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Effect of some Preceding Crops on Sugar Beet Productivity and its Relationship with Phyto-Nematodes Infestation

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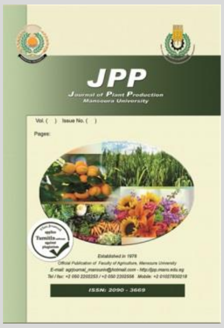

ABSTRACT

Two investigate field experiments the effect of four preceding crops (maize, sunflower, sesame and soybean) on growth and yield of sugar beet and the effect of the remnants of the previous crop of roots, leaves and stems residues on the root nematodes of sugar beet were carried out at Mallawi Agricultural Research Station, Minia Governorate, ARC, during two successive winter seasons 2016/2017 and 2017/2018 in a highly and naturally infested field with nematode. The result showed that the highest roots yield were recorded when sugar beet planting in place of soybean roots (37.98 ton/fad) followed by planting sugar beet in place of all sesame crop residues (36.89 ton/fad).Planting sugar beet in place of maize crop roots only or all residue where recorded minimum sugar beet roots (25.07 and 26.93 ton /fad), respectively. Highest sugar yield were observed when planting sugar beet in place of soybean crop roots only or sugar beet in place of all soybean crop residues(5.84 &5.08 ton/fad), respectively). The lowest value of surviving plants % were obtained when sugar beet planting in fallow lands (control) and planting sugar beet in place of maize crops roots only and all residues (68.39,68.45& 69.89%)respectively. It could be summarized that the redoes of the crop was to the loses a large number of tubers due to infection and death by plant nematodes. Sowing sugar beet revealed some increment in all nematode genera numbers that recorded the lowest number from sugar beet planted in the place of all sesame crop residues.

Keywords:, preceding crop, root Knot nematodes, residues, crop rotation, phyto- nematodes and root residue.

INTRODUCTION

Sugar beet (*Beta vulgaris L.*) is considered an important sugar crop in Egypt and the world. It is specialized as a short duration crop, where its growth period is about half that of sugarcane. Furthermore, sugar beet requires less water, which a kilogram of sugar requires about 1.4m^3 and 4.0 m^3 water to be produced by sugar beet and sugar cane, respectively and it is highly infested by Meloidogyne incognita. This nematode causes damage to epidermis, cortex and stele regions including giant cells in these regions, then reflect on the water and nutrient absorption. As a result, sugar beet produces a decline s of crop to lose a large number of tubers due to infection and death with plant nematodes. In addition, plant wastes affect the environment and are disposed of by cutting and chopping by the threshing machine and incorporated into soil as organic fertilizer to decompose in the soil and reduce the incidence of plant nematodes. Burning crop residues causing damage to humans and animals. (Sohier, Ouda, 2001*).*

Crop rotation is one of the most important agronomic strategies in designing sustainable farming.

Crop rotation is the simplest and cheapest method of manipulating (SCN) sugar beet cyst nematode populations. It is easier to in statute system of crop rotation for narrow host range species of nematode such as SCN. To reduce the SCN population, sugar beets should be rotated with non host crops such as grain, corn, onions, potatoes, alfalfa, mint, or beans for various lengths of time depending on nematode infestation levels. Crop rotation including legumes is one of the best alternatives for plant nutrient management which is environmentally safe and can efficiently reduce the fertilizer consumption in the developing countries. It is one of the effective tools for nutrient recycling and nitrogen fixation, which accelerate the microbial activity of the soil having the change in root physiology and interactions, better nutrient availability and higher crop yield (Deumelandt *et. al.*, 2010;Pokhrel and Pokhrel, 2013;Abdel-Galil *et. al.*,2014;Stein and Steinmann2018).

Agronomic measures have to be optimized to control disease and minimize yield and quality loss, because no fungicides can be applied. Resistant sugar beet cultivars have been introduced to reduce disease occurrence.

Furthermore, crop rotation can influence *R. solanioc currence*. In contrast to other cereals, maize serves as a host of the fungus. Sugar beet cultivar and crop rotation had the main impact on disease severity and sugar yield. With increasing proportion of maize, sugar yield decreased, whereas cultivation method had only a minor impact. Plowing directly before sugar beet increased sugar yield only within the unfavorable maize-maize-sugar beet rotation compared with mulching. *(*Rupple and Hecker, 1994;, Buhre *et. al.*, 2009; Cord and Christian, 2009 and Gehan Amin *et. al.*, 2013*).*

Repeated measurements of canopy development and leaf color during the growing season revealed a higher

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N-availability after pea as preceding crop. However, decreased growth after maize was not completely compensated for by high N-fertilizer doses. Overall, the causes for the differences in sugar yield between the preceding crops remained open. The results do not support concerns about sub stantial yield losses in sugar beet production due to a reduction in the cropping interval from 3 to 2 years. Nevertheless, short rotations with maize and sugar beet might increase the risk of *Rhizoctonia solani* crown and root rot infestation. Leguminous crops such as pea offer the potential for higher sugar beet yield with lower N-fertilizer doses (Heinz-Josef *et. al.,* 2018). Sugar beets following alfalfa had the highest incidence of disease, losing 47% of the stand to root rot. Sugar beets on sorghum and winter wheat ground followed with 41 and 38% stand losses, respectively. Sugar beets preceded by cotton, fallow, and sunflower all had significantly less disease, with 32, 22, and 21% losses, respectively. By season's end, sugar beets preceded by wheat, sorghum, or alfalfa had 84, 81, or 48% stand losses, respectively. Cotton, fallow, and sunflower were again best for preceding sugar beets, with 30, 22, and 19% stand losses, respectively. Sugar beets grown on previously fallow ground had significantly greater root yields than all other treatments except sunflower. Root yields of sugar beets following winter wheat and sorghum were low. However, in both years' percent sucrose was highest in sugar beets following wheat. Although previous crops affected yield and root disease development in the subsequent sugar beet crop *(*Rush and Winter 1990; Coulter *et. al.,* 2011and Holguin *et. al.,* 2015).

