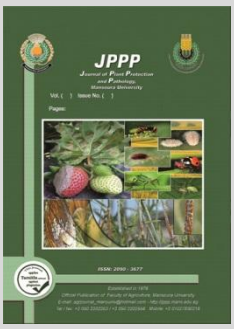
Journal of Plant Protection and Pathology

Journal homepage & Available online at: www.jppp.journals.ekb.eg

Agricultural Operations as Root-Knot Nematode Pest Management Strategy on Sugarbeet 1- Utilizing Certain Planting Dates and Sugarbeet Cultivars in Semi-arid Lands

Maareg, M. F.[1*]; K. M. Agami[2] ; H. M. El-Sharnoby[3] and A. M. El-Sheikh[4]

[1]Department of Plant Protection, Sugar Crops, Research Institute, Agriculture Research Center, Giza, Egypt
[2]Department of Agricultural Practices. Sugar Crops Research Institute, Agricultural Research Center , Giza, Egypt
[3]Department of Physiology and Chemical, Sugar Crops Research Institute, Agricultural Research Center , Giza, Egypt
[4]Department of Breed and Genetic, Sugar Crops, Research Institute, Agriculture Research Center, Giza, Egypt.



ABSTRACT

Two field experiments were conducted to study the effect of four planting dates and four sugarbeet cultivars on *Meloidogyne javanica* root-knot nematode reproduction, and crop productivity and quality. Delaying the planting date of sugarbeet from August 10 to November 10 significantly reduced the numbers of the second stage juveniles of nematodes in the soil from 31,436 to 6,145,, the different stages in the root system from 3,615 to 1,296 and the final nematode population from 35,051 to 7,441, this decrease is 71.69, 48.79 and 69.30%, compared to the first planting date, respectively, while the value of the reproduction factor decreased significantly from 19.47 to 4.13-folds, compared to the initial population. The sugarbeet cultivar, Oscar Poly showed the most significant ($P \leq 0.05$) reduction in the values of the studied nematode reproductive traits, and it also achieved the highest increase in top, roots, raw sugar and recoverable sugar yields (tons/fed) at all tested planting dates, compared to the other sugarbeet cultivars. Therefore, Oscar poly cultivar is suitable for cultivation at all tested planting dates, while cultivars, Francescan, Mirador and Sandorare suitable for cultivation during the 4th planting date only in soil contaminated with root-knot nematode, *M. javanica* at semi-arid lands. The latest planting date for sugarbeet, compared to other planting dates, achieved the highest significant reduction in nematode reproduction rate, and the highest significant increase in sugarbeet productivity. Hence, delaying the planting date can be considered as an agricultural method for nematode control.

Keywords :, sugarbeet , cultivars , planting date , *Meloidogyne javanica* .

INTRODUCTION

Sugarbeet is an important economic crop in Egypt, and it is the first crop for sugar production. Extracted sugar from sugarbeet represents 63.8% (1.79 million tons) of the total production (2.558 million tons) in Egypt (Sugar Crops Council , 2023). Sugarbeet is grown under different climatic conditions in many regions starting from the North to the Middle of Egypt.

The planting date of sugarbeet varies depending on the climate of the region and the genotype or variety used. Therefore, the planting date is the most important factor affecting the productivity and quality of sugarbeet. The planting date of sugarbeet in any place is determined by the temperature prevailing in the growing area, and is affected by soil moisture. Sugarbeet grows faster when the soil moisture in the seed bed is 23-27%, and the air and soil temperature is between 15 and 25 C° (Spaar *et al*., 2004).

Environmental factors cannot be controlled, but they can be modified in a positive direction for good crop performance in terms of yield and plant characteristics by planting at the optimum time (Romaneckas and Sarauski, 2003). The planting date of the crop is a non-cash input but plays an important role in increasing the productivity of sugarbeet. Therefore, determining the genotype or varieties /cultivars and the specific planting date are essential to obtain the economic return of the crop. Therefore, it is of utmost importance to know the specific genotype/ cultivars for the optimum planting date in order to obtain maximum roots and sugar production from sugarbeet. (Ferdous, *et al*., 2015).

Due to the lack of Egyptian conditions for growing sugarbeet for seed production, Egypt resorts to importing genotypes/varieties seeds from European countries. Therefore, it is necessary or important to evaluate these varieties/ cultivars under Egyptian conditions in terms of their suitability, productivity, and resistance to insect and disease pests prevalent in sugarbeet growing areas in Egypt, and to determine the optimal planting date for each variety/ cultivars to achieve the highest productivity and the highest reduction in damage resulting from infection with any of the various sugarbeet pests.

Therefore, this work was conducted to study the effect of different planting dates on the reproduction of the root-knot nematode *Meloidogyne javanica* and the productivity as well as the quality of some sugarbeet cultivars –in semi- arid lands at Bangar El Sokar area, Borg El-Arab region, Alexandria Governorate.

MATERIALS AND METHODS

Two field experiments were carried out during 2021/22 and 2022/23 seasons at Bangar El Sokar area, Borg El-Arab region, Alexandria Governorate , in sandy loam soil, naturally infested with *Meloidogyne javanica*, root-knot nematode second stage juveniles to investigate the effect of selected planting dates and cultivars as well as their

* **Corresponding author.**
E-mail address: drmohamedmaareg@gmail.com
DOI: 10.21608/jppp.2025.357936.1310

interaction on reproduction of nematode and productivity of sugarbeet crop.

