 10.5 m^2 i.e. 1/400 Fed), were in-furrow treatments.

Six sugarbeet varieties (Baraka, H Poly, Lola, Monte Bianco, Ras Poly and Samba) with different levels of susceptibility to *Fusarium* wilt and the root-knot nematode were evaluated by Maareg *et al*., 1998; Maareg *et al*., 2005; Gohar and Maareg, 2009; Maareg *et al*., 2009 and Saleh *et a*l., 2009.

The nematicide Contains 10% w/w Ethoprop, organophosphate nematicide (Mocap 10G, Bayer cropscience lp), Introduced in the 1960s, Ethoprop is a nonsystemic insecticide/nematicide. The mobility of Ethoprop in soil and its half-life are strongly dependent on soil organic matter (Norris *et al.,* 1988). It is not known to be carcinogenic and is available as granules or emulsifiable concentrates was applied at planting in the seed furrow at 1.2 kg a.i. per fed. Plots that did not receive Ethoprop were left untreated as controls for each variety. All Seeds of sugarbeet, *Beta vulgaris saccarifera* L. were sown on the last week of October over the two studied seasons and locations. Five hills per meter were planted to provide a density of 40,000 plants per fed. The treatments were allotted randomly in each block. With the exception of the treatments, all other agricultural practices for growing sugarbeet were done as recommended by Sugar Crops Research Institute for newly reclaimed soils. Also, weed and insect control was according to Cooperative Extension Service guidelines.

Number of survival plants per plot was counted for each treatment in all replicates to estimate their number/ fed. A sample of 10 guarded plants represent each treatment in all replicates were collected to determine: roots weight (g) per plant, Total Soluble Solids percentage (TSS %) which was determined using hand refractometer, sucrose was determined according to the method of Le Docte, 1927, purity % was estimated as it is equal (Sucrose % / TSS %) × 100 and sugar content g per plant was assessed as roots weight (g) × sucrose %. Sugarbeet plants of each plot were up-rooted, topped, cleaned and weighed to determine roots yield in tons/fed. Whereas, sugar yield per fed was estimated as it is = roots yield (tons/ fed) × sucrose % × purity %.

Species of the root-knot nematode were identified on the basis of perineal pattern morphology of the adult females as described by Eisenback *et al*. (1980) and Eisenback (1985). Nematode populations (second-stage juveniles [J2] and eggs were determined from a composite of 20 soil cores collected from the two center rows of each plot to a depth of 20 cm with a 2.5-cm-diameter sampling tube. Soil samples were collected on directly prior to planting to determine initial population (Pi) of root-knot nematode and in the termination of the experiment (six months from planting) to determine the final population (Pf). Nematodes were extracted from a 500 cm3 sub-sample by wet sieving and sugar flotation and J2 of *M. incognita* were counted under a dissecting microscope (Ayoub, 1980). All roots fragments in the sub-sample were collected and shaken for 4 min in 0.05% NaOCl to free the eggs from the egg masses (Hussey and. Barker, 1973). The total number of J2 and eggs in each plot was recorded for statistical analysis.

Severity of *Fusarium* wilt and root-knot nematode infection was rated following inspection of 10 plants per plot after harvest. Fusarium wilt severity was based on vascular stem discoloration as follows: 0 = no vascular discoloration; 1 = <10%; 2 = 11 to 25%; 3 = 26 to 50%; 4 = 51 to 75%; and 5 = >75% of the vascular tissue discolored modified after Ithurrart Maria and Petersen (2004). Root-knot severity was assessed as roots galling as follows: 0 = no galls; 1 = 1 to 2 galls; 2 = 3 to 10 galls; 3 = 11 to 30 galls; 4 = 31 to 100 galls; and 5 = >100 galls per roots system (Maareg *et al*., 2005).

Arbitrarily selected samples of roots displaying vascular discoloration were incubated on potato-carrot agar as small slices to verify the presence of *Fusarium oxysporum.*

Statistical analysis:

Bartlett's test (Snedecor and Cochran, 1983) is used to examine the null hypothesis, homogeneity of variances for the two season's records, that all observations per season variances are equal against the alternative that at least two are different. By comparing calculated X^2 with the tabulated one, X^2 value didn't exceed value of .05 probability so null hypothesis must be accepted indicating that there is no significant difference among the variances of the two seasons. Thus, data of the two seasons were combined for analysis of variance (ANOVA) using MSTAT version 4 (1987), followed by testing significant differences among the means of different treatments were separated by Duncan's Multiple Range Test at 0.05 and 0.01 probability according to Duncan (1955).

RESULTS

Effect of sugarbeet varieties and nematicide, Ethoprop (Mocap) on yield components:

1. Rat e of survival plants per fed:

The analysis of variance for the combined data illustrated in Table (1) showed the degree of difference at $P \leq 0.05$ and ≤ 0.01 between the six tested sugarbeet varieties in untreated plots (without Organophosphours nematicide, Ethoprop) which revealed the behavior of the sugarbeet varieties sown under contaminated soil with Root-knot nematode and *Fusarium* rot-welt diseases, and in treated plots to reveal the efficacy of sugarbeet variety × nematicide, Ethoprop on the main yield components as rate of survival plants, roots yield and sugar yield/ fed.

Although, five hills per meter were planted to provide a density of 40,000 plants / fed for the all six tested sugarbeet varieties. In Ismailia region, the average rate of survival plants/fed were 12655 for all tested sugarbeet varieties in untreated plots it is equal about 31.6% from the objective number. It is understandable that there are many factors influencing this among them the deeds of the two detected pathogens, root-knot nematode and *Fusarium* welt fungus. The most soaring sugarbeet varieties under these contaminated conditions were Baraka, Monte Bianco and Lola which recorded rates of 13400, 13242 and 12930 plants/ fed, respectively, for the two mentioned varieties, Baraka and Monte Bianco maybe there is significant deference between them at $P \leq 0.05$ but there no at ≤ 0.01. The other three sugarbeet varieties under the same condition, H. poly recorded the moderate rate of survival plants/fed (12334), however, Samba and Ras-poly recorded the lowest rate of survival plants/ fed, as they are 12040 and 11985 plants/ fed for H Poly, Samba and Ras Poly, respectively, with a significant deference at $P \leq 0.01$ between H Poly and the two others and without any significance between Samba and Ras Poly as shown in Table, 1.