Plant residues from crop residues effect as organic fertilizers in terms of utilization of plants after decomposition in soil. Organic manure improves soil physical properties that may enhance plant growth and reduce nematode infection. The addition of organic manure to achieve desirable benefits is a long-term process. After the decomposition of organic fertilizer in the soil is released buotric acid lion, which has a negative impact on nematodes (Sumner and Bell 1986; Rush and winter 1990;piepho et. al., 2003; Pfahler and Petersen 2004 and Heinz-Josef et. al., 2018).

Yield losses because of nematode damage in sugar beets can range from 10 to 80 percent. There are two broad categories for management practices: Chemical and Non chemical. The chemicals used earlier to control plant parasitic nematodes were usually fumigant and non-fumigant nematicides. These are not only expensive but also cause environmental pollution, phytotoxicity, contamination of ground water and adversely affect the land and its biotic environment. The demerits of hazardous chemicals have created interest in searching alternate methods for plant-parasitic nematode management *(*Sumner and Bell, 1982;Ruppel, 1991; Piepho *et. al.,* 2003 ; Windels and Brantner 2004*).*

Root knot nematodes (RKN) are responsible for 12.3% yield loss of the world's major crops. Nematodes are major pests of sager beet in Egypt and they constrain the use of other – wise desirable land for sugar beet production. Plant-parasitic nematodes are worst enemies of mankind and causing great damage to all agricultural and horticultural crops. They infect plant roots, bulbs, rhizomes, stems, leaves, buds, flowers, seeds etc. and cause damage to the plants directly or indirectly. The estimated annual yield loss in major crops of the world due to plant diseases *(*Liu and Sinclair 1991*;* Mazzola *et. al.,* 2003; Führer Ithurrart *et. al.,* 2004 ; Archana and Prasad, 2014).Wafaa El-Nagdi and Abd Elfattah (2011) concluded that plant residues, biofertilizer and organic compost alone or in combination with biocides also significantly increased the studied sugar beet growth and technological characteristics as percentage sucrose, total soluble solids and juice purity. Adding plant residues, organic compost and biocides alone in the soil gave significant reduction in the number of juveniles in the soil, the galls and the eggmasses on sugar beet roots. Also, organic compost caused a reduction of 86.3, 75.0 and 80.0% for the respective nematode criteria followed by dry leaves of fleabane, nemaless , mud sugar beet , nile fertile and dry leaves of sugar beet, respectively.

The objective of this research was to study the effect of previews summer crops i.e. , maize , sesame, sunflower and soybean on growth and yield of sugar beet and the effect of the remnants of the previous crop of roots, leaves and stems residues on the root nematodes of sugar beet under Middle Egypt conditions.

MATERAL AND METHOD

Two field trials were conducted at Mallawi Agricultural Research Station, Minia Governorate, ARC, during two successive winter seasons 2016/2017 and 2017/2018 in a high naturally infested field with nematodes. The purpose of this investigation was to study the effect of four preceding crops (maize, sunflower, sesame and soybean) on the growth , yield and chemical composition of sugar beet variety cv. Gloria, as well as to the study the effect of the remnants of the previous crop of roots, leaves and stems residues plants waste were cut and chopping by the threshing machine and incarnated in to soil as an organic fertilizer, then the experimental site was irrigated before land preparation to decomposed in soil and to reduce the incidence infestation of plant nematodes. Therefore, the experiment was conducted in soil infects nematode.

The experimental design was in randomized complete block design (RCBD) with three replicates.

The experiment included nine treatments as follows.

1. Cultivation sugar beet in place of maize crop roots only.
2. Cultivation sugar beet in place of all maize crop residues.
3. Cultivation sugar beet in place of sunflower crop roots only.
4. Cultivation sugar beet in place of all sunflower crop residues.
5. Cultivation sugar beet in place of sesame crop roots only.
6. Cultivation sugar beet in place of all sesame crop residues.
7. Cultivation sugar beet in place of soybean crop roots only.
8. Cultivation sugar beet in place of all soybean crop residues.
9. Cultivation sugar beet in fallow land (control).

Each plot consisted of 5 rows 7 m. in length and 60 cm in width. The area of each plot was 21 m2. Seeds were sown in hills 20 cm. apart. P_2O_5 in the form Calcium super-phosphate (15 % P_2O_5) at rate of 150 kg/fad and potassium sulfate (48% K_2O) at rate of 50 kg/fed were applied during soil preparation.

The nitrogen fertilizer was applied in the form of ammonium nitrate (33.5 % N) at the rate of 100 kg /fad in two equal doses at the first after thinning and the second after month later. Sugar beet seeds were planted on 27th and 23rdSeptember in 2016/2017 and 2017/2018 seasons, respectively.

Table 1. Some physical and chemical properties of the soil at depth of 0-30 cm during 2016/2017 and 2017/2018 seasons.

Properties	Sand %	Silt %	Clay %	pH	ECe	CaCo3 %	O. M%
1st season	10.15	42.46	55.40	8.01	1.73	1.80	1.87
2nd season Soil texture	11.23	40.29	52.35	8.12	1.76	1.74	1.90
Salty clay loam							
Available nutrient							

	N %	P ppm	Kppm
1st season	20.30	8.16	182
2nd season	19.98	8.10	187

E.C = Electric conductivity (ds/m, 1:5 soil water extract). O.M= Organic matter

The studied traits of Sugar beet:-

A-Growth traits:

At harvest time (after 190 days from sowing), the following traits were measured on ten guarded plants uprooted from each plot:Root length (cm), root diameter (cm), root weight (g) and top fresh weight per plant (g).

B-Yield traits (ton/ fad):

The plants from the three middle rows of each plot were harvested and cleaned then roots and tops were separated and weighted in Kg, and converted to estimate: Root yield /fad (ton), Top yield (ton/fad) ,Surviving Plants % and sugar yield / fad was calculated as follows :

Sugar yield / (ton/fad) = Root yield x Sugar recovery%.