The planting dates were August 10, September 10, October 10 and November 10. The tested sugarbeet cultivars were Francescan, Mirador, Sandor and Oscar poly. Treatments were laid out in a split- plot design with four replicates in two seasons. Planting dates were arranged in the mean plots. Sub-plots were assigned for the tested sugarbeet cultivars. Sub- plot area (10.5 m2) included five rows of 60 cm width and 3.5 m long. After preparing the soil field and before planting the sugarbeet seeds, at each planting date, random soil samples were taken from each plot at depth of 15 cm to estimate the number of juveniles stage of M. javanica in 200gm soil (initial population) by extracting them through a sieves and modified Baermann-funnel technique. Nitrogen fertilizer was applied in the form of ammonium nitrate (33.5% N) at the recommended rate (80 Kg N/fed.), in three equal doses, after thinning (4-6 leaf stage), 30 and 60 days later. Potassium fertilizer in the form potassium sulphat (48% K2O) at the rate of 24 Kg K2O/fed. was added after thinning, while phosphorus fertilizer in the form of calcium super phosphate (15.5%) was added during soil preparation at the rate of 100 Kg P2O5 /fed. Other agricultural practices required for growing sugarbeet were carried out as usually practiced in sugarbeet area.

At harvest time, after six months, all sugarbeet plants of each plot were harvested to estimate the roots and top yields. A total of 25 Kg roots was taken randomly from each plot and sent to Nile Sugar Company for quality parameters determination. The α- amino nitrogen (α- amino-N), Potassium (K) and Sodium (Na) were determined as meq/100 gm beet according to (De Whalley (1964), while the sugar content was estimated using a saccharemeter according to a method described by (A.O.A.C., 1995).

Sugar loss % was calculated using the following:

Sugar loss% = 0.29 + 0.343 (K + Na) + 0.094 (α- amino N).

Sugar recoverable % = sucrose % - sugar loss%.

Recoverable sugar yield (tons/fed.) = roots yield (tons/fed.) X recoverable sugar %.

Quality index = recoverable sugar % X 100 / sucrose %.

Raw sugar yield (tons/fed.) = roots yield (tons/fed.) X Sucrose %.

Sugar loss % (tons/fed.) = roots yield (tons/fed.) X sugar loss %.

Ten roots were taken randomly from each plot, washed with tap water, stained in lactic acid- fuchsine (Byrd *et al*., 1983) and examined to determine the total number of different stages (juveniles, females and egg masses). Also, number of *M. javanica* second stage juveniles in 200gm soil was extracted by sieving and modified Baermann funnel technique. Final nematode population (Pf) and reproduction factor (Rf) were calculated as follow:

Pf = Σ final nematodes in soil and root system

Rf = Pf / initial population soil (Pi).

Table (1) recorded soil and air temperatures C° and relative humidity prevailing in the growing area of sugarbeet planting dates.

Table 1. Average of soil, air temperature and relative humidity at the different tested planting dates.

Parameters	years	August	September	October	November
Soil temperature C°	2022	31.73	30.81	27.90	23.68
Air temperature C°		24.75	23.64	20.62	17.10
Relative Humidity		61.7	62.9	63.8	65.6
Soil temperature C°	2023	29.68	29.81	26.67	24.24
Air temperature C°		26.03	25.89	23.37	20.44
Relative Humidity		64.2	65.3	66.4	66.8

Data of the two seasons were combined and analyzed by MSTAT computer software pakage and a least significant deference (LSD) method was used to compare differences among treatment means at 0.05 probability level, followed by Dancan's multiple range tests to compare means (Duncan, 1955).

RESULTS AND DISCUSSION

1- Effect of different planting dates, sugarbeet cultivars and their interaction on reproduction of root-knot nematode, *Meloidogyne javanica* on sugarbeet fields:

Table (2), showed the reproduction traits of root-knot nematode, M. javanica, second stage juveniles (J_{2S}) in soil, different stages (DS) in root system and final population (Pf) as well as number of folds (Reproduction factor, Rf) compared to initial population under the influencing of four sugarbeet planting dates (August 10, September 10, October 10 and November 10), four sugarbeet cultivars (Francescan, Mirador, Oscar poly and Sandor) and their interactions.

Table 2. Effect of different planting dates, sugarbeet cultivars and their interaction on reproductive traits of root- knot nematode *Meloidogyne javanica* (combined over two seasons).