Table (1) Effect of sugarbeet varieties and nematicide, Ethoprop (Mocap) on main yield components at Ismailia and Nubariya fields that subjected to root-knot nematode–*Fusarium* Wilt complex disease by combined analysis between two seasons of 2009/2010 – 2010/2011.

Main yield components vs. treatments			Sugarbeet varieties						Mean	L. S.D at 0.05 / 0.01
			Baraka	H Poly	Lola	Monte Bianco	Ras Poly	Samba		
Rat e of survival plants/fed.	Ismailia	Untreated	13400	12334	12930	13242	11985	12040	12655	134.5 180.5
		Treated	19040	18542	18982	18704	18288	18852	18735	199.1 267.3
		Increase%	29.6	33.5	31.9	29.2	34.5	36.1	32.5	
	Nubariya	Untreated	10960	11016	10654	10100	11251	10452	10739	115.6 152.0
		Treated	17231	16524	16253	15965	16025	16054	16342	175.9 231.3
		Increase%	36.4	33.3	34.4	36.7	29.8	34.9	34.3	
Roots yield tons/ fed.	Ismailia	Untreated	11.4	10.0	10.0	10.6	9.9	9.0	10.2	0.11 0.14
		Treated	19.5	20.4	20.0	22.1	22.7	19.7	20.7	0.22 0.29
		Increase%	41.5	51.0	50.0	52.0	56.4	54.3	51.0	
	Nubariya	Untreated	8.1	8.5	8.2	8.3	8.3	7.9	8.2	0.09 0.12
		Treated	17.2	18.2	17.1	17.0	17.5	16.8	17.3	0.19 0.24
		Increase%	52.9	53.3	52.0	51.2	52.6	53.0	52.5	
Sugar yield tons / fed.	Ismailia	Untreated	1.496	1.018	0.990	1.184	1.100	1.149	1.156	0.019 0.024
		Treated	2.791	2.744	2.509	3.270	2.353	2.971	2.773	0.038 0.049
		Increase%	86.6	163.5	153.4	176.2	113.9	158.6	142.0	
	Nubariya	Untreated	0.845	0.956	0.895	0.861	0.982	0.987	0.921	0.035 0.045
		Treated	2.731	2.842	2.453	2.593	2.446	2.611	2.613	0.044 0.055
		Increase%	223.2	197.3	174.1	201.2	149.1	164.5	184.9	

Values are averages of four replicates.
Mocap 10G applied at 1.2 kg a.i. /fed at planting.
Means different according to Duncan's new multiple range test (P = 0.05).
Means significantly different at P = 0.01.

The average rate of survival plants/fed in Ethoprop treated plots for the tested sugarbeet varieties in the same region of Ismailia, exhibited increase equivalent about 32.5 % than it was in the untreated plots. The effect of varieties × nematicide application expressed as maintaining relatively higher plants population than in untreated plots. Baraka, Lola and Samba sugarbeet varieties were the most influenced by this interaction, whereas, they recorded the highest survival rates, 19040, 18982 and 18852 plants/ fed, respectively without any significance at P ≤ 0.05 and ≤ 0.01. The three rest of sugarbeet varieties (Monte Bianco, H Poly and Ras Poly) under the same treatment also proofed high rate of survival plants/ fed with significant difference from the three first ones at P ≤ 0.05 and ≤ 0.01, but among them there is no significant difference at P ≤ 0.05 and ≤ 0.01, except for Ras Poly and Monte Bianco and H Poly varieties there is a significant difference at P ≤ 0.05 and ≤ 0.01 (Table, 1).

The same tendency is almost observed in Nubariya region, where, there was significant variation for the rate of survival plants/ fed between Ethoprop treated sugarbeet plots which achieved an increase of 34.3 % in this rate than that of untreated sugarbeet plots. In untreated plots, Ras Poly sugarbeet variety recorded the highest rate of survival plants/fed followed by H Poly and Baraka sugarbeet varieties with survival rates of 11251, 11016 and 10960 plants/ fed, respectively, with significant difference at P ≤ 0.01 between the Baraka variety and the two other varieties which had no significant variation between them. The other tested sugarbeet varieties in the same untreated plots, Lola, Monte Bianco and Samba sugarbeet varieties had a lower survival rates ranged from 10100 to 10654 plants/ fed with significant differences among them. But the interaction between sugarbeet varieties and nematicide treatment was more effective on Baraka, H poly and Lola that recorded survival rates of 17231, 16524 and 16253 plants/ fed with significant difference at P ≤ 0.01 among them. Whereas, Samba, Ras Poly and Monte Bianco sugarbeet varieties had a lesser response to that interaction, where they recorded 16054, 16025 and 15965 plants/ fed, respectively without significant differences at P ≤ 0.05 among them as shown in Table, 1.

Generally, at Ismailia region, in nematicide, Ethoprop treated plots, Samba was the superior sugarbeet variety in regard to 36.1% increase in the rate of survival plants/fed, whereas, Monte Bianco sugarbeet variety in Nubariya region had the lead in this concern by attaining the highest increase percentage (36.7%) in the rate of survival plants/fed.

2. Roots yield (tons/ fed):

Roots yield data in Table (1) at Ismailia region showed that the tested sugarbeet varieties sown in free nematicide plots had to some extent significant differences at P ≤ 0.05 and ≤ 0.01. Baraka variety under untreated soils achieved 11.4 tons/ fed, soaring over the other tested sugarbeet varieties significantly at P ≤ 0.01. The second ranked variety in this contest was Monte Bianco (10.6 tons/fed) differed significantly at P ≤ 0.01 from the other tested varieties (H Poly, Lola and Ras Poly) which they recorded values around 10 tons / fed for each. The least value in this row went significantly to Samba variety (9.0 tons/ fed).

