

EFFECT OF NITROGEN FERTILIZATION LEVEL ON
POPULATION DENSITY OF TETRANYCHUS URTICAE
(KOCH) IN RELATION WITH YIELDING ABILITY
AND QUALITY OF SUMMER SQUASH

BY

M. Doss* and Samia, M. Saleh**

*Horticulture Dept. **Plant Protection Dept.
Faculty of Agriculture, Alexandria University,
Egypt.

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ABSTRACT

Under field conditions , a two years study was conducted to determine the effects of nitrogen fertilization on the population of mites attacking squash plants as well as on the total yield and yield components. Data showed significant differences among mite populations under nitrogen levels. A positive correlation was detected between nitrogen fertilizer rates (soil application) and the density of mite.

Total yield and fruit number per plant increased with increasing nitrogen level up to the rate of (60-120 Kg/feddan), whereas the average fruit weight (g) did not show a clear response.

Increasing N-fertilizer rate raised the leaf contents of phenolics and chlorophyll retention, since phenols accumulated in leaves and elevated mite population rates. These compounds could be regarded as preformed chemical resistance factors. However, only the symptoms (Senescence of leaves) caused by mite infestation was suppressed. In other words, it turned out that acquired resistance in summer squash plants, which received high nitrogen level, was effective only against the necrotic mites symptoms but not against multiplication of mite.

INTRODUCTION

The relationships between vegetable crops and the pests that attack them and decrease yield or adversely affect quality are complex, dynamic and quantitatively very variable (Eardner and Fletcher, 1974). Briefly, as it has been already explained (Chaboussou, 1976) nutritional equilibrium plays a dominant role in the plant's physiology and, hence, in its potential for resistance to pest attack. In particular, mites or thrips appear to be particularly sensitive to changes in internal conditions in the plants (Asly, 1965). Mites populations sensitivity appears to be related to high amino acid content in the sap as well as high content reducing sugars (Jeppson et al., 1961; Habib et al., 1972 and Chaboussou, 1972). However, nitrogen fertilizers promote the population growth of mites (Thalenhorst, 1974). Consequently, the populations of mites increase due to nitrogen fertilizers, but can partially be contracted by the application of potassium fertilizer (Pritchett and Smith, 1972 and Baule, 1975).

Recently, it was also shown that when the host plants were supplied with high rates of nitrogen, their resistance to necrotic symptoms usually increased (Kiraly, 1976). The effect of intensive nitrogen treatment on senescent symptoms resembles that of cytokinins. In this respect, the recognition by Peterson and Miller (1976) that the application of reduced nitrogen salts to plants can promote accumulation of cytokinins. Tetranychus urticae (Koch) field observation illustrated that spider mite is one of the most serious economic pests on squash plants. The mite can build up a population over one hundred mites per leaflet in summer growing seasons. The infested squash leaves turn yellow and then brown due to necrosis spots.

The present study was therefore carried out to determine to what extent should N-soil

fertilizer be applied, and to know more about nitrogen effects on summer squash plants and on mite populations.

MATERIALS AND METHODS

This work was conducted during summer seasons of 1989 and 1990 at the Agriculture Experiment Station of Alexandria University, to study the effect of nitrogen fertilizer levels on total yield, yield components and mite population.

Escandrany cultivar of summer squash (*Cucurbita pepo*, L.) was grown in fifteen equal plots. Each plot consisted of 7 rows (1.0 m wide and 5.0 m long). Seeds were sown on the second week of march in both experiments at 40 cm spacing. Five different levels of nitrogen fertilizers were used; 0 (control), 20, 30, 60, and 120 N Kg per feddan. These treatments were arranged in three replicates in a randomized complete blocks design.

Cultural procedures of growing squash were in accordance with good farm practices. No chemical control was used to control the mite pest.

Determination of the studied parameters:

Mite population:

Samples of 20 leaves from each plot were randomly taken at flowering time. All active forms (nymphs and adults) of mite on both leaves surfaces were counted.

Phenol content:

Extraction and assay of phenolics of squash leaves were estimated by the method of Swain and Hillis (1959).

Chlorophyll retention test:

The level of chlorophyll in a detached leaf may serve as a tentative basis for cytokinin assay (Juvenility of leaf). Chlorophyll retention test in this study was based on the

original bioassay (Osborne and Mc-Calla, 1961). The method of determination was described by Doss (1981).

Nitrogen-utilization:

Estimated values were obtained according to Doss and Baghdady, 1987.