Planting dates (A)	Sugarbeet cultivars(B)	Second stage juveniles (J_{2S}) in soil (200g).	Different stages in root system	Final population(Pf)	Number of folds compared with p_i (Rf)
August 10	Francescan	31,436	3,615	35,051	19.47
	Sandor	23,698	2,674	26,372	14.65
	Mirador	16,863	1,927	18,790	10.44
	Oscar Poly	14,836	1,906	16,742	9.30
	Mean	21,708 [a]	2,531 [a]	24,239 [a]	13.47 [a]
		0.00	0.00	0.00	
September 10	Francescan	26,446	2,928	29,374	16.32
	Sandor	16,897	1,974	18,871	10.48
	Mirador	14,654	1,575	16,228	9.02
	Oscar Poly	11,987	1,633	13,620	7.57
	Mean	17,496 [b]	2,028 [b]	19,523 [b]	10.85 [b]
		19.40	19.87	19.46	
October 10	Francescan	16,857	2,124	18,981	10.55
	Sandor	14,830	1,979	16,809	9.34
	Mirador	10,921	1,632	12,553	6.97
	Oscar Poly	9,692	1,572	11,264	6.26
	Mean	13,075 [c]	1,827 [c]	14,902 [c]	8.28 [c]
		39.77	27.82	38.52	
November 10	Francescan	9,925	1,555	11,480	6.38
	Sandor	7,392	1,470	8,862	4.92
	Mirador	4,657	1,345	6,002	3.33
	Oscar Poly	2,604	814	3,418	1.90
	Mean	6,145 [d]	1,296 [d]	7,441 [d]	4.13 [d]
		71.69	48.79	69.30	
Cultivars (B)	Francescan	21,166 [a]	2,556 [a]	23,722 [a]	13.18 [a]
	Sandor	15,704 [b]	2,024 [b]	17,729 [b]	9.85 [b]
	Mirador	11,774 [c]	1,620 [c]	13,393 [c]	7.44 [c]
	Oscar Poly	9,780 [d]	1,481 [d]	11,261 [d]	6.26 [d]

$L.S.D._{0.05}$ A X B 677.0 408.6 589.70 1.41 Data with tshe same letters within a column are not significantly (P≤0.05) different according to Duncan's a new multiple range test.

The results in Table (2) revealed a significant (P≤0.05) differences in J_{2S} number in soil due to plantings dates. When sugarbeet planting date was delayed from August 10 to September 10, October 10 and November 10 J_{2S} number was decreased (P≤0.05) significantly from 21,708 to 17,496, 13,075 and 6,145, respectively. The percentages of reduction were 19.40, 39.77 and 71.69% as compared to the early planting date (August 10).

Delaying sugarbeet planting date from August 10. to September 10, October 10. and November 10. Resulted in a gradual and significant (P≤0.05) decreased in DS numbers in

sugarbeet root system from 2,531 to 2,028, 1,827 and 1,296, respectively. The percentages of decrease in DS numbers were 19.87, 27.82 and 48.79% respectively, compared with early planting date. Also, delaying sugarbeet planting date from early date (August 10) to the two medium dates (September 10 and October 10) and late (November 10) planting dates significantly (P≤0.05) decreased Pf value from 24,239 to 19,523, 14,902 and 7,441, respectively. The decreases in Pf values were 19.46, 38.52 and 69.30% respectively, as compared to the first planting date, August 10 as shown in Table (2).

Table (2) also indicated that Rf value was progressively decreased from 13.47 during sugarbeet sown on early date (August 10.) to 10.85 and 8.28 during the second and third planting dates and continued to decrease to the lowest value (4.13 -folds), compared to the (Pi) during the late one.

In generally, the highest and the lowest values for all studies traits were recorded with Francescan and Oscar poly cultivars, respectively at all planting dates. These results consistent with research of Maareg *et al.* (2018), who classified the first cultivar as susceptible and the second as low susceptible or tolerant to this pest.

The interaction between planting dates and sugarbeet cultivars showed significant effect for all tested traits (Table 2). The highest values, 31,436; 3,615; 35,051 and 19.47 for J_{2S}, DS, Pf and Rf, respectively were obtained by Francescan cultivar during the first planting date. However, the lowest values were 2604, 814, 3418 and 1.90 for J_{2S}, DS, Pf and Rf, respectively were recorded with Oscar poly at the late planting date (November 10).

Current results showed significant differences among the different planting dates for all nematode parameters studied. The highest values of second stage juveniles in soils (21,708), different stages in root system (2,531), final population (24,239) and reproduction factor (13.47- folds, compared to initial nematode) were obtained from sugarbeet sown on early date (August 10), while the lowest values of J_{2S} (6,145), DS (1,296) Pf (7,441) and Rf (4.13- folds) were recorded in plots of sugarbeet sown on late planting date (October 10.), indicating that nematode population decreased with delayed planting date.

Under Egyptian conditions, the population fluctuations of root-knot nematodes have been studied by a few investigators in semi- arid lands (Maareg and Hassanien, 1999; Gohar, 2003; Maareg *et al*., 2004 and Farahat *et al*., 2008). The results of most of these studies showed that the root-knot nematode population (second stage juveniles) in the soil gradually increase starting from February until it reaches its peak during July and August when the soil temperature exceeds 25 C°. With the decrease in soil temperature from September, The population of nematodes decrease until it reaches its lowest level during December and January. In the last studies, no correlation was observed between the nematode population and soil moisture because the variation in soil moisture during the different seasons were not significant due to water scarcity and the application of sprinkler or drip irrigation systems.

In this respect Maareg *et al.* (2006) evaluated five planting dates from August to December on the root-knot nematode reproduction infection of five sugarbeet varieties, and found that the number of second stage juveniles in soil, different stages in root system and final population for nematode were decreased (P≤0.05)significantly with delaying planting date from August to December. The reduction was more 70% during the late planting date (during December). Also, Rady *et al*. (2016) reported that the all tested root-knot nematode parameters in soil and root system for sugarbeet cultivars were decreased significantly with delaying sugarbeet planting dates from August to October. The reduction was more than 65% during the late planting date (during October).

