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EFFECT OF NITROGEN AND SALINITY LEVELS IN IRRIGATION WATER ON GREENHOUSE TOMATOES USING DIAGNOSIS AND RECOMMENDATION INTEGRATED SYSTEM

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ABSTRACT: ***Norms for the Diagnosis and Recommendation Integrated System (DRIS) developed for greenhouse tomato (lycopersicon esculentum L.) were evaluated experimentaily by varying the N concentration (115, 230 and 460 mg Nl^{-1}) or the salinity level (0.88, 1.90 and 3.98 dSm^{-1}) of the irrigation water. Foliar samples were taken at different intervals during the season for total N, P, K, Ca and Mg analysis. The nutrient imbalance index (NII) was calculated by summing up DRIS indexes irrespective of sign. A dry matter index (DM) was included in the modified DRIS (M-DRIS) approach as a separator between excessive or deficient nutrients. Yield of marketable fruit that accumulated over a 8 week harvest period was quadratically related to N fertilization:115, 230 and 460 mgNL^{-1} produced 2.9 , 3.3 and 2.3 kg per plant respectively larger than critical NII values, 82 days after transplanting, were associated with excess of N, and Mg, and Ca deficiencies. Contrary to the DRIS and M-DRIS approaches, the critical nutrient range approach (CNR) did not indicate any N excess. In the salinity experiment, marketable yield decreased linearly with salinity: 0.88, 1.90 and 3.98 dSm^{-1} produced 3.3, 2.9 and 2.3 kg per plant, respectively. Increasing salinity caused an increase in the NII at all sampling periods. However, NII's were always smaller than the critical NII and were inconsistent with the low yields obtained. Thus, NII was considered a poor indicator of the salt effect.***

Key words: ***Tomatoes, lycopersicon esculentum l., tissue diagnosis, nutrient ratio, diagnosis and recommendation integrated system DRIS., modified diagnosis and recommendation integrated system M-DRIS., nutrient imbalance index NII, blossom end rot BER.***

INTRODUCTION

Tissue analysis is currently used to diagnose crop nutritional status because it integrates factors governing plant growth (Munson and Nelson, 1973). Analytical results can be compared with known minimum and maximum concentration values, which are called the critical nutrient range approach (CNR). However, these concentrations are affected by plant growth stage (Marschner, 1986) and nutrient interactions (Bates, 1971).

The Diagnosis and Recommendation Intergrated System (DRIS) has been proposed to diminish the effects associated with nutrient interactions and the dilution or accumulation of elements in the dry matter (Walworth and Sumner 1987). This approach appears to be complementary (Alkoshab et.al 1988), if not superior to the CNR diagnosis (Walworth and Sumner 1987). It classifies the elementes by their limiting order and assesses nutrient imbalances. The system calculates a nutrient index value, and the more negative this index , the more deficient the evaluated nutrient for plant growth . Conversely , a positive value indicates a relative excess .

Among the different methods that have been investigated in interpreting the DRIS diagnosis , the sum of nutrient indices irrespective of sign (NII) has been initially proposed (Beaufils ,1973) , and used with success (Davee *et.al,* 1986; Abdel Warth ,2002 ; Abdel Hady,2004 and Abdel Warth. *et.al.,* 2005). This interpretation appears more sensitive for greenhouse tomatoes when done by developmental stage. Indeed, higher correlation coefficient between the nutrient imbalance index (NII) and yield was obtained by using norms defined by sampling period (Caron and Parent,1989).

The introduction of the dry matter index (DM) in the modified-DRIS approach and (M-DRIS) approach could help to discriminate limiting from non-limiting nurients (Hallmark *et.al.,* 1987). So, the higher sensitivity of a DRIS system defined by developmental stage could be further improved by integrating the DM index in the M-DRIS approach, and the improved system could be tested for the diagnosis of vegetative growth or blossom end rot (BER) for greenhouse tomatoes. These nutritional disorders are often associated with an excess of nitrogen and high salinity levels in the irrigation water (Paterson and Hall , 1981 and Pill *et.al.,* 1978) and may cause important yield losses.

This work compared the CNR, DRIS, and M-DRIS approaches and evaluate nitrogen and salinity level on the yield of greenhous tomatoes.