All obtained data were statistically analysed by standard methods (Al-Rawi and Khalf-Allah, 1980). Correlation coefficient was, also, calculated to measure the relationship between two variable values of nitrogen level, mite multiplication and phenol concentration in squash leaves (Kendall, 1955).

RESULTS AND DISCUSSION

The used nitrogen fertilizer treatments were evaluated to determine their effects on mite population in relation with squash crop-susceptibility and yielding capability. Therefore several parameters were considered.

The comparisons among the different nitrogen-fertilizer levels appeared to reflect significant differences for mite numbers per plant, as shown in Table (1-a). The general trend, noticed from these comparisons; indicated that soil fertilization with various nitrogen rates gave significantly higher means for the average mite numbers. Also, the correlation between N-fertilizers rate and the average mites number per plant were found to be highly significant ($r = 0.87$ "and 0.91 ") for the seasons of 1989 and 1990, respectively. These results are in general agreement with data previously reported by Le-Roux (1954), Hamstead and Gould (1957), Watson (1964) and Farouk et al., (1986); indicating a positive correlation between nitrogen level and mite increase mainly T. urticae.

Table (1-b), shows the chlorophyll degradation in detached leaf after 96 hr. The bioassay

Table 1-a: Mite population density on squash leaves, as affected by N-fertilizer levels in 1989 and 1990.

Season	Average number of mites/plant Treatment: (N-fertilizer levels Kg/feddan)				
	0 (control)	20	30	60	120
1989	62 e	180 d	240 c	330 b	510 a
1990	142 d	380 c	410 c	540 b	780 a

Table 1-b: Hormones status in squash leaves, as affected by N-fertilizer levels in relation with mites infestation stress, in 1989 and 1990.

Treatments (N-level)	Hormones status			
	Juvenility area%		Senescent area%	
	1989	1990	1989	1990
0 Control	79.81 c	74.40 c	20.19 c	25.60 b
20 NKg/Feddan	71.30 d	72.06 d	28.70 b	27.94 a
30 NKg/Feddan	68.70 e	70.85 d	31.25 a	29.15 a
60 NKg/Feddan	84.10 b	79.66 b	15.90 d	20.34 c
120 NKg/Feddan	92.35 a	88.20 a	7.64 e	11.80 d

- Juvenility area% equals to that of chlorophyll retention % in detached leaves.
- Values with an alphabetical letter in common, in each Table, within a particular season, do not significantly differ, using Duncans's multiple range test; at 0.05 level.

Table 2: Phenolic compounds in squash leaves as affected by nitrogen levels in 1989 and 1990.

Treatment	Total phenol (mg/10 g f.wt.)	
	1989	1990
0 Control	4.26 c	3.18 d
20 NKg/Feddan	5.21 b	4.80 c
30 NKg/Feddan	5.52 b	5.10 c
60 NKg/Feddan	7.08 a	6.89 b
120 NKg/Feddan	7.17 a	7.42 a

Table 3: Nitrogen utilization%, total yield and yield components of squash as affected by nitrogen levels in 1989 and 1990.

Treatment (N-level)	N - uti- -lization %	Total yield (Kg/plant)	Yield components	
			Fruit No./plant	Fruit size(g)
1989				
0 Control	—	0.352 c	2.93 d	120 a
20 NKg/Feddan	29.60 b	0.398 c	3.75 c	106 b
30 NKg/Feddan	30.17 b	0.524 b	4.76 b	110 b
60 NKg/Feddan	31.25 b	0.590 a	5.61 a	105 b
120 NKg/Feddan	37.11 a	0.610 a	5.59 a	109 b
1990				
0 Control	—	0.285 d	2.71 d	105 a
20 NKg/Feddan	30.20 b	0.370 c	3.62 c	102 a
30 NKg/Feddan	31.42 b	0.410 c	3.98 c	103 a
60 NKg/Feddan	28.90 b	0.612 b	6.44 b	95 a
120 NKg/Feddan	35.70 a	0.715 a	7.08 a	101 a

- Values with an alphabetical letter in common, in each Table, within a particular season, do not significantly differ, using Duncan's multiple range at 0.05 level.

of the retention of chlorophyll could be taken as a measure of the cytokinin activity which delays chlorophyll degradation caused by mites infestation in squash leaves. The data received after 96 hr. indicated that retention values of nitrogen-fertilizer treatment were higher as compared to the control ones. Mites activity, in the case of senescent area of leaves, were raised to the maximum (31.25 and 29.15% in 1989 and 1990, respectively) under the level of 20 and 30 N Kg/feddan. However, the application of higher rates of N-fertilizer (60 to 120 N Kg/feddan) gave the lowest values of mites symptoms (senescent leaf area). This data reveal to a possible activity of cytokinin in the mechanism of protection. The cytokinin activity, in plants which received the highest rate of nitrogen (120 N Kg/feddan) seems to be higher than in other treatments, and may have a role in inducing protection against chlorophyll degradation as mites symptoms (Kiraly and Szalay-Marzso, 1971).