C- Quality parameters:

Sugar and other chemical contents of roots were determined in Abu- Korkas Company of Sugar by means of an automatic saccharometeras described by McGinnus (1971*)*.White sugar was calculated by linking the beet non-sugars potassium "K", Sodium "Na" and Alpha – amino – Nitrogen "α-amino-N" (expressed as mill equivalents/100 g of beet roots) as described by Harvey and Dutton (1993) as follows: ZB= Pol – (0.343 (K+Na) + 0.094 NB1 + 0.29) where ZB = Sugar recovery % beet and NB1= α-amino-N determined by the blue number. Quality index"QZ" was calculated as following in Abu- Korkas ompany of Sugar: QZ= ZB/Pol (pol % = poly saccharides % was determined by the (ICUMSA 1994).

Sampling nematode communities:-

According to Barker *et. al.,* (1985) and McSoley and Parrado, (1982) reported that soil samples were taken by a classical cylindrical tube sampler or auger from rhizosphere of the tested crops at depth of 30 cm. forty samples each 250 g soil were composed in a composite sample. Each one kilogram of the composite sample was represented by aliquant sample of 250 g soil. These samples were placed in plastic bags to prevent drying and keep away from sun then transferred to the laboratory of Plant Protection Department, Faculty of Agriculture Minia University.

Extraction of nematodes

Aliquot sample of 250 g was removed from the mixed composited sample for nematode extraction. Extraction of nematodes was by combination of Baermann funnels with elutriation and sieving technique (Barker *et al.,* 1985). Nematodes were killed by heating and each genus identified by the aid of classification keys (Thorne, 1961; Goody, 1963 ;Mai and Lyon, 1975). Each genus was separately transferred to the count slide (1 ml capacity) and examined using a light microscope for counting. Samples were taken to separate and promise plant nematodes five and ten weeks after planting.

Statistical analysis

Data were statistically analyzed according to Snedecor and Cochran (1980) and treatment means were compared by least significant difference test (LSD) at 0.05 level of significance. Bartlett test according to (Bartlett, 1937) was done to test the homogeneity of error variance. The test was not significant for all assessed traits, so, the two season's data were combined. The discussions of the results were carried out on the basis of combined analysis for the two seasons least significant differences was used to compare between means.

RESULTS AND DISCUSSION

Growth traits:

Combined analysis as presented in Table (2) showed that the effect of four preceding summer crops (maize, sunflower, sesame and soybean), treatments exhibit non-significant effect on root length (cm.) and root diameter (cm.) of sugar beet. While, root weight/plant (g) and top fresh weight/plant (g) were significantly influenced by planting sugar beet after whomever each of the four summer crops under study.

The results showed that all characters were recorded the higher values when sugar beet sown after summer crops (maize, sunflower, sesame and soybean) compared to fallow lands (control).Root weight/plant (g) is an important yield determined trait. Which presented in Table (2).The maximum root weight / plant was recorded when sugar beet planting in place of all sesame crop residues 1028.3g., followed by planting sugar beet in place of soybean crop roots only 987.5g. The minimum value of root weight per plant was recorded from planting sugar beet in place of all soybean crop residues. These results are in agreement with *(*Rush and Winter, 1990 and Coulter *et. al.,* 2011) showed that sugar beets grown on previously fallow land had significantly less than root yields than all other treatments except sesame.

Concerning, top fresh weight per plant (g) significantly affected by planting sugar beet in place of maize, sunflower, sesame and soybean with or without mixing residues (Table 2). The maximum value of top fresh weight/plant was recorded when sugar beet planting in place of soybean crop roots only 410.6 g .The minimum value of fresh weight /plant was recorded for sugar beet planting in fallow lands (control) 234.3g .These results are coincided with those obtained by (Windels and Branter 2004 ; Heinz-Josef *et. al.,* 2018).

Table 2. Effect of four preceding crops (maize, sunflower, sesame and soybean) on growth of sugar beet in 2016/2017, 2017/2018 and combined analysis of both seasons.

Treatments (Plantations)	Root length (cm)			Root diameter (cm)			Root weight/plant (g)			Top fresh weight/plant (g)		
	2016 /2017	2017 /2018	Comb.	2016 /2017	2017 /2018	Comb.	2016 /2017	2017 /2018	Comb.	2016 /2017	2017 /2018	Comb.
In place of maize crop roots only	32.1	29.3	30.7	25.60	23.8	24.7	746.7	766.7	756.7	317.8	399.0	358.4
In place of all maize crop residues	33.1	33.9	33.5	24.5	27.3	25.9	800.0	797.7	798.8	300.0	356.8	328.4
In place of sunflower crop roots only	32.4	30.0	31.2	21.9	25.7	23.8	673.3	800.0	736.7	300.0	411.3	355.7
In place of all sunflower crop residues	32.0	29.6	30.8	24.7	25.4	25.1	825.0	855.7	840.3	342.8	313.7	328.2
In place of sesame crop roots only	33.3	27.2	30.3	24.9	27.7	26.3	786.7	834.3	810.5	260.0	270.0	265.0
In place of all sesame crop residues	31.5	30.6	31.0	25.9	25.1	25.5	946.7	1110.0	1028.3	328.9	345.3	337.0
In place of soybean crop roots only	33.7	29.5	31.6	25.7	21.7	23.7	962.7	1012.3	987.5	388.9	432.3	410.6
In place of all soybean crop residues	30.3	31.7	31.0	24.0	28.6	26.3	693.3	779.0	736.2	233.3	240.7	237.0
In fallow lands(control)	33.6	32.5	33.0	22.9	21.4	22.2	786.7	776.7	781.7	233.3	235.3	234.3
L.S.D 5%	N.s	N.s	N.s	N.s	4.4	N.s	N.s	N.s	174.9	51.7	49.4	62.6

Yield traits:

Result to are presented in Table (3) revealed that the preceding crops maize, sunflower, sesame and soybean had affected significantly on all characters under study sugar beet root yield is the final goal from planting sugar beet. The highest sugar beet yield was recorded when sugar beet planting in place of soybean crop roots only 38.0 ton/fad, followed by planting in place of all sesame crop residues (36.9 ton/fad). Planting sugar beet in place of maize crop roots only or in place of all maize crop residues recorded a decrease in root yield which giving (25.1 and 26.9 ton /fad), respectively. Such best root yield of the sugar beet planting in place of soybean crop roots or its planting in place of all sesame crop residues followed by sugar beet planting in place of all sesame crop residues might be due to the list of botanicals that effective against plant parasitic nematodes *(*Archana and Prasad 2014*)*.In addition ,the fact that soybean is a legume crop that reduces the nitrogen ratio in the soil because it contains a radical contract to increase the yield of the next crop in agriculture. Nevertheless, short rotations with maize and sugar beet might increase the risk of *Rhizoctonia solani* crown and root rot infestation.