MATERIALS AND METHODS

The DRIS norms used here have been published by Caron and Parent (1989). CNR norms used have been developed by the Conseil des Productions Vegetales du Quebec(1984): 5% to 5.5% for N, 0.5% to 0.8%for P, 3.75% to 5.25% for K, 1.5% to 4% for Ca and 0.4% to 0.5% for Mg. The tissue diagnosed the fifth leaf from the top and leaf samples were composited within one experimental unit due to the restricted number of plants and the frequent sampling intervals in both experiments. Tissue samples were oven dried to 70^{o}C, then milled. Total N was determined by micro-Kjeldahl digestion and measured colorimetircally on a Technicon Auto analyzer I.

The DRIS indices were calculated as described by Sumner (1978) and the NII was evaluated by summing up the DRIS indices irrespective of sign. Marketable yield consisted of the fruit without form or appearnce defects.

Experiment one : A field experiment was conducted at El-Tor area prolonged at south Sinai which characteristics as a sandy textured soil. Some soil physical and chemical characteristics are shown in Table (1).

Table (1): Some physical and chemical characteristics of the studied soils.

Depth (cm)	pH	Ec dS/m	Soluble anions me/l				Soluble cations me/l				O.M. %	Particle size distribation (%)		
			Co_3^{-2}	HCO_3^-	Cl^-	So_4^{-2}	Ca^{+2}	Mg^{+2}	Na^+	K^+		Sand	Silt	Clay
0-20	8.30	0.95	0.0	2.39	4.87	2.85	2.61	2.57	4.35	0.58	0.26	92.6	1.7	5.7
20-40	8.20	0.66	0.0	2.19	1.67	2.55	2.79	2.12	1.48	0.52	0.30	95.2	2.0	2.8
40-60	8.40	0.51	0.0	2.07	1.54	1.61	1.87	1.23	1.61	0.51	0.20	96.0	1.6	2.4

The experiment one under nitrogen levels was conducted with the varieties Supper Red, seeded in containers on January 25, and then transplanted into peat pots. Seedlings were transplanted on March 15 in the greenhouse at a density of 3.23 plants per m^2. Irrigation water which used was a second grade (1.9 dSm^{-1}). From germination to transplanting, the seedlings were watered regularly with a 10-52-10 (N: P_2O_5: K_2O) liquid fertilizer (3 to 6 gl^{-1}). Three nitrogen treatments were applied using ammonium nitrate as N sources (in mg Nl^{-1}) :115, 230 and 460 mgl^{-1}. The P, K, Ca, Mg, and micronutrient concentrations were constant. Day temperature was maintained at 21^oC ± 2^oC and night temperature at 15^oC±2^oC.

Tissue samples were collected on May 5 and 23 and on Junes 5, which corresponded to sampling period C, D and E as defined by Caron and Parent (1989).

The Ca, Mg and K concentrations in leaf tissues were determined with atomic absorption spectrophotometry and P concentrations were measured colcrimetrically aftere nitric and perchloric acid digestion. Tissue samples were prepared and analyzed for N as already described.

Experiment Two: The experiment on salinity levels in the irrigation water, three wells water varied in their salinity levels (i-e 0.88, 1.90 and 3.98 dSm^{-1}) were used for irrigation. Chemical analyses of different used irrigation water are presented in Table (2). Tomatoes seeded on April 17, and transplanted on May 25 at a density of 3.23 plants per m^2. from April 17 to May 9, before transplanting, the plants received a standard 10-52-10 (N: P_2O_5: K_2O) fertilization (3 to 6 gl^{-1}). After transplanting, plants were fertilized with recommended dose. Tissue samples were taken on July 18 and August 15, that is, during sampling periods D and E respectively, of Caron and Parent

(1989). They were then prepared and analyzed for N, P, K, Ca, and Mg as described above.

Table (2): Chemical analysis of the used irrigation water.

Ec dS/m	S.C mg/l	Soluble anions me/l				Soluble cations me/l				pH	SAR
		Co_3^{-2}	HCO_3^-	Cl^-	So_4^{-2}	Ca^{+2}	Mg^{+2}	Na^+	K^+		
0.88	563	-	1.4	5.10	2.35	3.64	0.64	4.50	0.25	7.50	3.10
1.90	1216	-	5.2	10.00	3.80	8.00	8.00	8.90	0.20	7.45	3.81
3.98	2547	-	8.0	19.50	11.72	17.80	17.80	15.90	0.23	7.70	4.69

S.C. = Salt concentration.