The comparisons among the five nitrogen fertilizer levels on the basis of phenol contents are illustrated in Table (2). Most of the comparisons among the different nitrogen rates reflected significant differences. There is a positive correlation between N-levels and phenol concentration in squash leaves ($r = 0.85$ "for 1989 and $r = 0.87$ " for 1990).

Infestation(stress),damaged plant tissues, and there by induction of physiological state that resembles to senescence, then oxidation of phenols, brown discoloration of leaves are the characteristic symptoms of mite infestation.

In both seasons , the application of N-fertilizer at different rates gave significant differences in total yield(Table 3).The results reflected pronounced effects for nitrogen on the total yield/plant, fruit No/plant and N-utilization%. Increasing the nitrogen level increased the percentage of nitrogen utilization

and total yield. The same trend was found in assessing the average fruit number per plant. However, the differences of the average fruit size among the nitrogen levels did not appear significant.

Similar findings were also found by several investigators working such as; Moursi and Sirry (1956), Gomma (1958), Borna (1974) and Moustafa et al., (1978).

From the previously discussed results, it turned out that acquired resistance of squash plants, caused by high nitrogen fertilizer rates was effective only against mites symptoms but not against the multiplication of mite-pest.

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الملخص العربى

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اجريت تجربتان حقليتان فى موسمى صيف عام ١٩٨٩، ١٩٩٠ بمزرعة محطة البحوث - كلية الزراعة - جامعة الاسكندرية وتهدف هذه الدراسة الى محاولة تصنيع التاشيرات الخاصة للتسميد الازوتى "معدلات الاضافة" على محصول الكوسة الاسكندرانى فى النقاط التالية :

اولا :
— دراسة علاقة الاضافة النتروجينية "معدلات تسميد ارضية" على حجم الاصابة بالكاروسات.

ثانيا :
— دراسة العلاقة الخاصة بين معدلات اضافة النتروجين ومستوى كل من الكلوروفيل والفيتولات فى الاوراق ومدى ارتباطهما بمقدرة نبات الكوسة على مقاومة او احتمال الاصابة بالاكاروسات.

ثالثا :
— دراسة العلاقات الارتباطية لمعدلات التاشير الخاص والمحرك لمعدلات الاضافة على المحصول الشاى كما ونوعا.

وقد اظهرت نتائج الدراسة مايلى :

- ١- وجود علاقة ارتباط احصائى بين معدلات الاضافة الازوتية مع عدد الثمار الناتجة للنبات الواحد.
- ٢- اختلفت قيم اعداد الاكاروس اختلافا معنويا وللمعدلات الاضافة السمادية، وقدر الارتباط الاحصائى بينها بقيمة موجبة عالية.
- ٣- ادى استخدام معدلات الاضافة السمادية ٦٠ ، ١٢٠ كجم نتروجين للفدان الى زيادة مؤكدة احصائيا فى كل من المحصول الكلى (كجم/نبات). وكذلك فى عدد الثمار/نبات ، اى فى زيادة المقدرة الانتاجية لنبات الكوسة.
- ٤- ان الاعراض الخارجية (مقاسة بمعدلات الهدم الكلوروفيل) قد تناقصت بزيادة معدلات الاضافة السمادية رغم تزايد اعداد الاكاروس على النبات بزيادة التسميد الازوتى.
- ٥- زيادة محتوى الاوراق من الفيتولات وزيادة حيوية النبات (مقاسة بقدرة بقاء الكلوروفيل فى الاوراق الملقوعة) توافقت احصائيا مع زيادة معدلات التسميد الازوتى من صفر الى ١٢٠ كجم ازوت للفدان) لمحصول الكوسة.

اظهرت النتائج بصورة عامة ان زيادة معدلات التسميد الازوتى تؤدي عمليا لخفض اعراض الاصابة بالاكاروسات ولكنها لا تؤثر على الافة ذاتها او اعدادها ، اى انها تؤدي الى زيادة قدرة النبات على تحمل اضرارها وبالتالي لا يتاثر انتاجه كما او نوعا.