Leguminous crops such as pea offer the potential for higher sugar beet yield with lower N-fertilizer doses *(*Heinz- Josef 2018; Coulter *et. al.,* 2011; Stein and Steinmann 2018 and Deumelandt, *et. al.,* 2010).

Maximum top fresh yield was recorded when sugar beet planting in place of soybean crop roots only (13.3 ton/fad). Whereas the minimum of top fresh was recorded from sugar beet planting in fallow land (control) 5.6 ton /fad.

Table (3) showed that the highest sugar yield were observed when planting sugar beet in place of soybean crop roots only or sugar beet in place of all soybean crop residues (5.8 &5.1 ton/fad) respectively, also planting sugar beet in place of all sesame crop residues recorded the same result (5.8 ton/fad). By Similar result were found *(*Rush and Winter, 1990; Pokhrel and Pokhrel, 2013; Cord and Christian 2009; Gehan *et. al.,* 2013).

Results of (Table 3) show that the highest value of surviving plants % was obtained when planting sugar beet in place of all sesame and soybean crops residues (91.6 & 82.2%), respectively. The lowest surviving plants % produced when planting sugar beet in fallow lands (control) followed by sugar beet planting in place of maize crop roots only (68.4 & 68.5%), respectively. Such results revel that the shortage of crop due to the result of the number of plants left without nematode infection until the harvest. Sugar beet produces a decaling, yield to lose of large number of tubers due to infection and death with plant nematodes. Similar trend was obtained by (Rush and Winter, 1990;Pfahler and Petersen, 2004;Wafaa El-Nagdi and Abd Elfattah , 2011 ; Coulter *et. al.,* 2011).

Table 3. Effect of four preceding crops (maize, sunflower, sesame and soybean) on sugar beet yield in 2016/2017, 2017/2018 and combined analysis of both seasons.

Treatments (Plantations)	Root yield (Ton/fad.)			Top fresh weight (Ton/fad.)			Sugar yield (Ton fad.)			Surviving Plants %		
	2016 /2017	2017 /2018	Comb.	2016 /2017	2017 /2018	Comb.	2016 /2017	2017 /2018	Comb.	2016 /2017	2017 /2018	Comb.
In place of maize crop roots only	24.2	26.0	25.1	7.3	10.1	8.7	3.9	3.9	3.9	67.8	66.7	68.5
In place of all maize crop residues	24.2	29.7	26.9	8.2	9.7	10.3	3.7	4.3	4.0	69.4	70.4	69.9
In place of sunflower crop roots only	26.7	27.2	27.0	8.8	12.3	10.6	3.9	3.9	3.9	72.9	76.0	75.6
In place of all sunflower crop residues	27.2	28.7	27.9	5.7	6.0	5.9	4.3	4.4	4.4	75.3	85.4	79.1
In place of sesame crop roots only	31.4	30.5	31.0	5.8	6.0	5.9	4.9	4.7	4.8	74.9	80.7	77.8
In place of all sesame crop residues	36.3	37.4	37.0	7.5	11.8	9.6	5.8	5.8	5.8	89.3	94.0	91.6
In place of soybean crop roots only	37.5	38.4	38.0	12.4	14.2	13.3	5.8	5.9	5.8	76.2	75.6	75.9
In place of all soybean crop residues	35.9	34.3	35.1	8.4	8.4	8.4	5.2	5.0	5.1	78.0	86.5	82.2
In fallow lands(control)	26.0	27.2	26.6	5.6	5.6	5.6	4.0	4.1	4.0	70.1	69.1	68.4
L.S.D 5%	2.4	5.0	4.2	0.8	5.1	2.7	0.4	1.0	0.7	9.9	9.2	9.2

Quality parameters:

The results presented in Table (4) showed insignificant effect on pol%, non-sugars potassium "K", Sodium "Na" and Alpha – amino – Nitrogen "α-amino-N" (expressed as mill equivalents/100 g of beet ,Quality index and sugar recovery%. The quality standards in sugar beet did not vary according to the previous summer crop due to the difference in these characteristics according to the different varieties. Similar results were obtained by Macias *et. al.,* 2001 and Abdel-Galil *et. al.,* 2014 reported that photosynthesis is the key to sucrose production in sugar beet, as it is the basis of all plant growth. It is through photosynthesis and subsequent leaf biochemistry which produces sucrose. This lead to increasing root length and diameter, root weight per plant, root yield per fed., meanwhile, the opposite trend was recorded for T.S.S. and sucrose percentages.

Table 4. Effect of four preceding crops (maize, sunflower, sesame and soybean) on some quality parameters of sugar beet in 2016/2017, 2017/2018 and combined analysis of both seasons.