The interaction of varieties × Ethoprop distinctly revealed that there were significant differences among roots yield of the tested sugarbeet varieties except for Baraka and Samba that there was no significance between them at P ≤ 0.05 and they achieved the lowest roots yield values under nematicide treatment (19.5 and 19.7 tons roots / fed). The highest roots yield recorded for Ras Poly and Monte Bianco (22.7 and 22.1 ton/ fed, respectively). The overall mean of increase percentage in roots yield ton/ fed for treated plot was about 51%. Also, from Table (1) the findings of roots yield for Nubariya region indicated that there were some significant differences at P ≤ 0.05 and ≤ 0.01 among investigated sugarbeet varieties under free nematicide plots conditions, whereas, the highest roots yield value didn't exceed 8.5 tons/fed recorded for H Poly variety, and the lowest was for Samba variety (7.9 tons roots yield/

fed). The average roots yield for this untreated treatment was 8.2 tons/ fed compared with untreated plots. The status in nematicide, Ethoprop treated plots differed significantly, whereas, this average was 17.3 tons/ fed with increase percentage equal 52.5%. The most responded variety for the interaction of varieties × nematicide was H Poly as achieved 18.2 tons/ fed followed by Ras Poly variety (17.5 tons/ fed) with significance at $P \leq 0.01$. While the least response in this respect was Samba variety (16.8 tons/ fed) differed than the nearest value, 17.0 tons/ fed recorded with Monte Bianco variety at this contest with significance at just $P \leq 0.05$ (Table, 1).

3. Sugar yields tons per fed.:

In Ismailia region, recorded data for sugar yield (Table, 1) revealed that there was significant differences among the tested sugarbeet varieties that sown in the plots without nematicide application with significance at mostly $P \leq 0.01$. The higher value one in this regard was for Baraka variety (1.496 tons/ fed) and the lowest one (0.990) went to Lola variety. The overall average for sugar yields tons/ fed was 1.156 tons/ fed. While in nematicide, Ethoprop treated plots the overall average was 2.773 tons/ fed with increase percentage about 142.0 %. The varieties × nematicide, Ethoprop interaction distinguished among sugar yield of the tested sugarbeet varieties significantly at $P \leq 0.01$, whereas , the highest value of sugar yield (3.270 tons/ fed) was for Monte Bianco variety and the lowest went to Ras Poly (2.353 tons/ fed).

In Nubariya region, the same manner for sugar yield response of the tested varieties was noticed (Table, 1), Samba and Ras Poly varieties recorded the highest values under absent of nematicide (0.987 and 0.882 tons sugar yield/ fed, respectively) differed significantly at $P \leq 0.01$ from the other tested sugarbeet varieties in the same treatment. While, Baraka and Monte Bianco varieties, recorded the lowest values as 0.845 and 0.861 tons sugar yield / fed, respectively without significant differences between them. The other tested varieties, distinguished significantly at $P \leq 0.01$ of each other. The most affected variety by the interaction of varieties × Ethoprop application was H Poly which recorded 2.842 tons sugar yield/ fed differing at $P \leq 0.01$ than Baraka (2.731 tons/ fed). Whereas, Lola and Ras Poly varieties (2.453 and 2.446 tons/fed, respectively) were at the same significance and differed at $P \leq 0.01$ from Samba and Monte Bianco varieties (2.611 and 2.593 tons, respectively) which they were at the same level of significance.

Effect of sugarbeet varieties and nematicide Ethoprop (Mocap) on yield quality characters

1. Total Soluble Solids percentage (T.S.S %):

The combined analysis of the data showed in Table (2) indicated that there were significant differences ($P \leq 0.05$ and ≤ 0.01) among the most sugarbeet varieties at both treated and untreated plots for T.S.S. %. In untreated plots of Ismailia experiments, the highest T.S.S% values achieved by Baraka variety (20.0 %) and the lowest one recorded by Samba variety (15.8 %). This may reflects the potentiality of the varieties under contaminated soil with Root-knot nematode and Fusarium rot-welt diseases. The same trend of indefinite significance of differences at $P \leq 0.05$ and ≤ 0.01 in untreated plots in Nubariya experiments, as, the Lola variety had the highest value of T.S.S. % (20.6) and lowest value (18.8) was for Baraka variety and this may reflects the different response of sugarbeet varieties as location varies.

In treated plots by Ethoprop, as an indication for the interaction among variety, Ethoprop and location (i.e. physical, chemical characteristics and degree & type of infestation), the combined analysis of the data pointed out that Monte Bianco variety was superior under nematicide application in both localities (Ismailia and Nubariya) whereas, recorded 22.4 and 22.2 %, respectively. This illustrates the stability of this variety response. Oppositely, the unstable responses to the varieties × Ethoprop interaction were due to other tested sugarbeet varieties. Whereas, they varied in their responses under the various treatments and under the same treatment laid in different locations.

2. Sucrose percentage:

Data in Table (2) revealed that sucrose % was the most affected by Ethoprop treatment, whereas, there were significant differences (P ≤0.05 and ≤0.01) between treated and untreated plots. Under untreated plots, Baraka variety was superior as it recorded 16.2 % sucrose and the lowest percentage was for Lola variety (14.0) in Ismailia region. While, in Nubariya region under nematicide, Ethoprop free plots the superior sugarbeet variety was Samba variety (15.4 % sucrose) and the lowest was for Baraka variety (14.0 %), i.e. there is no lead for a specific variety to exhibit a stable response under soil infestation by Root-knot nematode and Fusarium rot-welt diseases.

Treated plots in both studied regions, Ismailia and Nubariya, the six tested sugarbeet varieties attained average percentage of increase in sucrose % as 13.5 and 16.2, respectively than the untreated plots. Monte Bianco variety was superior for sucrose % under nematicide application in both localities (Ismailia and Nubariya) whereas, recorded 18.2 and 28.4 %, respectively. Also, this demonstrates the stability of this variety positive response as sucrose % for the interaction of Ethoprop × variety. On the other hand, the rest of tested sugarbeet varieties under in furrow Ethoprop application didn't show stable response in this regard as Lola variety had the lowest sucrose % (16.2) in Ismailia, while, Ras Poly recorded the lowest value (16.8) in Nubariya region.