Comparing tested sugarbeet cultivars, Francescan had the highest values of the tested nematode traits (J_{2S}, DS, Pf and Rf) followed by Sandor, Mirador and Oscar poly which had the lowest ones. For the reason, Oscar poly cultivar was more suitable to planting in infested soil with *M. javanica* root-knot nematode at different planting dates. The varietal differences in the previous tested traits may be due to the construction of whole pooled genes and the differences in all tested traits among sugarbeet cultivars might be principally due to their genetic variation.

2- Effect of different planting dates, cultivars and their interaction on sugarbeet quantitative and qualitative traits:

Quantitative traits:

Data in Table (3) indicated the effects of four planting dates (August 10, September 10, October 10 and November 10), four sugarbeet cultivars (Francescan, Mirador, Oscar poly and Sandor) and the interaction among them on quantitative traits, top yield, roots yield, raw sugar yield and recoverable sugar yield (tons/fed.) of sugarbeet.

Data showed clearly that planting dates had significant effects on all tested traits. There were significant differences among the four planting dates. The results are arranged from the lowest value to highest value for all tested traits, top, roots, raw sugar and recoverable sugar yields of sugarbeet (Table 3).

When sugarbeet planting dates was delayed from August 10 to November 10, top yield was increased (P≤0.05) significantly by 20.59%, from 12.24 to 14.76 tons/fed. Later sugarbeet planting date (November 10) significantly (P≤0.05) increased root yield by 17.91%, from 21.61 to 25.48 tons/fed. , raw sugar yield by 24.85%, from 3.34 to 4.17 tons/fed. and recoverable sugar by 28.84%, from 2.67 to 3.44 tons/fed.

The Oscar poly cultivar gave the highest significant (P≤0.05)values for all the tested traits, top, roots, raw sugar and recoverable sugar yields at the first, second and fourth planting dates, while at the third planting date it recorded the highest values for roots, raw sugar and recoverable sugar yields only, compared to the other tested cultivars. However, at the last planting date, Francescan, Mirador and Sandor sugarbeet cultivars achieved the highest values for all tested traits, compared to the other tested planting dates. Cultivars Francescan and Sandor have almost the same value for roots yield/fed at the second and third planting dates. There were no significant difference in both raw sugar yield and recoverable sugar yield between Mirador and Oscar poly cultivars at the first planting date, and between Sandor and Mirador cultivars at the second and fourth planting dates as shown in Table (3).

Also, Table (3) showed that there were significant (P≤0.05)differences in tested traits, top, roots, raw sugar and recoverable sugar yields (tons/fed.) were determined among tested sugarbeet cultivars, Francescan, Mirador, Oscar poly and Sandor. The values range of top yield for such sugarbeet cultivars were (12.11 - 14.82), roots yield (21.81 - 25.30), raw sugar yield (3.38 – 4.00) and recoverable sugar yield (2.75 – 3.25 tons/fed.). The Oscar poly sugarbeet cultivar achieved the significant the greatest values for the studied traits

followed by Mirador, Sandor, and Francescan cultivars, respectively. The differences among them were significant for all traits, but there was no significant difference between Mirador, and Sandor cultivars in the raw sugar yield/fed. only. The difference among the tested sugarbeet cultivars might by principally due to the genetic variation.

Table 3. Effect of different planting dates, cultivars and their interaction on quantitative traits of sugarbeet (combined over two seasons)

Planting dates (A)	Sugarbeet cultivars(B)	Top yield (tons/fed.)	Roots yield (tons/fed.)	Raw sugar yield (tons/fed.)	Recoverable sugar yield (tons/fed.)
	Francescan	10.95	19.81	2.97	2.35
August	Sandor	11.45	20.93	3.35	2.70
10	Mirador	12.91	22.58	3.49	2.79
	Oscar Poly	14.11	23.11	3.54	2.84
Mean		12.24 ^{d}	21.61 ^{d}	3.34 ^{d}	2.67 ^{d}
		(0.00)	(0.00)	(0.00)	(0.00)
	Francescan	11.40	21.44	3.32	2.70
September	Sandor	12.70	22.27	3.68	3.00
10	Mirador	13.44	22.84	3.65	3.00
	Oscar Poly	14.61	24.72	3.91	3.17
Mean		13.04 ^{c}	22.82 ^{c}	3.64 ^{c}	2.97 ^{c}
		(6.54%)	(5.60%)	(8.98%)	(11.24%)
	Francescan	12.16	21.81	3.42	2.75
October	Sandor	12.72	22.57	3.74	3.04
10	Mirador	14.62	25.58	3.10	3.33
	Oscar Poly	15.38	26.11	4.14	3.37
Mean		13.72 ^{b}	24.02 ^{b}	3.85 ^{b}	3.12 ^{b}
		(12.09%)	(11.15%)	(15.27%)	(16.85%)
	Francescan	13.94	24.19	3.81	3.21
November	Sandor	14.15	24.26	4.19	3.44
10	Mirador	14.79	25.83	4.25	3.48
	Oscar Poly	16.17	27.26	4.42	3.61
Mean		14.76 ^{a}	25.48 ^{a}	4.17 ^{a}	3.44 ^{a}
		(20.59%)	(17.91%)	(24.85%)	(28.84%)
	Francescan	12.11 ^{d}	21.81 ^{d}	3.38 ^{c}	2.75 ^{d}
Cultivars	Sandor	12.77 ^{c}	22.60 ^{c}	3.74^{b}	3.05 ^{c}
(B)	Mirador	14.19 ^{b}	24.21 ^{b}	3.62 ^{b}	3.15 ^{b}
	Oscar Poly	14.82 ^{a}	25.30 ^{a}	4.00 ^{a}	3.25 ^{a}

