THE IMPACT OF DIFFERENT N SOURCES ON THE GROWTH AND YIELD OF CUCUMBER VARIETIES UNDER THE PLASTIC GREENHOUSE

STUDII ASUPRA INFLUENȚEI DIVERSELOR SURSE DE AZOT ASUPRA CREŞTERII ŞI PRODUCȚIEI LA DIVERSE SOIURI DE CASTRAVEȚI DIN SOLARII

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Abstract. *This experiment was conducted at Horticulture Research Station (USAMV Bucuresti) during the summer season of the year 2016. Two cucumbers varieties: Ansor F1 and Trilogy F1, planted under 10 micro plastic greenhouses. The fertilizers treatments included: 300 g/m^{2}DIX 10 N (D); 50 and100 g/m^{2}NovaTec (N1, N2) ; 200 g/m^{2}Orgevit (O) and unfertilized control (CA,CT). Results indicated that, there are significant differences among treatments but it was observed that for all characters studied, there is an increase with significantly difference with an increase in N level. Generally, all N fertilizer treatments (organic and Inorganic) increased the soil (N-NH_4, N-NO_3 , P-PO_4 , K) levels in soil . Results showed Ansor F1 fertilized with DIX 10 N (AD) and (Ansor F1 and Trilogy F1) with NovaTec 100 g/m^2 (AN2) and(TN2) gave the strongly positive effect in plant length , plant androot dry matter %. The highest content of pigments was found in Ansor F1 fertilized with DIX 10 N (AD), NovaTec 100 g/m^2 (AN2) and Trilogy with DIX 10 N (TD). Also observed a significant increasing in leaf content of N-NO_3 represented by inorganic fertilizer treatments while the highest content of P-PO_4 represented by TN2 and TO (657.86 and 728.93 ppm) respectively). It is clearly showed the highest K content effected strongly with the increase of inorganic fertilizers recorded with AN2 and TN2 (4513 and 4640 ppm). Results showed that all inorganic treatments gave over the normal and healthy concentration of N-NO_2 and K in fruits. All treatments had strongly effect with fruit length but the greatest diameter recorded with TN1 and TN2. The best yield results were recorded by Trilogy F1 fertilized with DIX 10 N(TD)and Orgevit(TO)followed by Ansor F1 with Orgevit (AO) treatment,which were obtained on the plant4.10 Kg, 4.04 Kg and 4.05Kg, respectively.There are significant variations between varieties regarding CO_2 concentration in response to the different commercial fertilizers. The highest values was observed to control CA and CT (1449.97 and 1516.76 ppm). All treatments showed significant increase in O_2 comparing with control variants .*

Key words: greenhouse, cucumber varieties, fertilizing treatments, plant growth, fruit yield , rates of CO_2 and O_2 in the atmosphere

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Rezumat. *Experimentul a fost implementat în cadrul staţiunii de cercetare horticola a USAMV Bucureşti pe durata verii 2016. Doi hibrizi de castraveţi Ansor F1 şi Trilogy F1 au fost plantaţi în solarii cu folie de plastic de 10 microni. Tratamentele de fertilizare au inclus: 300 g/m^{2}DIX 10 N (D); 50 şi 100 g/m^{2}NovaTec (N1 , N2); 200 g/m^{2}Orgevit (O) şi varianta nefertilizată (CA,CT). Rezultatele au indicat că există diferenţe semnificative între tratamente, dar s-a observat că, la toate variantele luate în studiu, există o creştere semnificativă a concentraţiei de azot. În general, tratamentele cu azot (organic şi anorganic) au determinat creşterea nivelurilor de N-NH_4 , N-NO_3 , P-PO_4 , K în sol. Rezultatele au arătat că fertilizarea cu DIX 10 N (AD) a hibridului Ansor F1 şi cu NovaTec 100 g/m^2 (AN2) şi (TN2) a hibrizilor Ansor F1 şi Trilogy F1 sunt corelate puternic pozitiv cu lungimea plantelor, substanţa uscată a plantei şi a sistemului radicular. Cel mai ridicat conţinut în pigmenţi s-a înregistrat în cazul fertilizării cu DIX 10 N (AD), NovaTec 100 g/m^2 (AN2) şi Trilogy with DIX 10 N (TD) asupra hibridului Ansor F1. S-a observat de asemenea o creştere a conţinutului de N-NO_3 din frunze reprezentat de tratamentele chimice cu conţinut ridicat de P-PO_4 din TN2 şi TO (657.86 şi respectiv 728.93 ppm). Se observă, de asemenea, că cele mai ridicate concentraţii de K au fost determinate în cadrul tratamentelor chimice cu AN2 şi TN2 (4513 şi 4640 ppm). Rezultatele arată că toate tratamentele chimice au produs concentraţii peste cele normale şi considerate sănătoase în fructe. Toate tratamentele au influenţat pozitiv lungimea fructelor, cel mai mare diametru fiind înregistrt în cazul tratamentelor cu TN1 şi TN2. Cea mai mare producţie a fost obţinută în cazul hibridului Trilogy F1 fertilizat cu DIX 10 N (TD) şi Orgevit (TO), urmat de Ansor F1 fertilizat cu Orgevit (AO), cu următoarele rezultate: 4.10 Kg, 4.04 Kg şi respectiv 4.05Kg. Există variaţii semnificative între hibrizi în ceea ce priveşte concentraţia de CO_2 în funcţie de diferitele tratamente. Cele mai mari valori au fost obţinute în variantele martor CA şi CT (1449.97 şi 1516.76 ppm). Toate tratamentele au arătat o creştere semnificativă a concentraţiei de O_2 în comparaţie cu variantele martor.*