3. Purity percentage:

The values of juice purity % for the tested sugarbeet varieties illustrated in Table (3) figured out the significant differences (P ≤0.05 and ≤0.01) among varieties in the same treatment, across treatments and across locations. The highest purity in the free Ethoprop plots was achieved by Samba variety (89.9 and 81.1 %) in Ismailia and Nubariya, respectively. This reflects the stability of Samba variety for this character (purity %) under unhealed soil in different localities. But, by in Ethoprop treatment where there was interaction with the varieties, the stability didn't show up whereas, in Ismailia the lead was for Samba variety (with an average purity%, 93.1 5%) while it was for Baraka variety (with an average purity%, 88.2 %) in Nubariya region.

Anyhow, there was significant enhancement (P ≤0.05 and ≤0.01) took place in purity % character for the all tested sugarbeet varieties in plots received Ethoprop in both experimental localities (Ismailia and Nubariya) as they were 5.9 and 10.7 %, respectively.

Effect of sugarbeet varieties and nematicide, Ethoprop (Mocap) on root-knot nematodes:

1. Number of galls per root system:

Data in Table (3) represented that numbers of galls/root system among varieties and between treatments were similar in Ismailia and Nubariya regions. In untreated plots in both Ismailia or Nubariya locality there were significant differences (P ≤0.01) among sugarbeet varieties, whereas, the highest galls number/ roots system was for Monte Bianco (113 galls / roots) and Baraka (100 galls/ roots) in Ismailia and Nubariya regions, respectively and the lowest record for this parameter was for Ras Poly variety in both localities where it had 63 and 59 galls/ roots in Ismailia and Nubariya regions, respectively, hence, this variety proved stability under root-knot nematodes soil contamination.

The sugarbeet varieties × Ethoprop interaction effect was significant in both experimental localities. The most affected variety in this respect was H poly which had one gall/ root system with reduction % in galls number equal 98.5% in Ismailia region. While, the most affected variety in Nubariya region was Lola which boasted 3 galls/ roots system with reduction % came to 96.4%. The overall mean reduction% in Ethoprop application for galls number/ root system at both Ismailia and Nubariya regions was typical (92%), this reflects the consistency of the Ethoprop application effect on roots-knot diseases development.

Table (2): Effect of sugarbeet varieties and nematicide, Ethoprop (Mocap) on yield quality characters at Ismailia and Nubariya fields that subjected to root-knot nematode–*Fusarium* Wilt complex disease by combined analysis between two seasons of 2009/2010 – 2010/2011.

Quality characters Vs. treatments			Sugarbeet varieties						Mean	L. S.D at 0.05 / 0.01
			Baraka	H Poly	Lola	Monte Bianco	Ras Poly	Samba		
Total Soluble Solids% (T.S.S%)	Ismailia	Untreated	20.0	19.8	19.	19.6	19.2	15.8	19.0	0.20 0.26
		Treated	20.2	22.0	20.4	22.4	22.0	17.4	20.7	0.22 0.28
		Increase%	1.0	10.0	2.9	12.5	12.7	9.2	8.1	
	Nubariya	Untreated	18.8	20.0	20.6	20.0	19.0	19.0	19.6	0.21 0.27
		Treated	20.4	21.2	21.6	22.2	20.2	20.4	21.0	0.23 0.29
		Increase%	7.8	5.7	4.6	9.9	5.9	6.9	6.8	
Sucrose %	Ismailia	Untreated	16.2	14.2	14.0	14.8	14.6	14.2	14.7	0.16 0.20
		Treated	17.0	17.2	16.0	18.2	17.2	16.2	17.0	0.19 0.23
		Increase%	4.7	17.4	12.5	18.7	15.1	12.3	13.5	
	Nubariya	Untreated	14.0	15.0	15.0	14.4	15.0	15.4	14.8	0.17 0.20
		Treated	18.0	18.2	17.6	18.4	16.8	17.8	17.8	0.20 0.24
		Increase%	22.2	17.6	14.8	21.7	10.7	10.2	16.2	
Purity %	Ismailia	Untreated	81.0	71.7	70.7	75.5	76.0	89.9	77.5	0.87 1.04
		Treated	84.2	78.2	78.4	81.3	78.2	93.1	82.2	0.92 1.10
		Increase%	3.8	8.3	9.8	7.1	2.7	3.5	5.9	
	Nubariya	Untreated	74.5	75.0	72.8	72.0	78.9	81.1	75.7	0.85 1.01
		Treated	88.2	85.8	81.5	82.9	83.2	87.3	84.8	0.95 1.13
		Increase%	15.6	12.6	10.6	13.1	5.1	7.1	10.7	

Values are averages of four replicates.
Mocap 10G applied at 1.2 kg a.i. /fed at planting.
Means different according to Duncan's new multiple range test (P = 0.05).
Means significantly different at P = 0.01.

Table (3): Effect of sugarbeet varieties and nematicide, Ethoprop (Mocap) on nematodes severity at Ismailia and Nubariya fields that subjected to root-knot nematode–*Fusarium* Wilt complex disease by combined analysis between two seasons of 2009/2010 – 2010/2011.