Treatments (Plantations)	Pol (%)			K (milleq / 100 g)			Na (milleq / 100 g)			α-amino-N (milleq / 100 g)			Quality Index			Sugar recovery (%)Quality		
	2016 /2017	2017 /2018	Comb.	2016 /2017	2017 /2018	Comb.	2016 /2017	2017 /2018	Comb.	2016 /2017	2017 /2018	Comb.	2016 /2017	2017 /2018	Comb.	2016 /2017	2017 /2018	Comb.
In place of maize crop roots only	18.1	17.7	17.9	3.6	3.6	3.6	2.3	2.2	2.2	2.3	2.3	2.3	84.9	85.6	85.3	16.0	15.2	15.6
In place of all maize crop residues	17.3	17.3	17.3	3.8	3.9	3.9	2.1	1.9	2.0	2.7	2.7	2.7	84.8	85.1	85.0	15.1	14.8	14.9
In place of sunflower crop roots only	16.6	16.8	16.7	3.5	3.4	3.5	1.8	1.8	1.8	2.7	2.7	2.7	85.9	86.3	86.1	14.5	14.4	14.5
In place of all sunflower crop residues	16.8	17.3	17.0	4.0	4.0	4.0	2.5	2.5	2.5	2.4	2.4	2.4	83.9	84.1	84.0	14.4	14.5	14.5
In place of sesame crop roots only	17.7	17.8	17.7	3.4	3.4	3.4	2.0	1.9	2.0	2.5	2.4	2.4	86.5	87.0	86.8	15.7	15.4	15.6
In place of all sesame crop residues	18.0	17.9	17.9	3.4	3.3	3.3	1.5	1.9	1.7	2.1	2.0	2.1	88.0	87.2	87.6	16.2	15.6	15.9
In place of soybean crop roots only	17.5	17.7	17.7	3.4	3.7	3.7	1.9	1.7	1.8	2.9	2.7	2.8	86.0	86.4	86.2	15.4	15.3	15.4
In place of all soybean crop residues	17.4	17.4	17.4	3.0	2.9	3.0	1.9	1.9	1.9	2.2	2.2	2.2	86.0	87.3	87.2	15.4	15.30	15.4
In fallow lands(control)	17.2	17.5	17.3	3.4	3.5	3.5	2.2	2.5	2.3	1.5	1.6	1.6	87.1	85.3	85.5	15.5	15.0	15.1
L.S.D 5%	N.s	N.s	N.s	N.s	N.s	N.s	N.s	N.s	N.s	N.s	N.s	N.s	N.s	N.s	N.s	N.s	N.s	N.s

Nematode infestation:-

Data in Table (5) showed that population of different nematode genera associated with sugar beet during 2016/ 2017 season after five weeks from sowing with the plantation in place of maize, sunflower, sesame and soybean without and with mixing their residues in soil before the sugar beet sowing, as well as the plantation in fallow lands. It was observed that root knot nematodes *Meloidogyne* spp. recorded high number (67/250g soil) associated with sugar beet after 5 weeks from plantation in place of soybean crop roots only followed by(53/ 250 g soil) in place of sunflower crop roots only. Less population of (11/250 g soil) was attained in sugar beet planted in place all residues maize crop. While it reduced to the least (9 / 250 g soil) in the plantation in place of all residues sesame crop. The number of root knot nematode after five weeks from plantation in place of fallow lands recorded (48 /250 g soil) with sugar beet. This high number might due to the survival of eggs in the fallow lands resultant the gelatinous matrix of the egg masses protecting eggs from the dryness. Lesion nematode recorded high population densities,(54 and 43/250g soil) with sugar beet planted in the place of soybean crop roots only and all residues, respectively. The less recorded number of lesion nematode (10/250g soil) was in the consequent plantation in place of all residues sesame crop. Stubby nematodes *Trichodorus* spp. was in highest numbers with sugar beet planted after maize crop roots only or all residues, recording (36 and 28/250g soil) after roots only and all residues, respectively after 5 weeks from sowing of sugar beet 2016/2017 season.

Nil number of stubby nematode had been recorded in the planting in place of all residues sesame crop and in the place of fallow land. Spiral nematode was observed that root knot nematodes *Helicotylenchus spp*. recorded high number 54/ 250g soil associated with sugar beet after 5 weeks from plantation in place of soybean crop roots only followed by(48/250g soil) in place of all residues maize crop. Less population of(4/250 g soil) was attained in sugar beet planting in place all residues sesame crop. While it reduced to the least (2 g/ 250 g soil) in the plantation in fallow lands. As for lance nematode *Hoplolaimus* spp. It recorded high numbers of(43 and 42/250 g soil) after five weeks of sugar beet plant at on consequent to maize and soybean crop roots only as well as(37 and 33/250g soil) with the plantation in place of all residues maize and soybean crop, respectively. These numbers differed significantly than other. These results confirm the results stated that maize and soybean were high preferred hosts to lance nematode. Holguin *et al.*,(2015) reported that *Hoplolaimus* species are considered to be economically important and can cause serious damage to agronomic crops, including cotton (*Gossypium hirsutum* L.), corn (*Zea mays* L.) and soybean (*Glycine max* L.)

On the other hand lance nematode recorded the number of (26/250 g soil)with the plantation in place of fallow land. This result may be attributed to the tolerance of this genus to dryness occurred in the fallow lands (Fassuliotis, 1976).Moderate numbers of (19 and 15/250g soil) were recorded with the plantation after sunflower without and with mixing their residues in soil. The lowest numbers of (5 and 2/250g soil)were recorded after sesame plantation without and with mixing sesame residues. Leandro (1977) reported that sesame residues in soil act as nematostats. On the other hand Miller, 1978 and Hassan, 1992, reported that nitrogen combinations such as proteins, poly proteins, enzymes, casein and amino acids that release ammonia from plant leaves incorporated in soil were shown to be toxic against nematodes.

Data in Table (5) show the number of different nematode genera detected after five weeks from sowing of sugar beet after different crops without and with mixing their residues in soil during 2017/2018. It was obvious that results in 2017/2018 were in similar trend of those results recorded in 2016/2017 season. Root knot nematodes *Meloidogyne* spp. recorded high number (86/ 250g soil) associated with sugar beet after 5 weeks from plantation in place of soybean crop roots only followed by(68/250g soil) also in place of sunflower crop roots only. Less population of (14/250g soil) was attained in sugar beet planting in place of all residues maize crop. While it reduced to the least (12 g/ 250 g soil) in the planting in place of all residues sesame crop. The number of root knot nematode after five weeks from plantation in place of fallow lands recorded (62 /250g soil) with sugar beet. Lesion nematode recorded high population densities, (70 and 55/250g soil) with sugar beet planted in the place of soybean crop roots only and all residues, respectively.