RESULTS

Experiment one: Tomatoes yield showed a quadratic effect to N fertilization (Table 3). The foliar N content increased with increasing N concentration in the liquid fertilizer (Table 4).

The 460 Nl^{-1} treatment significantly reduced cation absorption at period D and E relative to treatments at 115 and 230 $mgNL^{-1}$. For all treatment, Mg content increased at period E, possibly due to a translocation of Mg from the old leaves to the younger tissues over time.

The CNR diagnosis of these results showed:

N deficiency was during periods C and E for the 115 and 230 $mgNl^{-1}$ treatments. K deficiency was more pronounced in periods C and D;. Ca deficiency appeared during periods D and E; a pronounced Mg deficiency recorded during periods C and D; the phosphorus content was generally adequate.

Table (3): Effect the nitrogen level and the electrical conductivity level of the irrigation water on the marketable yield of greenhouse tomatoes.

Experiment 1		Experiment 2	
Nitrogen level Mg Nl^{-1}	Marketable yield (g/plant)	Electrical conductivity (dsm^{-1})	Marketable yield (g/plant)
115	2929	0.88	3269
230	3387	1.90	2954
460	2329	3.98	2316
F values			
Linear effect	**		**
Quadratic effect	**		n.s.
Standard deviation	747		305

***n.s. , *,**; nonsignificant and significant at the 5 and 1% level respectively.**

Table (4): Nitrogen ,P, K, Ca and Mg contents of the fifth leaf of tomato plants subjected to different nitrogen levels and sampled over three different periods.

Period	Treatment (mg Nl^{-1})	N	P	K	Ca	Mg
		(g/100 g of dry matter)				
C 50 day	115	4.00b	0.59	3.31	1.68	0.24
	230	4.27b	0.55	3.84	1.79	0.24
	460	5.05a	0.60	3.33	1.52	0.24
	LSD	0.66	n.s.	n.s.	n.s.	n.s.
D 68 day	115	5.18	0.47	3.59	1.46a	0.23a
	230	5.21	0.46	3.54	1.40a	0.22ab
	460	5.78	0.49	3.49	0.98b	0.21b
	LSD	n.s.	n.s.	n.s.	0.20	0.02
E 80 day	115	4.36b	0.60b	3.90a	1.05ab	0.40a
	230	4.73b	0.60b	3.80a	1.27a	0.42a
	460	5.46a	0.67a	3.63b	0.72b	0.34b
	LSD	0.62	0.06	0.14	0.36	0.05

Underlined values are lower than the CNR conseil (1984)
Treatments that have the same letter do not differ significantly at the P= 0.05.
LSD significant at P= 0.05 (n.s. = f nonsignificant)

The DRIS calculation for the data from Table 4 showed that during period C, NII was interior to the critical NII value of 63 over which a higher yield than 4 Kg per plant can not be obtained Table (5).

Table (5): DRIS diagnosis of analytical results presented in table 4 (NII: nutritional imbalance index)

Period	Treatment (mg Nl^{-1})	Index					
		N	P	K	Ca	Mg	NII
C 50 day	115	7b	-1a	-5	7	-12a	33b
	230	8b	-6b	5	8	-16b	44ab
	460	23a	-3a	-5	0	-17b	60a
	LSD	6.79	3.5	n.s.	n.s.	3.2	19.5
D 60 day	115	22b	-14	4	4a	-16a	66b
	230	25b	-14	5	3a	-19ab	68b
	460	42a	-9	10	-20b	-23b	105a
	LSD	9.2	n.s.	n.s.	8.6	6.2	23.2
E 80 day	115	14b	-2b	-5	-41b	33	104b
	230	14b	-6b	-15	-21a	28	85b
	460	49a	11a	-7	-79b	25	171a
	LSD	13.2	9.5	n.s.	31.0	n.s.	53.3

LSD significant at P=0.05 (n.s. : nonsignificant).
Treatments that have the same letter do not differ significantly at P=0.05.
Sum of individual indices irrespective of sign might differ from NII reported her , because of rounding off of individual indices.