Nematodes severity Vs treatments			Sugarbeet varieties						Mean	L. S.D at 0.05 0.01
			Baraka	H Poly	Lola	Monte Bianco	Ras Poly	Samba		
No. of galls/roots system	Ismailia	Untreated	83	66	96	113	63	85	84	0.94 1.12
		Treated	3	1	5	13	7	11	7	0.08 0.09
		Reduction%	96.4	98.5	94.8	88.5	88.9	87.1	92	
	Nubariya	Untreated	100	71	83	93	59	69	79	0.98 1.02
		Treated	7	5	3	9	5	7	6	0.07 0.08
		Reduction%	93.0	93.0	96.4	90.3	91.5	89.9	92	
Roots gall rating	Ismailia	Untreated	4	4	4	5	4	4	4.2	0.05 0.06
		Treated	2	1	2	3	2	3	2.2	0.02 0.03
		Reduction%	50.0	75.0	50.0	40.0	50.0	75.0	56.7	
	Nubariya	Untreated	4	4	4	4	4	4	4	0.04 0.05
		Treated	2	2	2	2	2	2	2	ns
		Reduction%	50.0	50.0	50.0	50.0	50.0	50.0	50.0	
No. of egg-masses/ roots system	Ismailia	Untreated	63	45	55	61	55	45	54	0.54 0.68
		Treated	3	2	3	2	1	1	2	0.02 0.03
		Reduction%	95.2	95.6	94.5	96.7	98.2	97.8	96	
	Nubariya	Untreated	56	61	49	53	48	51	53	0.53 0.80
		Treated	1	2	1	3	1	2	2	0.02 0.03
		Reduction%	98.2	96.7	98.0	94.3	97.9	96.1	97	
No. of eggs/egg-mass	Ismailia	Untreated	158	133	174	111	169	129	145.7	1.46 2.19
		Treated	74	105	99	103	98	93	95.3	0.95 1.43
		Reduction%	53.2	21.1	43.1	7.2	42.0	27.9	32.4	
	Nubariya	Untreated	189	163	187	163	185	179	177.7	1.77 2.67
		Treated	63	55	89	76	63	75	70.2	0.70 1.05
		Reduction%	66.7	66.3	52.4	53.4	65.9	58.1	60.5	

Values are averages of four replicates.
Roots gall rating on a scale of 0 to 5: 0 = no roots galling, 5 = severe roots galling.
Mocap 10 G applied at 1.20 kg a.i. /fed at planting.
Root-knot severity was assessed as roots galling as follows: 0 = no galls; 1 = 1 to 2 galls; 2 = 3 to 10 galls; 3 = 11 to 30 galls; 4 = 31 to 100 galls; and 5 = >100 galls per roots system.
Means different according to Duncan's new multiple range test (P = 0.05).
Means significantly different at P = 0.01

2. Roots gall rating:

Since roots gall rating is an index deals with ranges of numbers to express them as a simple figures didn't exceed five degrees, the combined analysis of variance for gall rating data of the two seasons in Table (3) showed that there are some significance differences (P ≤0.01) for some varieties × Ethoprop interaction appeared in Ismailia but didn't show up in Nubariya region in both treated or non treated plots at P≤0.05. Generally, in Ismailia and Nubariya, gall ratings were 56.7 and 50.0%, respectively, in the Ethoprop plots.

3. Number of egg-masses per root system:

Egg-masses development on roots system of the sugarbeet varieties is taken as scale among others to assess the response to the tested treatments; the combined analysis of variance for this parameter proved that there is similar response among sugarbeet varieties under either Ethoprop or free Ethoprop plots. But, in furrow Ethoprop application suppression had been happened for egg-masses development on roots system in both localities. Whereas, the overall means of reduction% were 96 and 97% in egg-masses numbers of Ethoprop at Ismailia and Nubariya regions, respectively. Although, there was significant difference (P ≤0.05 and ≤0.01) among varieties the potentiality of the effect on this parameter was due to Ethoprop application (Table, 3).

4. Number of eggs per egg-mass:

Combined analysis for the two seasons records of eggs/egg-mass showed in Table (3) indicated that there was significant difference (P ≤0.01) among sugarbeet varieties in both tested localities and/or between treatments (with and without Ethoprop). The least varieties with egg-mass implied lesser average number of eggs was Monte Bianco variety (111 eggs/ egg-mass) in the untreated plots of Ismailia and Nubariya (163 eggs/ egg-mass) plus H Poly in Nubariya untreated plots with the same previous value (163), i.e. there is constancy for Monte Bianco variety in this character. On the other hand, the most varieties with high number of eggs/ egg-mass was Lola variety (174 eggs/ egg-mass) in Ismailia and Baraka followed by Lola (189 and 187 eggs/ egg-mass, respectively), without significant difference (P ≤0.01), that, Lola variety harbor egg- mass with high number of eggs under the two tested localities.

Nematicide, Ethoprop application reduced number of eggs/ egg-mass by 32.4 and 70.2 % in Ismailia and Nubariya regions, respectively, i.e. the effect of varieties Ethoprop application interaction was higher on this parameter in Nubariya region.

5. Numbers of nematodes stages:

5.1. Number of juveniles per plant:

Distinctly, combined analysis of variance for the number of juveniles/ plant (Table, 4), proved significant difference (P≤ 0.01) among the tested sugarbeet varieties which them all harbored relatively high numbers of nematode's juveniles that was under untreated plots in both experimental localities. But, Ethoprop plots had great reduction in the number of juveniles/ plant with percentages of 99.3 and 99.5 % as overall mean for Ismailia and Nubariya region, respectively. The Ras Poly variety was the most steady one as affected by in furrow Ethoprop × varieties interaction, whereas, it recorded 2 juveniles/ plant in the two tested regions.

5.2. Number of juvenile per 200 g soil:

The same manner of previous parameter had been noticed where the number of juveniles/ 200 g soil (beneath each tested variety) was relatively high for all tested varieties in the free Ethoprop plots, that made existence of significance differences among sugarbeet varieties lost its importance. Application of nematicide, Ethoprop efficiently reduced the number of juveniles/ 200 g soil across the two successive seasons, for all tested sugarbeet varieties and across the two experimental locations as the overall mean reductions % were 98.8 and 99.8 % in Ismailia and Nubariya regions, orderly (Table, 4).

Table (4): Effect of sugarbeet varieties and nematicide, Ethoprop (Mocap) on numbers of nematodes stages at Ismailia and Nubariya fields that subjected to root-knot nematode–*Fusarium* Wilt complex disease by combined analysis between two seasons of 2009/2010 – 2010/2011.