Moderate numbers were recorded after sunflower by (50 and 36 /250 g soil) sunflower crop roots and all residues debris, respectively. The less recorded number of lesion nematode (14/ 250g soil) was after planting in place of all residues sesame crop. In place of fallow land, number of lesion nematode was (18 / 250g soil). Stubby nematodes *Trichodorus* spp. was in highest numbers with sugar beet planting in place of all residues maize crop and roots only, recording (46 and 36/250g soil) without and with mixing their residues, respectively after 5 weeks from sowing of sugar beet 2017/2018 season. Nil number of stubby nematode had been recorded in the plantation after sesame with mixing their residues and in the place of fallow land as shown in the previous season.

Table 5. Effect of the preceding crops on sugar beet infestation by phyto-nematodes after five weeks from sugar beet sowing in 2016/2017 and 2017/2018.

Treatments (Plantations)	Root-knot nematode *Meloidogyne* spp. No./ 250g soil		Lesion nematode *Pratylenchus* spp. No./ 250g soil		Stubby nematode *Trichodorus* spp. No./ 250g soil		Spiral nematode *Helicotylenchus* spp. No./ 250g soil		Lance nematodes *Hoplolaimus* spp. No./ 250g soil	
	2016 /2017	2017 /2018	2016 /2017	2017 /2018	2016 /2017	2017 /2018	2016 /2017	2017 /2018	2016 /2017	2017 /2018
In place of maize crop roots only	17 .0	22 .0	27 .0	35 .0	36 .0	46 .0	51.0	66 .0	43 .0	55.0
In place of all maize crop residues	11 .0	14 .0	20 .0	23.0	28 .0	36 .0	48 .0	62 .0	37 .0	48 .0
In place of sunflower crop roots only	53 .0	68 .0	39 .0	50 .0	15 .0	20 .0	23 .0	29 .0	19 .0	24 .0
In place of all sunflower crop residues	23 .0	30 .0	28 .0	36 .0	11 .0	14 .0	20 .0	26 .0	15 .0	19 .0
In place of sesame crop roots only	12 .0	16 .0	16 .0	21 .0	3 .0	4 .0	10 .0	13 .0	5 .0	7 .0
In place of all sesame crop residues	9 .0	12 .0	10 .0	14 .0	0 .0	0 .0	4 .0	5 .0	2 .0	3 .0
In place of soybean crop roots only	67 .0	86 .0	54 .0	70 .0	19 .0	24 .0	54 .0	70 .0	42 .0	54 .0
In place of all soybean crop residues	32 .0	41 .0	43 .0	55 .0	10.0	13.0	27 .0	35 .0	33 .0	42.0
In fallow lands (Control)	48 .0	62 .0	14 .0	18 .0	0 .0	0 .0	2 .0	3 .0	26 .0	33 .0
L.S.D. 5%	8.4	11.6	10.2	8.9	4.9	6.0	5.8	7.5	6.4	8.2

Spiral nematode was observed that root knot nematodes *Helicotylenchus spp*. recorded high number (70/ 250 g soil) associated with sugar beet after 5 weeks from plantation in place of soybean crop roots only followed by(66/250g soil) in place of maize crop roots only. Less population of (5/250 g soil) was attained in sugar beet planting in place all residues sesame crop. While it reduced to the least (3/250 g soil) in the plantation in fallow lands.Lance nematode in the second season 2017/2018 increased than the 1st season recording high populations (55 and 48 /250g soil) after maize crop roots only and all residues, respectively as well as (54 and 42 /250 g soil) after soybean crop roots only and all residues, respectively. In the place of fallow land the recorded number of lance nematode in sugar beet was (33 /250 g soil).

The population of different nematode genera associated with sugar beet during 2016/ 2017 and 2017/2018 seasons after ten weeks from sowing with the plantation in place of maize, sunflower, sesame and soybean crop roots only and all residues in soil before the sugar beet sowing, as well as the plantation in fallow lands was tabulated in Table (6).Root knot nematodes *Meloidogyne* spp. recorded high number(127&136/250g soil) associated with sugar beet after ten weeks from plantation in place of soybean crop roots only followed by (100 &112 /250 g soil) in place of sunflower crop roots only also. Less population of (16 & 25 /250 g soil) was attained in sugar beet planting in place all residues sesame crop in the two seasons respectively. The number of root knot nematode after ten weeks from plantation in place of fallow lands recorded(86 & 98/250g soil)with sugar beet in the two seasons respectively. Lesion nematode *Pratylenchus* spp. recorded high population densities, (102,114 and 77, 89 /250g soil) with sugar beet planted in the place of soybean crop roots only and all residues, respectively. The less recorded number of lesion nematode (19&29 /250 g soil) was in the consequent planting in place of all residues sesame crop in the two seasons respectively . After ten weeks from sugar beet plantation, stubby nematode *Trichodorus* spp. was in highest numbers with sugar beet planted after maize plantation, recording (68, 77 and 50 ,61 /250g soil) after roots only and all residues, respectively. Nil number of stubby nematode had been recorded in the planting in place of all residues sesame crop as well as after fallow land.Spiral nematode was observed that root knot nematodes *Helicotylenchus spp*. recorded high number (152&164/ 250g soil)associated with sugar beet after ten weeks from plantation in place of maize crop roots only followed by (139&148/250g soil) in place of soybean crop roots only in the two seasons respectively. Less population of (22&28/250g soil) was attained in sugar beet planting in place all residues sesame crop. While it reduced to the least

(77&89 g/250 g soil) in the plantation in fallow lands in the two seasons respectively.