L.S.D. $_{0.05}$ **A × B 0.64 0.85 0.16 0.13 Data with the same letters within a column are not significantly (P≤0.05)different according to Douncan's a new multiple range test.**

The interaction between planting dates and sugarbeet cultivars had a significant (P≤0.05)effect on top yield, roots yield and recoverable sugar yield only. The highest significant value for top yield (16.17) roots yield (27.26), raw sugar yield (4.42) and recoverable sugar yield (3.61 tons/fed.) were obtained by Oscar poly cultivar in case of planting it on November 10, and the lowest ones were recorded with Francescan cultivar when it was sown on the August 10 as shown in Table (3).

Qualitative traits:

The data presented in Table (4) showed that the tested planting date had significant (P≤0.05)effects on qualitative traits, sugar content, recoverable sugar percentage, loss sugar yield, sugar loss in molasses percentage and quality index. There were significant (P≤0.05)differences among the four planting dates (August 10, September 10, October 10 and November 10). The results order from the smallest value to the greatest value for sugar content, recoverable sugar%, loss sugar yield and quality index traits, while the results were arranged from the highest value to the lowest value with sugar loss in molasses percentage trait only.

With the delay of planting date of sugarbeet from August 10. to Novmber 10. sugar content was increased (P≤0.05)significantly by 5.05%, from 15.45 to 16.37, recoverable sugar percentage by 8.08%, from 12.25 to 13.24 and loss sugar yield by 10.33%, from 0.668 to 0.737 tons/fed., but sugar loss in molasses% decreased (P≤0.05)significantly by 6.77%, from 3.10 to 2.89% (Table, 4).

Table 4. Effect of different planting dates, cultivars and their interaction on qualitative traits of sugarbeet (combined over two seasons)

Planting dates (A)	Sugarbeet cultivars(B)	Sugar content%	Recoverable sugar%	Loss sugar In molasses%	Loss sugar yield in molasses (tons/fed.)	Quality Index
	Francescan	15.00	11.88	3.12	0.618	79.20
August	Sandor	16.02	12.89	3.13	0.655	80.46
10	Mirador	15.44	12.34	3.10	0.700	79.92
	Oscar Poly	15.33	12.30	3.03	0.700	80.23
Mean		15.45^{d}	12.25 ^{d}	3.10 ^{a}	0.668 ^{d}	79.98 ^{d}
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
	Francescan	15.49	12.59	2.90	0.668	81.28
September	Sandor	16.53	13.44	3.09	0.622	81.31
10	Mirador	15.97	12.94	3.03	0.688	81.03
	Oscar Poly	15.81	12.81	3.00	0.692	81.02
Mean		15.95 ^{c}	12.91 ^{c}	3.01 ^{b}	0.686 ^{c}	81.16 ^{c}
		(2.33%)	(5.80%)	(-2.90%)	(2.70%)	(1.48%)
	Francescan	15.70	12.62	3.08	0.672	80.38
October 10	Sandor	16.55	13.46	3.09	0.697	81.33
	Mirador	16.04	13.01	3.03	0.775	81.11
	Oscar Poly	15.87	12.90	2.97	0.775	81.29
Mean		16.04 ^{b}	13.00 ^{b}	3.04 ^{c}	0.730^{b}	81.03 ^{b}
		(3.82%)	(6.12%)	(-1.94%)	(9.30%)	(1.31%)
	Francescan	15.77	13.27	2.50	0.605	84.15
November	Sandor	17.02	13.97	3.05	0.751	82.08
10	Mirador	16.46	13.46	3.00	0.775	82.93
	Oscar Poly	16.23	12.24	3.00	0.818	81.58
Mean		16.37 ^{a}	13.24 ^{a}	2.89 ^{d}	0.737 ^{a}	82.69 ^{a}
		(5.05%)	(8.08%)	(-6.77%)	(10.33%)	(3.39%)
	Francescan	15.49 ^{d}	12.59^{c}	2.90 ^{d}	0.641 ^{d}	81.25 ^{b}
Cultivars	Sandor	16.53^{a}	13.45^{a}	3.09 ^{a}	0.681 ^{c}	81.31 ^{a}
(B)	Mirador	15.98 ^{b}	13.07^{b}	3.05 ^{b}	0.735 ^{b}	81.25 ^{b}
	Oscar Poly	15.81 ^{c}	13.00 ^{b}	2.96 ^{c}	0.746 ^{a}	81.03 ^{c}

L.S.D. $_{0.05}$ **A X B 0.29 0.25 0.06 0.28 Data with the same letters within a column are not significantly (P≤0.05)different according to Douncan's a new multiple range test.**

Sandor cultivar showed that the highest significant values for sugar content, recoverable sugar percentage, sugar loss in molasses and quality index at the first and second planting dates, but at the third and fourth planting dates it achieved the highest sugar content and recoverable sugar percentage only, compared to the other tested sugarbeet cultivars. At the last planting date (November 10.), the cultivar Francescan gave the highest value (84.15%) for quality index and lowest value (0.605 tons/fed.) for loss sugar yield. While cultivar Sandor gave the highest value for the sugar content (17.02%) and recoverable sugar percentage (13.97%), and cultivar Oscar poly recorded the highest value for loss sugar yield (0.818 ton/fed.) as compared to the other tested planting dates. There were no significant differences between Mirador and Oscar poly cultivars in sugar content and recoverable sugar percentage during the first planting date, and in loss sugar yield during the first and third planting dates as shown in Table (4).