The NII increased with increasing N in period D, and all treatments reached NII values above the critical NII. This trend was accentuated in period E and all calculated NII values exceeded the critical NII. This diagnosis agreed with the low yields obtained.

The M-DRIS diagnosis was similar to the DRIS diagnosis (Table 6). Threshold NII (set at 72 for M-DRIS (Caron, and Parent 1989)) was surpassed for all treatments during period D and E, but only for the 460 mgNl^{-1} treatment during period C. As M-DRIS introduces a separator between limiting and non-limiting elements. The approach simplifies the interpretation of results with a detailed diagnosis by sampling period for greenhouse tomato.

Table (6): M-DRIS diagnosis of analytical data presented in table 4 .

Period	Treatment (mg Nl^{-1})	Index						
		N	P	K	Ca	Mg	DM	NII
C 50 day	115	3b	-4a	-4	5	-15a	15	51b
	230	6b	-10b	3	7	-18b	12	55b
	460	21a	-6a	-7	-2	-19b	12	73a
	LSD	7.9	3.8	n.s.	n.s.	2.6	n.s.	11.8
D 68 day	115	18b	-15	1	1a	-17a	11b	74b
	230	21b	-16	2	0a	-20ab	13b	77b
	460	36a	-11	5	-25b	-24b	18a	120a
	LSD	9.1	n.s.	n.s.	9.0	5.1	5.0	21
E 80 day	115	11b	-3b	-9	-44b	31	14ab	117b
	230	13b	-7b	-17	-22a	28	6b	94b
	460	44a	8a	-12	-83b	22	22a	193a
	LSD	12.3	8.1	n.s.	33.2	n.s.	8.0	56.2

LSD significant at P=0.05 (n.s. : nonsignificant).
Treatments that have the same letter do not differ significantly at P=0.05.
Sum of individual indices irrespective of sign might differ from NII reported her, because of rounding off of individual indices.

While CNR diagnosis highlights a constant Mg deficiency and a frequent deficiency in N and K during period C. M-DRIS does not indicate any major nutrent imbalance as reflected by the NII. However, all elements appear lower than the DM index (and there fore were diagnosed as limiting) while N appears in excess for 460 mg Nl^{-1} treatment being higher than the DM index.

During period D, the CNR diagnosed K and Mg deficiencies and a strong Ca deficiency showed up for plants treated 460 mg Nl^{-1}. The M-DRIS also indicated a major nutrent imbalance, (using the over all NII) and this effect was more pronounced for 460 mg Nl^{-1} treatment, where an excess of N and, by order of importance Ca, Mg, P, and K deficiencies were identified as being

lower than the DM index. During period E, the CNR diagnosis showed no N deficiency linked to the 460 mg Nl^{-1} treatment and ageneral Ca deficiency. The M-DRIS showed too high an NII; K and Ca deficiencies were diagnosed, while excess N was important.

Experiment$_2$: The increase in salinity levels of the irrigation water led to a linear decrease of marketable yield of greenhouse tomato (table3), while total yields were only slightly higher for the treatment at 0.88 dSm^{-1}. Blossom end rot caused rejection of 11 and 12% of the fruits for plants submitted to the 0.88 and 1.9 dSm^{-1} treatments respectively, and 28% for the 3.98 dSm^{-1} treatment.

The CNR diagnosis indicated generalized N and Mg dificiencies (Table 7) while a Ca deficiency was diagnosed in period D for the plants submitted to the 3.98 dSm^{-1} treatment, no deficiency was indicated in period E.

Table (7): Effect of salinity level (EC= electrical conductivity) of the irrigation water on the fifth leaf of tomato plant sampled at two different periods.

Period	Ec (dsm^{-1})	N	P	K	Ca	Mg
		(g/100 g of dry matter)				
D 63 dayes	0.88	<u>3.64b</u>	0.52a	<u>3.57</u>	1.81a	<u>0.25a</u>
	1.90	<u>3.98ab</u>	0.53a	3.78	1.53ab	<u>0.21b</u>
	3.98	<u>4.13a</u>	0.48b	3.72	<u>1.30b</u>	<u>0.20b</u>
	LSD	0.44	n.s.	n.s.	0.36	0.04
E 80 dayes	0.88	<u>4.09b</u>	0.69a	4.52	1.88	<u>0.32a</u>
	1.90	<u>4.23b</u>	0.58b	4.93	1.79	<u>0.27b</u>
	3.98	4.70a	0.60ab	5.02	1.72	<u>0.23ab</u>
	LSD	0.57	0.10	0.49	n.s.	0.04

Underlined values are lower than the CNR
LSD significant at P=0.05 (n.s. : nonsignificant).
Treatments that have the same letter do not differ significantly at P=0.05.