The populations of lance nematode during the season of 2016/2017 and 2017/2018 after ten weeks from sowing were significantly high with the plantation followed maize and soybean crop roots only recording (77, 89 and 71,83/250g soil) as well as (59,68 and 48,59 /250g soil) with the plantation in place of all residues maize and soybean crop in the two seasons, respectively. On the other hand lance nematode recorded the number of(40&52/250 g soil) with the plantation in place of fallow land. This result may be attributed to the tolerance of this genus to dryness occurred in the fallow lands. Moderate numbers of (27,36 and 19,28 /250 g soil) were recorded with the planting in place of sunflower crop roots only and all residues in soil in the two seasons respectively. The lowest numbers of (12,20 and 7,12 /250g soil) were recorded after sesame plantation roots only and with in place of all residues sesame crop in the two seasons respectively. Leandro (1977) reported that sesame residues in soil act as nematostats. Table (6) indicate that the samples were taken after ten weeks from sowing sugar beet in the second season 2017/2018 revealed some increment in all nematode genera numbers with the superior of spiral nematode that recorded the highest number (164/250g soil) in the samples from sugar beet planted in the place of maize without mixing residues.

Table 6. Effect of the preceding crops on sugar beet infestation by phyto-nematodes after ten weeks from sugar beet sowing in 2016/2017 and 2017/2018 seasons.

Treatments (Plantations)	Root-knot nematode Meloidogyne spp. No./ 250g soil		Lesion nematode Pratylenchus spp. No./ 250g soil		Stubby nematode Trichodorus spp. No./ 250g soil		Spiral nematode Helicotylenchus spp. No./ 250g soil		Lance nematodes Hoplolaimus spp. No./ 250g soil	
	2016 /2017	2017 /2018	2016 /2017	2017 /2018	2016 /2017	2017 /2018	2016 /2017	2017 /2018	2016 /2017	2017 /2018
In place of maize crop roots only	30.0	39 .0	51 .0	62 .0	68 .0	77 .0	152.0	164.0	77 .0	89 .0
In place of maize crop all residues	20.0	31 .0	38 .0	50 .0	50 .0	61 .0	142.0	155.0	59 .0	68 .0
In place of sunflower crop roots	100 .0	112 .0	74 .0	83 .0	27 .0	35 .0	52.0	61.0	27 .0	36 .0
In place of sunflower crop all residues	41 .0	50 .0	53 .0	64 .0	20 .0	28 .0	36.0	42.0	19 .0	28 .0
In place of sesame crop roots only	22 .0	32 .0	30 .0	39 .0	5 .0	13 .0	23.0	29.0	12 .0	20 .0
In place of sesame crop all residues	16 .0	25 .0	19 .0	29 .0	0 .0	0 .0	22.0	28.0	7 .0	12 .0
In place of soybean crop roots only	127 .0	136 .0	102 .0	114 .0	34 .0	24 .0	139.0	148.0	71 .0	83 .0
In place of soybean crop all residues	58	66	77	89	19	27	94	102	48	59
In fallow lands (Control)	86.0	98.0	22.0	31.0	0.0	0.0	77.0	89.0	40.0	52.0
L.S.D. 5%	10.6	13.9	12.5	9.3	5.6	8.7	16.8	14.5	6.9	10.3

The results presented in Fig.(1) Indicated that combined of nematode numbers /250g soil of the two seasons after five weeks from plantation all tested preceding crops significantly decreased the population of the tested nematode except soybean and maize that increased the population of the tested nematode. As well as the results presented in Fig. (2) Indicated that combined of nematode numbers / 250 g soil of the two seasons after ten weeks from plantation all tested preceding crops significantly decreased the population of the tested nematode except soybean and maize that increased the population of the tested nematode.

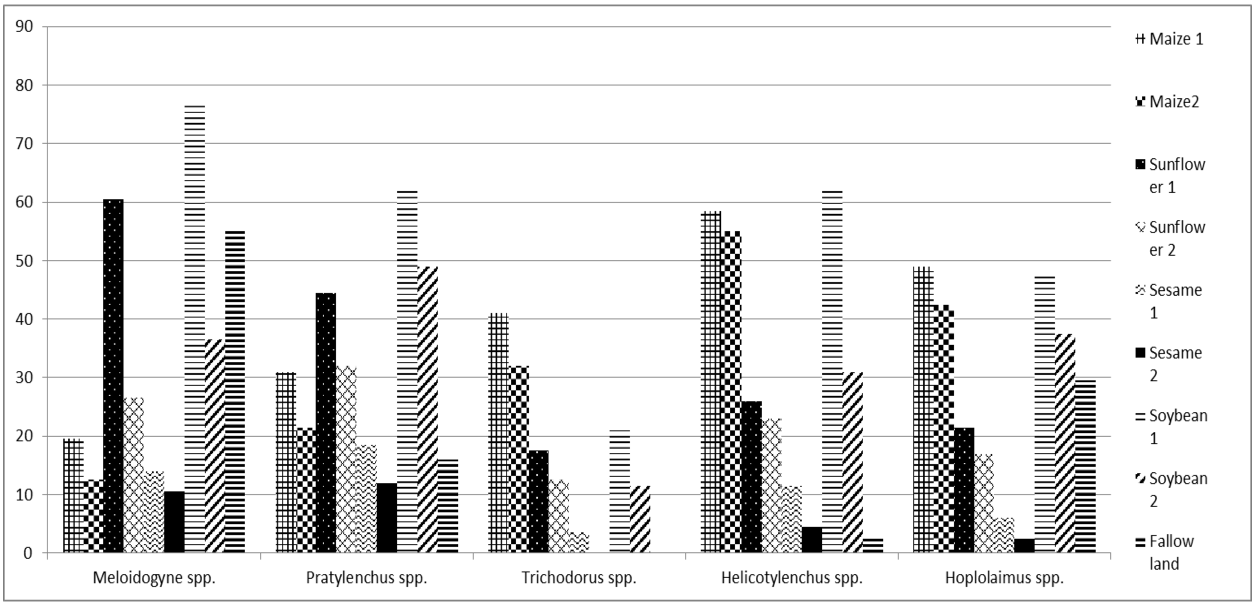

Fig. 1 .Combined for two seasons 2016/2017 & 2017/2018 of nematode numbers / 250 g soil after five weeks from planting