The interaction between planting dates and sugarbeet cultivars had significant effect on sugar content, recoverable sugar percentage, losses sugar yield and quality index. The highest significant percentages for sugar content (17.02**%**) and recoverable sugar (13.97%)were recorded with Sandor sugarbeet cultivar during last planting date (November 10),

while the highest loss sugar in molasses percentage (3.13%) and quality index (84.15%) were determined by cultivar Sandor, Francescan at the first and fourth planting dates, respectively. The highest loss sugar yield value was determined by Oscar poly cultivar at the fourth planting date (November 10.) as shown in Table **(**4).

The differences among the tested sugarbeet cultivars were significant for all qualitative traits, sugar content, recoverable sugar percentage, loss sugar in molasses percentage, loss sugar yield and quality index. Sandor sugarbeet cultivar had the highest significant sugar content, recoverable sugar percentage and loss sugar in molasses percentage, followed by Mirador, Oscar poly and Francescan cultivars. The highest and lowest significant values of loss sugar yield were recorded with Oscar poly and Sandor cultivars, respectively. for all the tested planting dates Sandor at the second planting date recorded the lowest value for loss sugar yield (Table 4).

There were not significant differences between Mirador and Oscar poly cultivars for recoverable sugar percentage, and between Mirador and Francescan cultivars for loss sugar yield and quality index.

The previous results showed that delaying the planting of sugarbeet from first planting date, (August 10) to the last planting date (November 10) led to a significant increase in all tested traits of quantitative (top, roots, raw sugar and recoverable sugar yields) and qualitative (sugar content, raw suagar percentage, recoverable sugar percentage and quality index) except for the sugar loss in molasses percentage, which decreased significantly.

The increase in roots yield and sugar content with the late planting date (November 10) might be due to suitable weather condition especially temperature during plant growing from planting to harvest that helped in formation of strong canopy Raw sugar yield which was affected by roots yield and sugar content, while, recoverable sugar yield was affected by roots yield, sucrose content and impurity content. Also, superior percentage of sugar loss due to high impurities (Na, K and α- amino nitrogen) content of beet roots. More the delaying planting dates from August 10 to November 10 significantly decreased root-knot nematode, *M. javanica* population in soil and in root system could be the reason for more roots yield.

Under Egyptian conditions, many researches have studied the effect of various planting dates on the quantitative and qualitative traits of sugarbeet grown in healthy soils not infested with plant parasite nematodes. They concluded that the early planting of sugarbeet on 1st October increased roots and sugar yields and gave the best quality parameters (Abo-El-magd, 2003). Also, the highest values of top, roots, sugar yield, sucrose% and purity% for sugarbeet were recovered when planted on 15th September and 15th October compared to the late planting date (15th November). The highest roots and recoverable sugar yields as well as sugar content, recoverable sugar percentage and quality index of sugarbeet were achieved by sowing sugarbeet on 15th October followed by15th September and 15th November planting dates (Ferweez *et al*., 2006). On the other hand, the October planting date produced the highest sucrose% and the highest quality index values, and early planting date during August had a negative effect on sugar yield. Late planting during October produced maximum sugar yield/fed. due to its high roots yield (El-Agamy, 2007). Also, early planting of sugarbeet (15th September- 15th October) produced the highest sucrose% as well as roots and sugar yields in comparing on planting dates, 15th November and 15th December (Sakr *et al*., 2013). In addition to the late planting date, 25th October significantly increased sugarbeet roots, top and sugar yields, and significantly decreased sucrose% than the other two planting dates (25th August and 25th September). Ghonema and Abo-El-Ftooh (2017) and El-Sharnoby and Ebieda (2021) reported that sugarbeet planted on 25th October (as late planting date) gave the highest values for roots, top, gross sugar and recoverable sugar yields as well as all quality parameters except loss sugar%, while the first date (25th August) gave the lowest values for them.

Few researches have studied the effect of planting dates on the quantitative and qualitative traits of sugarbeet in soil contaminated with root-knot nematodes in semi-arid regions and found that delaying the sugarbeet planting date from August 10 to November 10 significantly increased all productivity and quality traits except for loss sugar in molasses%, which decreased significantly with the delaying the planting date Maareg *et al*. (2006). While Sabra, (2016) stated that the maximum values of sucrose content, recoverable sugar percentage, purity% and sugar yield were obtained when sugarbeet was planted on August 15, but the highest values of roots yield and loss sugar% were obtained from sowing sugarbeet on October 15.