The DRIS and M-DRIS showed NII values lower than the respective NII threshold (Table 8 and 9). Since significant yield responses were measured for salinity treatments, the information provided by the NII was there fore insufficient to diagnosis a nutrient imbalance due to high salinity. The DRIS and M-DRIS indicated a general increase of the Ca, Mg, and a relative increase in N and K indices with increasing salt level in the irrigation water.

The Ca, P, and Mg indices of M-DRIS were lower than the DM index for plants submitted to the 1.9 and 3.98 dsm^{-1} treatments during period D and remained lower in period E, indicating a potential deficiency in elements.

Table (8): DRIS of analytical data presented in Table 7.

Period	Ec (dSm^{-1})	Index					
		N	P	K	Ca	Mg	NII
D 63 day	0.88	-10b	-6	3b	19a	-6a	44
	1.90	1a	-3	13a	9b	-21b	50
	3.98	9a	-6	16a	16	-21b	55
	LSD	10.1	n.s.	7.1	8.9	8.8	n.s.
E 80 day	0.88	-5c	1a	-5b	4	5a	21
	1.90	2b	-7b	4a	3	-3b	21
	3.98	9a	-8b	3a	-1	-3b	24
	LSD	2.5	3.6	7.0	n.s.	5.3	n.s.

LSD significant at P=0.05 (n.s. : nonsignificant).
Treatments that have the same letter do not differ significantly at P=0.05.
Sum of individual indices irrespective of sign might differ from NII reported her , because of rounding off of individual indices.

Table (9): M-DRIS of analytical data presented in table 7.

Period	Ec (dSm^{-1})	Index						
		N	P	K	Ca	Mg	DM	NII
D 63 day	0.88	-12b	-8	1b	16a	-8a	11	57
	1.90	-2a	-5	10a	7ab	-23b	13	61
	3.98	5a	-8	11a	-2b	-23b	11	68
	LSD	8.0	n.s.	7.3	10.0	2.8	n.s.	n.s.
E 80 day	0.88	-5c	0a	-6b	4	5a	1	24
	1.90	2b	-7b	3a	3	-3b	4	25
	3.98	9a	-8b	3a	-2	-4b	1	27
	LSD	3.5	3.9	6.9	n.s.	6.3	n.s.	n.s.

LSD significant at P=0.05 (n.s. : nonsignificant).
Treatments that have the same letter do not differ significantly at P=0.05.
Sum of individual indices irrespective of sign might differ from NII reported her , because of rounding off of individual indices.

DISCUSSION:

The low yields obtained with the plants receiving the treatment of 460mgl^{-1} of N were possibly attributable to vigorous vegetative growth at the expense of fruiting (Marschner 1986) to the antagonism of the ammonium ion against Ca and Mg (Pill *et al* 1978), or to a combination of both factors.

All three diagnosis systems indicated a decrease in leaf Ca content for the 460 mgl^{-1} treatment compared with the other treatments. Since the presence of ammonium has been shown to decrease leaf Ca level (Pill *et al* 1978) restricted Ca uptake du to ammonium antagonism is likely to be involved. However, increasing amounts of nitrate have been also shown to decrease

Ca leaf while favoring vegetative growth at the expense of fruit growth (Pill *et al* 1978). There fore, a clear distinction between a possible ammonium or total N excess could not be made since the form of N in the nutrient solution had to be changed progressively when increasing total nitrogen concentration in order to maintain all other ion concentrations constant.

Both DRIS and M-DRIS adequately diagnosed the excess of N in the 460 mgl^{-1} treatment, while the CNR approach wrongly diagnosed a N deficiency. Either the approach, or the CNR value for N used, might be the cause of the poor performance of the CNR. The appeared to provide a useful index, indicating a pronounced nutrient imbalance during periods D and E, for the 460 $mgNl^{-1}$ treatment for both DRIS and M-DRIS approaches.