Nematodes parameters Vs. treatments			Sugarbeet varieties: Baraka	H Poly	Lola	Monte Bianco	Ras Poly	Samba	Mean	L. S.D at 0.05 0.01
No. of juveniles/ plant	Ismailia	Untreated	532	412	601	463	562	591	526.8	5.25 7.88
		Treated	3	2	3	5	4	6	3.8	0.04 0.06
		Reduction%	99.4	99.5	99.5	98.9	99.3	99.0	99.3	
	Nubariya	Untreated	611	501	511	536	451	573	530.5	5.58 8.38
		Treated	3	2	3	4	2	3	2.8	0.03 0.04
		Reduction%	99.5	99.6	99.4	99.3	99.6	99.5	99.5	
No. of juveniles/ 200 g soil	Ismailia	Untreated	1064	902	777	819	893	773	871.3	9.34 12.54
		Treated	13	10	9	11	7	5	9.2	0.10 0.20
		Reduction%	98.8	98.9	98.8	98.7	99.2	99.4	98.9	
	Nubariya	Untreated	2013	1754	1546	1850	1931	1645	1789.8	19.18 25.57
		Treated	3	2	3	5	3	3	3.2	0.03 0.05
		Reduction%	99.9	99.9	99.8	99.7	99.8	99.8	99.8	
No. of mature females/ roots system	Ismailia	Untreated	93	75	56	81	45	55	67.5	0.63 1.05
		Treated	3	1	2	4	2	2	2.3	0.02 0.04
		Reduction%	96.8	98.7	96.4	95.1	95.6	96.4	96.5	
	Nubariya	Untreated	96	63	71	103	56	45	72.3	0.63 1.26
		Treated	2	3	3	3	1	2	2.3	0.02 0.04
		Reduction%	97.9	95.2	95.8	97.1	98.2	95.6	96.8	

Values are averages of four replicates.
Mocap 10G applied at 1.2 kg a.i. /fed at planting.
Means different according to Duncan's new multiple range test (P = 0.05).
Means significantly different at P = 0.01.

5.3. Number of mature females per root system:

Although, from interpreting Table (4) there were significant differences (P≤ 0.01) among sugarbeet varieties concerning number of mature females/ root system in untreated plots which had relatively high numbers ranged from 45 – 103 or/and in Ethoprop treated plots which had hardly detectable numbers of mature female (ranged from 1 – 3) in the two experienced locations. Thus, the important issue in this concern is observable impact of Ethoprop application on the massive reduction which was around 96% reduction of mature females' number/ roots system over the two locations across the two studied seasons.

5.4. Nematodes build-up:

When the land is planted to a suitable crop for the nematodes like sugarbeet, the eggs hatch and new populations of nematodes build up in the soil. Each succeeding year, if conditions are favorable, many more eggs are present, spreading the nematode population in ever-widening circles. Thus, nematodes build-up is an important parameter to assess the efficacy of any control measures. The combined analysis of variance for the two seasons data presented in Table (5) showed that there are significant differences (P ≤0.05 and ≤0.01) among sugarbeet varieties for their suitability to sustain root-knot nematode build up under free Ethoprop. The same trend was observed in the two experienced localities, but, the build-up rate was higher significantly (P≤ 0.01) in Nubariya region with an average of 11.3 where it was 8.1 for Ismailia.

Nematicide, Ethoprop application × varieties interaction affected root-knot nematode build-up sharply, whereas, it didn't exceed 0.1 in Ismailia with reduction 98.8 % and 0.04 build-up equal 99.6 % reduction.

Table (5): Effect of sugarbeet varieties and nematicide, Ethoprop (Mocap) on nematodes build-up at Ismailia and Nubariya fields that subjected to root-knot nematode–*Fusarium* Wilt complex by combined analysis between two seasons of 2009/2010 – 2010/2011.

Build-up Vs. and Treatments			Sugarbeet varieties						Mean	L. S.D at 0.05 0.01
			Baraka	H Poly	Lola	Monte Bianco	Ras Poly	Samba		
Build up (Pf/Pi)	Ismailia	Untreated	9.4	7.7	8	7.6	8.1	7.9	8.1	0.08 0.12
		Treated	0.1	0.1	0.1	0.1	0.1	0.1	0.1	ns
		Reduction%	98.9	98.7	98.8	98.7	98.8	98.7	98.8	
	Nubariya	Untreated	12.8	10.9	10	11.7	11.5	10.7	11.3	0.11 0.17
		Treated	0.04	0.03	0.04	0.06	0.03	0.04	0.04	ns
		Reduction%	99.7	99.7	99.6	99.5	99.7	99.6	99.6	

Values are averages of four replicates.
Mocap 10G applied at 1.2 kg a.i. /fed at planting.
Means different according to Duncan's new multiple range test (*P* = 0.05).
Means significantly different at *P* = 0.01.
Pi for Root-knot nematode in Ismailia was 180 juvenile/200 g soil
Pi for Root-knot nematode in Nubariya was 212 juvenile/200 g soil
Build up = (Pf/Pi)
Average Pi for the two successive seasons was 180 J^2 for Ismailia and 212 J^2/200 g soil for Nubariya

Effect of sugarbeet varieties and nematicide, Ethoprop (Mocap) on *Fusarium* wilt severity:

Although mean wilt ratings in sugarbeet roots were a little higher in Ismailia locality than Nubariya (2.4 and 2.3, respectively), the results were similar (Table 6). The highest wilt ratings were 2.7 in both localities. In Ismailia and Nubariya regions, wilt ratings were 76.3 and 84.3% lower, respectively, in the Ethoprop plots. Wilt ratings were different among cultivars in both localities (P≤ 0.01), but the interaction between sugarbeet varieties and treatments was significant either location (*P* = 0.05) but, most varieties were similar in pairs. In Ismailia, Baraka and H Poly had zero wilt rating. While in Nubariya region, H Poly only had the zero wilt ratings followed by Baraka and Monte Bianco varieties which had 0.3 wilt rating. That meant these two varieties were the most benefited from Ethoprop application × varieties interaction wilt ratings than the other cultivars. *Fusarium oxysporum* was consistently recovered from stem sections displaying vascular discoloration.