Among the four sugarbeet cultivars used in this study, Oscar poly had the highest values for roots, top, raw sugar and recoverable sugar yields, followed by cultivar Mirador, Sandor and Francescan, respectively, with significantly differences among them, confirming the results of Maareg *et al*. (2018). Also, cultivar, Oscar poly had the highest top, roots, raw sugar and recoverable sugar yields in all tested planting dates, compared to the three other cultivars. The differences among the tested sugarbeet cultivars might by principally due to the genetic variation.

CONCLUSION

From the previous results, it was found that delaying the planting date of sugarbeet from August 10 to November 10 resulted in a significant reduction in *M. javanica* second stage juveniles in soil, development stages in root system, final population and reproduction factor on sugarbeet plants. On the contrary, delaying the planting date of sugarbeet from August 10 to November 10 led to a highly significant increase in sugarbeet quantitative traits, roots, top, raw sugar and recoverable sugar yields, and the most quality traits. Oscarpoly cultivar gave the highest significant reduction in the all tested nematode traits and the highest significant increase in the all quantitative traits of sugarbeet during the all tested planting dates, compared to the other tested cultivars. However, cultivars, Francescan, Mirador and Sandor recorded the highest values of the same traits during the last planting date (November 10), compared to the other planting dates. From these results, we recommend planting the Oscar Poly cultivar at all the tested planting dates (as a tolerant variety) and the other three cultivars at the last planting date as susceptible cultivars, as the number of nematodes in the soil is low. Among planting dates, the last planting date demonstrated the best control reducing second stage juveniles in soil, final population and reproduction factor of nematode, and increasing the sugarbeet roots, raw sugar and recoverable sugar yields in comparison to the other ones. Hence, delaying the planting date can be considered as an agricultural method to control of root-knot nematode.

REFERENCES

A.O.A.C. (1990). Association of Official Analytical Chemists methodof analysis, 16th Ed., A.O.A.C. International. Washington, D.C., USA.

Abo-El-Magd, B.M. ; Ebraheim, M.F. and Aboushady, K.H.A.. (2003). Some chemical and technological characteristics by planting methods and different harvesting dates. J. Agric. Sci., Mansoura Univ. 28 (7): 5115-5128.

Byrd, D.W.; Kirkpatrick, Jr. T. and Barker, K.R. (1983). An improved technique for clearing and staining plant tissue for detecting of nematodes . J. Nematol. 15:142-143.

De whalley, H.C.S. 1964: lCUMSA, methods of sugar analysis. Elsevier pub. CO., New York: 10-19,37-44.

Duncan, D. B. (1955). Multiple range and multiple F tests. Biometrics, 11(1): 1-42.

El- Agamy, S. Z.; Abou- salama, A. M.; El- sherief, H. A. and Khater, M. S. H. (2007). Improving of quality for sugarbeet varieties using planting and harvesting dates, proceedings of international conference on "World Perspectives for Sugarbeet and Cane as a Food and Energy Crop, Sharm El- Sheikh, Egypt. P12.

El-Sharnoby, H.M. and Ebieda, A. M. (2021). Physiological characters, productivity and quality of sugarbeet and nematode infection as affected by planting dates and its cultivars. Middle East J. Agric. Res. 10(1): 315-327.

Farahat, A.A. ; Hendy, H.H.; El-Naggar, H.I. and El-Ghonaimy, A.M. (2008). Occurrence and population dynamics of the root-knot nematodes in each peach farms with emphasis on sandy soil. Egypt, J. Agronematol. 6(2):147-158.

Ferdous, M. H. ; Khaliq, A. Q. and Karim, A. (2015). Effect of sowing dates on growth and yield of tropical sugarbeet. Intl. J. Agron. Agric. Res. 7(1): 53-60.

Ferweez, H.; Abbas, H.M. and Abou El-Magd, B. M. (2006). Determination of the losses in yield, quality of sugarbeet roots resulted from exceeding nitrogen fertilization and processing delay. Minia J. Agric. Res. & Develop :26 (1): 27- 44.

Ghonema, M. A. and Abo El-Ftooh, A. A. (2017). Effect of sowing date on productivity, quality and insect infestation of some sugarbeet cultivars under newly reclaimed soil conditions. Egypt J. Plant Breed. 21(1): 115 – 140.

Gohar, I. M. A. (2003). The relationships between plant parasitic nematodes of sugarbeet and other soil fauna. Ph.D. Thesis, Fac. Of Agric. Moshtohor, Zagazig Univ., Egypt 221pp.

Maareg M. F. and Hassanein, M.A. (1999). Survey and ecological studies on plant parasitic nematodes in the West of Nubaryia: In. The effects of nematode on sugarbeet at Al-Bostan region. Project funded from National Council of Sugar Crops (NCSC). 51 pp.

Maareg, M. F.; Gohar, I.M.A. and Agmi, K.M. (2006). Effect of selected planting dates on root-knot nematodes and the yield components of some sugarbeet varieties in sandy soil. Project fund from National Council of Sugar Crops (NCSC) PP: 9-13.

Maareg, M.F. ; El- Gindi, A.Y.; Mona E. El- Shalaby and Abeer, S. Yassin. (2018). Evaluation of some sugarbeet varieties for their susceptibility to root- knot nematode, Meloidogyne incognita, according to modified host parasite index (MHPI) scale. Egypt. J. Agronematol., 17(1): 1- 12.