In the salinity experiment, CNR again appeared to provide contradictory results for nitrogen, diagnosis it to be less limiting salt levels, which failed to correlate with the yield decrease obsereved with increasing salinities.

The DRIS and M-DRIS diagnosis, based on their NII, did not indicate an important nutrient imbalance. Even of increasing salinity level did cause important losses, due mainly to BER, their NII, while significantly different between salinity treatments, still showed values too low for the yields obtained. Indeed, the NII values reached would predict much higher yields than those obtained (Caron and Parent, 1989). Therefore, NII did not appear sensitive enough in assessing the effect of the salinity level in the irrigation water for DRIS. The M-DRIS, with a higher proportion of norms to evaluate the nutritional status, should theoretically improve the sensitivity of the system (Beaufils and Sumner 1976), but practically failed to do so.

Adams and Ho (1985) showed that increasing salinity would induce leaf and fruit, Ca deficiencies, and cause BER. The high BER incidence obtained supports the possibility of Ca deficiency. All three diagnosis systems showed a consistent drop in either Ca content or the Ca index, but relying on NII as a basis for decision would lead us to conclude that no nutrient was limiting.

Hallmark's *et al.* (1987), interpretation using M-DRIS might, however, represent an alternative explanation of our data.

It would allow us to conclude that Ca was limiting for both periods, at 1.9 and 3.98 dsm^{-1}. Indeed, the Ca indices were lower than the DM index and this would confer a superiority of M-DRIS over the CNR or the DRIS approaches, when high salinities are used.

However, this explanation remains hypothetical since no corrective treatment was applied to confirm the importance of Ca deficiency relative to other deficiencies diagnosed in the salinity treatment (e.g. P and Mg) and therefore requires further investigation. If tru, it would provide us with a more sensitive tool to diagnose excess salt in irrigation water and thus help to prevent BER losses due to high salinity.

Conclusions:

The two experiments showed that DRIS and M-DRIS on the one hand, and CNR on the other, may lead to different diagnoses, mainly with nitrogen. Both DRIS and M-DRIS were found effective to manage N fertilization while CNR led us to a wrong diagnosis. Using the NII as threshold values for intervention was not suffticent to manage salinity levels. High salinities caused a constant increase in NII, but the calculated NII values did not correspond to the low yields obtained, found to be ineffective as indicators of any salinity effect on yield in both the DRIS and M-DRIS systems. Further research is needed to test the superiority of M-DRIS over DRIS to manage salinity levels in order to prevent BER losses.

REFERENCES

Abdel-Hady, A.M. (2004). Studies on fertility evaluation of Kalubia soils using diagnosis and recommendation integrated system. MS.C. Thesis Fac. of Agric., Moshtohor, Zagazig Univ., Egypt.

Abdel-Warth, M. (2002). Fertility status of some soils in south Sinai. ph.D. Thesis fac. of Agric., Moshtohor, Zagazig Univ., Egypt.

Abdel-Warth, M., M.M. Mahmoud, M.H. Abdel-Salam and M.M. El-Shouny (2005). Using DRIS indices and sufficiency level approaches to asses the N, P and K status in corn plant. Minf. J. Agric. Res. Vol.30 No.3:1081-1095.

Adams, P. and L. Ho. (1985). Two disorders but one cause. Grower 103:17-21.

AlKoshab, D., T.L. Righetti and A.R. Dixon (1988). Evaluation of DRIS for judging the nutritional status of hazelnuts. J.AM. Soc. Hort. Sci. 163:643-647.

Bates, T.E. (1971). Factors affecting critical nutrient concentrations in plant and their evaluation: Areview. Soil Sci. 12:116:130.

Beaufils, E.R. (1973). Diagnosis and Recommendation Integrated System (DRIS) soil Sci. Buil. No.1. Univ. of Natal, South Africa.

Beaufils, E.R. and M.E. Sumner (1976). Application of the DRIS approach for calibrating soil and plant factors in their effect on yield of sugarcane. Proc. S. Afr. Sugar Tech. Assoc. 56:118-124.

Conseil des productions vegetales du Quebec. 1984 legumes deserre. Culture. Agder 290/20.156P.

Caron, J. and L.E. Parent (1989). Derivation and assessment of DRIS norms for greenhouse tomatoes. Can. J. Plant Sci, 69:1027-1035.