DISCUSSION

Nematicide, Ethoprop is an organophosphate nematicide (Mocap 10G, Bayer cropscience LP), is a nonsystemic insecticide/nematicide. The mobility of Ethoprop in soil and its half-life are strongly dependent on soil organic matter (Norris *et al.,* 1988). It is was applied at planting in the seed furrow at 1.2 kg a.i. per Fed i.e., 12 kg/fed., this dosage was determined as experienced by Nubariya Sugar Crops Research Unit through Integrated Control of Sugarbeet Nematode Project funded from Sugar Crops Council. It was applied and proved high efficiency in the infested sugarbeet field with rate ranged from 10-12 kg/fed.

Table (6): Effect of sugarbeet varieties and nematicide, Ethoprop (Mocap) on *Fusarium* wilt severity ratings by combined analysis between two seasons of 2009/2010 – 2010/2011.

Fusarium wilt severity vs. treatments			Sugarbeet varieties						Mean	L. S.D at 0.05 0.01
			Baraka	H Poly	Lola	Monte Bianco	Ras Poly	Samba		
Welt rating	Ismailia	Untreated	2.7	2.1	2.3	3	2.3	2	2.4	0.02 0.04
		Treated	0	0	1	1	0.7	0.7	0.6	0.005 0.010
		Reduction%	100.0	100.0	56.5	66.7	69.6	65.0	76.3	
	Nubariya	Untreated	2.2	1.7	2.3	2.7	2.7	2.3	2.3	0.02 0.04
		Treated	0.3	0	0.7	0.3	0.7	0.3	0.4	0.003 0.007
		Reduction%	86.4	100.0	69.6	88.9	74.1	87.0	84.3	

Values are averages of four replicates.
Mocap 10G applied at 1.2 kg a.i. /fed at planting.
Means different according to Duncan's new multiple range test (*P* = 0.05).
Means significantly different at *P* = 0.01.
Wilt rating on a scale of 0 to 5: 0 = no vascular discoloration, 5 = entire vascular ring discolored.
Mocap 10G applied at 1.2 kg a.i./ha in-furrow at planting.
Fusarium wilt severity was based on vascular stem discoloration as follows: 0 = no vascular discoloration; 1 = <10%; 2 = 11 to 25%; 3 = 26 to 50%; 4 = 51 to 75%; and 5 = >75% of the vascular tissue discolored.

The relative effects of in-furrow treatments and varieties on the rate of survival plants and roots yields/ fed were similar as a trend in both locations, but, in Ismailia the two mentioned parameters were higher than in Nubariya where they were 18735 and 20.7 against 16342 plants and 17.3 7 ton roots/ fed in Nubariya. Sugar yield/ fed was lower in Ismailia than in Nubariya (3.505 and 3.977 tons/fed., respectively) due to extremely dry conditions of the second location. Thus, beside as mentioned previously in the Materials and Methods on describing experimental localities, Ismailia was much richer in its chemical and physical characteristics. Whereas, Nubariya had distinctly lower percent of organic matter %, had relatively lower soluble cations and anions, and had relatively lower low N, P and K than Ismailia locality. So that, the in furrow Ethoprop application × varieties interaction had more positive influences on all studied parameters both of main yield components or/and quality characters as rat e of survival, roots yield Ton/ fed. And total soluble solids (T.S.S), except for sugar yield Ton / fed., sucrose % and purity % the positive effect on them was in Nubariya locality. Organic matter is one of the most important components of soil (Magdoff, 1992). Many of the soil's biological, physical, and chemical properties are a function of soil organic matter. Organic matter has many benefits including increasing plant nutrient availability, providing a favorable physical condition for plant growth, increasing soil buffering capacity, stimulating roots development, increasing biological diversity, and facilitating a number of global cycles such as carbon and nitrogen. As soil organic matter decreases, it becomes more difficult to grow plants because problems of fertility, water availability, compaction, erosion, disease, and insects become more common. This requires higher levels of fertilizers, irrigation water, and pesticides to maintain yields (Abawi and Widmer 2000).

The application of Ethoprop improved sugar yield in both locations across the two studied seasons and sucrose percentage and reduced the severity of the root-knot nematode–Fusarium wilt disease complex in both localities. Other researchers have improved cotton yields and reduced roots galling caused by the root-knot nematode with the application of nematicides (Kirkpatrick 1994). The ability of Ethoprop to reduce the severity of the root-knot nematode–Fusarium wilt disease complex in this study is probably related to its impact on numbers of *M. incognita*, which were reduced at the beginning of experiment after application of nematicide, Ethoprop at both locations. It has been demonstrated previously that management of root-knot nematodes reduces the severity of Fusarium wilt (Kappelman and Sappenfield, 1973; Martin *et, al,* 1956 and Minton and Minton, 1966).

Sugar beet varieties differ in yield potential and qualities. Some of the observed differences in sugar yield, T.S.S. %, sucrose% and purity% among sugarbeet varieties may have been the result of differences in yield potential among cultivars (Stevens *et al.* 2008 Tsialtas and Maslaris, 2012), whereas, others may have been the result of different levels of resistance to the root-knot nematode (Maareg *et al.,*2005; Gohar and Maareg, 2009; Maareg *et al*, 2009; Saleh *et. al*., 2009 and EL-Sayed, 2009) whom found in their investigations that Computed damage index classified the screened numerous sugarbeet genotypes for their susceptibility to root-knot nematode into four categories which were highly susceptible, susceptible, moderate resistant and resistant. The same hypothesis could be also applied on *Fusarium* wilt disease, whereas, some isolates are specific only to sugarbeet varieties which vary in their response to this fungus while other isolates can cause disease in other plants in the family *Chenopodiaceous*, such as spinach and red roots pigweed (Jacobsen, 2005).

From the many studies on nematode and fungal epidemiology, it seems highly reasonable that additional environmental factors such as soil pH (Rupe *et al*., 1999), soil moisture and meteorological conditions (Robinson *et al*., 1987) will also be linked to the development of a disease complex, depending on the organisms involved. Some studies showed that the *Meloidogyne incognita- Fusarium oxysporum* disease complex can cause severe yield losses in *some* crops. Chemicals viz. carbofuran and bavistin showed a significant effect in increase of growth parameters, (i.e., yield) and in suppression of the disease complex of green gram, *Vigna radiata* (Haseeb et *al* 2005.).