Maareg, M.F. ; Gohar, I.M.A. and Agami, K.M. (2004). Occurrence and population dynamics of the root knot nematodes, *Meloidogyne* spp.. in sandy soil at Al-Bostan region. Project fund from National Council of Sugar Crops (NCSC), 57.

Rady, G. H. H.; Gaabob, I. A.; Gohar, I. M. A.; Eliwa, H. M. and Sabra, T. F. Y. (2016). Effect selected planting dates on root-knot nematodes population and productivity of sugarbeet varieties, Pleno. Annals Agric. Sci., Moshtohor. 54(1): 139-146.

Romaneckas, K. and Sarauskis, E. (2003). The investigation of sugarbeet seedbed by Kriz method (Sweden) under different soil tillage and sowing pattern Zemdirbyste – Agriculturee 81 (1): 67-74.

Sabra, T.F.Y (2016). Studies on sugarbeet nematodes and effect of different control methods on yield quantity and quality. M. Sci. Thesis, Fac. Agric. Moshtohor, Benha Univ. 167 p.

Sakr, M. M.; Salah, M. H. Gowayed; Kadasa, N. M. S.; Enas S. I. Azab and Ahmed, S. A. Harabawy. (2013). The relationship between sowing dates and vernalization treatments and growth characters and some chemical components of Beta vulgaris L. cv. Pleno. Life Sci. J. 10(3): 1846-1849.

Spaar, D.; Dreger, D. and Zacharenko, A. (2004). Sugarbeet. CUP,, Orech, Minsk, pp. 133-135 (in Russian).

Sugar Crops Council (2023). Annual report "Sugar crops and sugar production in Egypt in 2022/2023 growing and juice 2022 seseaon" 207pp.

العمليات الزراعية كإستراتيجية لمكافحة نيماتودا تعقد الجذورعلى بنجر السكر1- بإستخدام بعض مواعيد الزراعة وأصناف بنجر السكر فى الأراضي شبه الجافة

محمد فتحي معارج[1] ، كمال محمد عجمي[2] ، حسام محمد الشرنوبي[3] و عمرو محمد الشيخ[4]

[1]قسم وقاية النبات - - معهد بحوث المحاصيل السكرية- مركز البحوث الزراعية – الجيزة - مصر
[2]قسم المعاملات الزراعية- معهد بحوث المحاصيل السكرية- مركز البحوث الزراعية – الجيزة – مصر
[3]قسم الفسيولوجي والكيمياء - معهد بحوث المحاصيل السكرية- مركز البحوث الزراعية – الجيزة – مصر
[4]قسم التربية والوراثة - معهد بحوث المحاصيل السكرية- مركز البحوث الزراعية – الجيزة - مصر

الملخص

نفذت تجربتان حقليتان موسمي 22/2021 و 23/2022 لدراسة تأثير أربعة مواعيد زراعة (10 أغسطس، 10 سبتمبر، 10 أكتوبر، و10 نوفمبر) وأربعة أصناف من بنجر السكر (فرانشيسكان، ميرادور، أوسكاربولي، وساندور) على تكاثر نيماتودا تعقد الجذور *Meloidogyne javanica* وإنتاجية وجودة المحصول.أظهرت النتائج أن تأخير ميعاد الزراعة من 10 أغسطس إلى 10 نوفمبر أدى إلى انخفاض معنوي في أعداد النيماتودا، حيث انخفض عدد الطور اليرقي الثاني في التربة من 31,436 إلى 6,145، ، الأطوار المختلفة في المجموع الجذري من 3615 إلى 1296 والتعداد النهائي للنيماتودا من 35,051 إلى 7,441، مما يمثل انخفاضًا بنسبة 71.69% و69.30% على التوالي. بينما قيمة معدل التكاثر انخفضت معنويا من 19.47 إلى 4.13 ضعفا مقارنة مع التعداد الاولي بالتربة. كما زادت مكونات المحصول مع تأخير ميعاد الزراعة، حيث ارتفع محصول الأوراق من 12.24 إلى 14.76 طن/فدان، ومحصول الجذور من 19.81 إلى 25.48 طن/فدان. ومحصول السكر الخام من 2.97 إلى 4.17 طن/فدان، ومحصول السكر الأبيض من 2.35 إلى 3.44 طن/فدان. كما أدى الميعاد الأخير لزراعة بنجر السكر إلى زيادة معنوية في محتوى السكر ، نسبة السكر الأبيض، ومحصول السكر المفقود في المولاس ومعامل الجودة بنسبة 5.05، 8.08، 18.33 و3.39% على التوالي مقارنة بالميعاد الأول للزراعة.سجل صنف أوسكار بولي أعلى انخفاض في تكاثر النيماتودا وأعلى زيادة في المحصول مقارنة بالأصناف الأخرى. بينما كانت الأصناف فرانسيسكان وميرادور وساندور أكثر ملاءمة للزراعة في الميعاد الأخير فقط.بناءً على النتائج، يُوصى بزراعة صنف أوسكار بولي في جميع مواعيد الزراعة كصنف متحمل، بينما تُعتبر الأصناف الأخرى مناسبة فقط للزراعة في الميعاد الأخير. يُعتبر تأخير ميعاد الزراعة أسلوبًا فعالًا لمكافحة النيماتودا وتحسين إنتاجية بنجر السكر.