Hallmark, W.B., J.L. Walworth, M.E. Sumner. G.J. de Mooy. J. Pesek and K.P.Shao. (1987). Separating limiting from non-limiting nutrients. J. plant Nutr. 10:1381-1390.

Marschner, H.(1986). Mineral Nutrition of Higher plants. Academic Press. London.

Munson, R.D. and W.L. Nelson (1973). principles and practices in plant analysis. Soil testing and plant analysis. Soil Sci. Soci. Of Amer. Inc. 223-248.

Paterson, J.A. and D.A. Hall (1981). Amethod dor studying the influence of nutrition on tomao plan vigour in hydroponic culture. Hort. Res. 21:103-106.

Pill, W.G., P. Lambeth. and T.M. Hinckely (1978). Effects of nitrogen from and level on ion concentrations. water stress. and blossom-end rot incidence in tomato. J.Amer. Sac. Hort. Sci. 103:265-268.

Sumner, M.E. (1979). Interpretation of foliar analysis for diagnostic purposes. Agron. J. 71:343-348.

Walworth, J.L. and M.E. Sumner (1987). The diagnosis and recommendation integrated system. Adv. Soil Sci. 6:149-188.

Davee, D. E., T. L. Righetti, E. Fallahi and S.Robins (1986). An evaluation of the DRIS approach for identifying mineral limita tions on yield in "Napolean" sweet cherry. J. AM. Soc. Hort. Sci. 111:988-993.

تأثير مستويات كل من النيتروجين وملوحة مياة الري علي محصول الطماطم تحت الزراعات المحمية باستخدام نظم التشخيص والتوصيات المتكاملة

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معهد بحوث الأراضي والمياه والبيئة– مركز البحوث الزراعية– الجيزة– مصر

الملخص العربي

لقد تم تطوير قواعد وأساسيات نظم التشخيص و التوصيات المتكاملة (DRIS) لمحصول الطماطم وذلك بالتقييم من خلال تجارب مستويات مختلفة من النيتروجين (١١٥، ٢٣٠، ٤٦٠ مليجرام نيتروجين/ لتر) وكذلك مستويات ملوحة مختلفة لمياة الري (٨٨، ١.٩، ٣.٩٨ ملليموز/سم) وهذة التجارب تمت في منطقة طور سيناء محافظة جنوب سيناء وتم اخذ عينات ورقية لأوقات مختلفة علي مدار الموسم وتقدير المحتوي الكلي من Mg, Ca, K, P, N وكذلك تقدير معامل الاتزان للعناصر (NII) وتقدير قيم معامل DRIS وتقدير المادة العضوية ومن خلالها تقدير قيمة نظم التشخيص والتوصيات المتكاملة المعدلة M-DRIS وتقدير مدي الزيادة والنقص في العناصر. وكذلك تقدير المحصول التجاري المتحصل علية من خلال ٨ أسابيع حيث وجد علاقة خطية بين معدل النيتروجين والمحصول حيث عند ١١٥، ٢٣٠، ٤٦٠ مليجرام نيتروجين/لتر أعطي ٢.٩، ٣.٣، ٢.٣ كجم/نبات علي الترتيب، أكثر من ذلك فان المعدل الحرج لمعدل الاتزان للعناصر (NII) بعد ٨٢ يوم من نقل الشتلات ارتبط بزيادة في النيتروجين و الماغنسيوم ونقص في الكالسيوم. وعلي العكس من DRIS، M-DRIS فان المعامل الحرج للمغذيات (CNR) لم يعطي أي مؤشرات لزيادة النيتروجين.

وفي تجربة ملوحة مياة الري فان المحصول التجاري نقص بزيادة ملوحة مياة الري حيث عند ٠.٨٨، ١.٩٠، ٣.٩٨ dSm^{-1} أعطي ٣.٣، ٢.٩، ٢.٣ كجم/للنبات علي الترتيب حيث بزيادة الملوحة زاد معامل الاتزان بين العناصر NII في كل المراحل. علاوة علي ذلك فان NII متشابهة في الحدود الحرجة لـ NII وغير ثابتة في المحاصيل المنخفضة المتحصل عليها لذا يعتبر NII من العوامل الضعيفة لتقييم تأثير الأملاح.