L.S.D.5% (Combined) 10.82 9.55 5.72 6.34 7.69

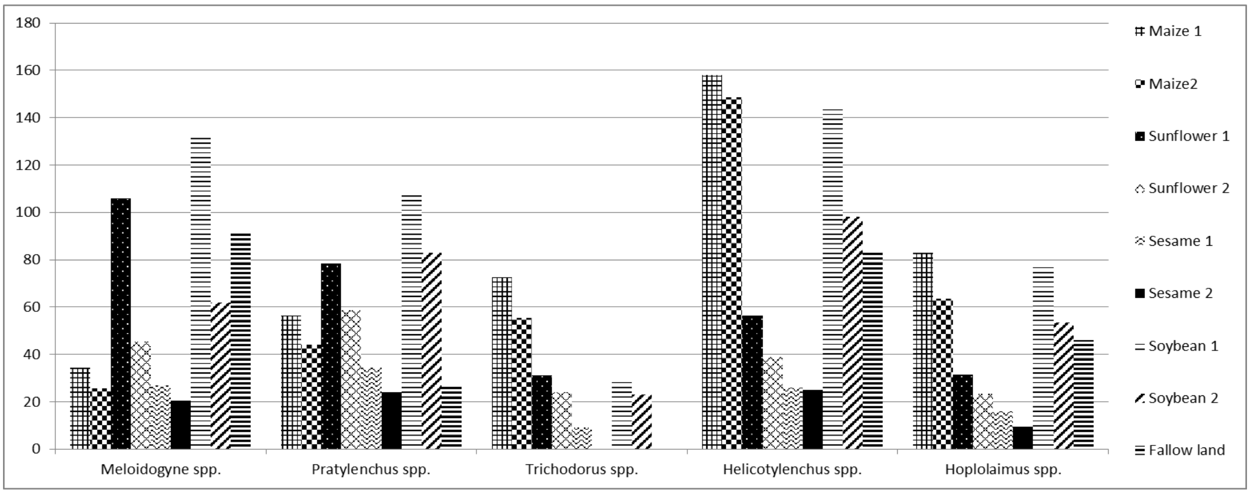

Fig. 2. Combined for seasons 2016/2017& 2017/2018 of nematode numbers / 250 g soil after ten weeks from planting

L.S.D. 5% (Combined) 10.71 11.66 7.12 13.21 9.45

CONCLUSION

Sugar beet yield after soybean meal and after sesame crop residues affecting the nematode infection. On the contrary, in short rotations with sugar beet and maize, Rhizoctonia infestation might become a serious threat for sugar beet production so we recommend cultivation of sugar beet after a previous summer crop of soybeans or sesame with the addition of plant residues of sesame crop in the soil before planting recorded the highest yield of sugar beet and reduce the incidence infestation of phyto-nematodes.

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تأثير بعض المحاصيل السابقة على إنتاجية بنجر السكر وإصابتها بالنيماتودا النباتية

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تم إجراء تجربة حقلية في محطة ملوي للبحوث الزراعية ، بمحافظة المنيا ، مركز البحوث الزراعية ، خلال موسمين شتويين متعاقبين 2017/2016 و 2018/2017 في حقل موبوء بالديدان الخيطية. حيث يهدف هذا البحث دراسة تأثير أربعة محاصيل سابقة (الذرة ، وعباد الشمس ، والسمسم ، وفول الصويا) على النموو المحصول لبنجر السكر و تأثير بقايا المحصول السابق من الجذور فقط أو من بقايا مخلفاته بالنيماتوداالنباتية وفيما يلى أهم النتائج. 1- أظهرت النتائج أعلى القيم لجميع الصفات المدروسة من زراعة بنجر السكر على جذور محصول فول الصويا تتبعها مباشرة زراعة بنجر السكر على كل بقايا محصول السمسم وكان أعلى محصول من الدرنات عند زراعة بنجر السكر غقب جذور محصول فول الصويا فقط (37.9 طن للفدان) يلية مباشرة محصول بنجر السكر المنزرع عقب مخلفات وبقايا محصول السمسم قدر(36.9 طن للفدان). ووجد أن أقل محصول من الدرنات كان عند زراعة بنجر السكر عقب محصول الذرة الشاميه سواء كان بعد جذوره فقط او بعد كل مخلفاته وسجلت (25.1 و26.9 طن للفدان) على التوالى. 2- أوضحت النتائج أن أعلى محصول من السكر كان عند زراعة بنجر السكر عقب جميع مخلفات محصول السمسم وايضا بعد زراعتة عقب جذورمحصول فول الصويا حيث سجلت (5.8 و 5.8 طن للفدان) على التوالى يليهما المنزرع عقب مخلفات فول الصويا قدر (5.1 طن للفدان). 3- أوضحت النتائج أن أعلى نسبة من عدد النباتات المتبقية عند الحصاد كانت عند زراعة بنجر السكر عقب بقايا ومخلفات محصول السمسم حيث قدرت كنسبة مئويه(91.6 %) يليها مباشرة المنزرع عقب كل مخلفات وبقايا محصول فول الصويا حيث قدر (82.2 %) وأقل عدد من النباتات عند زراعة بنجر السكر عقب الارض البور وعقب الذرة الشاميه سواء بعد الجذور أو بعد مخلفاتها حيث قدرت (68.4 و68.5 و 69.9 %) على التوالى. مما سبق يتضح أن نقص المحصول كان لفقد عددًا كبيرًا من الدرنات فى أول عمرها بسبب العدوى والموت بالديدان الخيطية النباتية. 4- أوضحت النتائج أن أعداد النيماتودا بجميع أنواعهاالتى تصيب بنجر السكر كانت أقل عند زراعة بنجر السكر عقب زراعة السمسم سواء عقب جذورة أو عقب كل مخلفاته . توصى الدراسة بزراعة بنجر السكر بعد محصول فول الصويا أو محصول السمسم مع إضافة بقايا النباتات من مخلفات محصول السمسم في التربة قبل الزراعة للحصول على أعلى محصول من بنجر السكر وتقليل الإصابة بالانواع المختلفة التى تصيب بنجر السكر من ديدان النيماتودا النباتية.