Fusarium roots rot, caused by *F. oxysporum* f.sp. *radis-betae*, has been observed in sugarbeet producing areas (France *et al*., 2001). It has likely been overlooked because it often occurs as part of a complex with other roots diseases. The disease complex often reduces sugarbeet yields; losses include reduced harvestable tonnage and reduced white sugar recovery. Many of these pathogens also cause post harvest losses in storage piles.

As mentioned in the introduction, this study was directed to producing areas with low sugarbeet production, this can be noticed from average reduced harvestable tonnage (around 10 tons roots/fed.) in the untreated plots at both experimental localities of Ismailia and Nubariya. Whereas, the overall mean in the untreated plots was 9.2 tons roots / fed while, it was 19.0 tons/fed inside the Ethoprop plots with an average increase 51.6 % (deduced from Table, 1).

Conclusion and recommendation

- The application of Ethoprop at planting reduced the severity of the roots knot nematode–Fusarium wilt complex in sugarbeet and maintained good rate of survival plants/fed**.,** this consequently improved roots yield, sucrose percentage, and sugar yield.
- Although some of these improvements may be related to yield potential among varieties, it is apparent that the reduction in the disease complex was also involved.
- The average roots yield per fed of the treated plots (19.0 tons/fed) is around the normal known production even better than a little.
- The corresponding cost of Ethoprop application (price of Ethoprop + labor) was about 800 L.E. /fed, while, the increase in roots yield equaled about 10 ton/fed., its expected return is about 2500 L.E., i.e. the net return for this increase is about 1700 L.E., allowing producers have potential in gross returns per fed, allowing for potential of additional production increase.
- More thorough investigation of the contribution of reducing nematode population density with nematicides to the overall severity of the root-knot nematode–Fusarium wilt disease complex may allow more cost-effective management strategies to be developed.
- Monte Bianco followed by H Poly variety the most suitable for poor production areas in Ismailia. While, Barak sugar beet followed by Monte Bianco then H Poly variety are best suited for the Nubariya under the same conditions.

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تأثير بعض أصناف بنجر السكر والمبيد النيماتودي إيثوبروب (موكاب) على المرض المركب لنيماتودا تعقد الجذور والذبول الفيوزاريومي في حقول بنجر السكر بالإسماعيلية والنوبارية

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الملخص العربي

تم إجراء تجربتين في منطقتي الإسماعيلية والنوبارية خلال موسمي 2010/2009 – 2011/2010 لقييم تأثير ستة أصناف من بنجر السكر مع أو بدون تطبيق مبيد النيماتودا إيثوبروب على شدة الإصابة بالمرض المركب تعقد الجذور والذبول الفيوزاريومي في حقول بنجر السكر المنخفضة الإنتاجية. تم استخدام تصميم القطع المنشقة مرة واحدة حيث كانت الإصناف في القطع الرئيسة ومعاملات المبيد في القطع الفرعية. وقد تشابهت منطقتي الدراسة في اتجاه النتائج، حيث أعطى استخدام المبيد النيماتودي مع بعض أصناف بنجر السكر المختبرة (بركة ولولا وسامبا) أعلى كثافة نباتية مقارنةً بالغير معاملبالمبيد وكان أهم النتائج المتحصل عليها:

- المتوسط العام لنسبة الزيادة في محصول الجذورالمعاملة 51% مقارنةً بغير المعاملة.
- حقق الصنف "لولا" المعامل أعلى قيمة لمحصول السكر (3.993 طن/فدان) بينماحقق الصنف بركة الغير معامل أقل قيمة (0.958 طن/فدان).
- سجل الصنف "لولا" المعامل أعلى نسبة مئوية للمواد الصلبة الذائبة الكلية في العصير (20.6% .T.S.S).
- سجلت الأصناف المعاملة في المنطقتين زيادة في متوسط النسبة المئوية للسكروز عن الغي معامل وكان أعلاها الصنف "مونت بيانكو". كما كان هناك تحسن معنويفي نسبة النقاوة للأصناف المعاملة.
- ارتبط الانخفاض في عدد التعقدات/جذر ودرجة التعقد وعدد كتل البيض/جذر وعدد البيض/كتلة بيض وكذلك انخفاض عدد اليرقات/نبات وعدد اليرقات/200 جم تربة وعدد الإناث الناضجة/جذر بالقطع التجريبية المعاملة بالمبيد النيماتودي. وكان الصنف "راس بولي" الأكثر ثباتاً من حيث تأثره بمعاملة المبيد وسجل 2 يرقة/نبات في كلا المنطقتين.
- الصنفان "بركة" و"أتش بولي" كانا الأكثر استفادة من معاملة المبيد من حيث خفض شدة الإصابة بالذبول الفيوزاريومي مقارنةً بباقي الإصناف المعاملة .
- أدى تطبيق المبيد النيماتودي إيثوبروب عند الزلراعة إلى خفض شدة الإصابة بالمرض المركب تعقد الجذور والذبول الفيوزاريومي لنبات بنجر السكر والمحافظة على معدل جيد لعدد النباتات/فدان، مما ترتب عليه تحسن في محصول الجذور والسكر ونسبة السكروز.

<u>التوصية:</u> بناء على ان محصول السكر هو منتوج محصول الجذور مضروباً في نسبة السكروز مضروباً في النسبة المئوية للنقاوة، تعتبر الزيادة فيه المؤشر الأمثل لتحسن محصول بنجر السكر استجابةً لعملية مكافحة النيماتودا في حقول بنجر السكر، وعلى هذا الأساس تعتبر النسبة المئوية للزيادة في محصول السكر هي المقياس على مدى ملائمة الصنف واستجابته لعملية المكافحة ولذا يعتبر الصنف مونت بيانكو يليه الصنف اتش بولي هما الصنفان الاكثر ملائمة لمناطق الاسماعيلية ضعيفة الانتاج ويعتبر الصنف بركة يليه الصنف مونت بيانكو ثم الصنف اتش بولي هم الانسب لمنطقة النوبارية تحت نفس الظروف اي ان كل من الصنفين مونت بيانكو واتش بولي يناسبان كل من الاسماعيلية والنوبارية.