Cuvinte cheie: solar, hibrizi de castraveţi, fertilizare, creşterea plantelor, producţie, concentraţia CO_2 şi O_2 în atmosferă

INTRODUCTION

Cucumber (*Cucumis sativum* L.) is an important vegetable and one of the most popular member of cucurbitaceae family and one of the oldest vegetables cultivated by man for over than 3,000 years (Adetula and Denton, 2003; Okonmah, 2011). It is second culture after tomato in Europe (Eifediyi and Remison, 2010). In Romania the total area planted with cucumber in 2015 was 12700 ha.and the productivity of cucumber was 193800 tons/ha (INS, 2015). Cucumbers contains approximately 95% water, 3.6% carbohydrates, and 0.65% protein, and are low in calories (150 kcal kg^{-1}). They are a good source of the following nutrients (in mg/kg^{-1}): pantothenic acid (B5 0.026); vitamin C (0.28); magnesium (1.3). The consumption of pickles has been waning, but use of cucumbers as a fresh vegetable has been increasing (Lucier and Jerardo, 2007). Inorganic and organic fertilizers are applied to maintain the nutritional condition of different cropping systems (Ginting *et al*, 2003; Watts *et al*, 2010). The importance of fertilizer

application to cucumber has also been reported (Kano *et al.*, 2001; Ruiz and Romero, 2002; Moreno *et al.* 2003; Ciofu *et al.*, 2003; Jasso-Chaverria *et al.* 2005).

Nitrogen is an essential element required for successful plant growth and production. It's required for cellular synthesis of enzymes, proteins, chlorophyll, DNA and RNA. Inadequate supply of available N frequently results in plants that have slow growth, depressed protein levels, poor yield of low quality and inefficient water use (Hayat *et al.*, 2010).

The intensive use of nitrogen fertilizers in order to increase crop yield has a negative impact on various aspects of the environment: nitrate leaching from agricultural land into groundwater, nitrogen losses associated with soil erosion, gaseous nitrogen losses during denitrification and ammonium emission processes. In order to reduce the losses of nitrogen leaching from fertilizers, a variety of techniques that reduce the fertilizer solubility and increase the uptake by plants are being developed (Davidson and Gu, 2012; Liu and Lal, 2015). Using NovaTec classic effectively increased the tuber yield, but produced different effect on their quality. In soil fertilized with NovaTec classic, which contains nitrification inhibitor, potato tubers were most starchy and accumulated the lowest amount of nitrates compared with the other fertilizers and increased the yield of grain barley by 1.8–11.6% on average (Vokė, 2017). Although inorganic nitrogen compounds (*i.e.*, NH_4+, NO_2, and NO_3) account for less than 5% of the total nitrogen in soil (Brady and Weil, 2008) they are the main form of the element absorbed by most plants. The chemical fertilizers were first introduced into the agriculture field, most of the problems faced by farmers to increase yield of their plantation have been solved. However, chemical fertilizers slowly started to show their side effect on human and environment (Zakaria, 2009). Orgevit is inorganic fertilizer in the form of pellets derived from organic substances of natural origin and contain micro and macro elements needed. This contains a large percentage of organic elements that are essential for maintaining soil fertility, eases up the gradual absorption of the nutrients from the soil, improves soil structure and increases water retention capacity (Nicolae *et al.,* 2014). As well as organically produced crops have increased nutritional value than conventionally produced crops (Rembiałkowska, 2007; Lairon, 2010). This means that organic agricultural systems have already proved ability to produce food with high quality standards. For that it's noticed that using DIX 10N treatment give highest grain of maize yield and 1.000 grain weight (Vesna *et al*, 2014).

The aim of experiment was to determine nutritional quality of organic and inorganic fertilizers to produce highest parameters growth and yield in cucumber plants. The influence regarding rates of CO_2 and O_2 in the plastic greenhouse atmospherehas also been studied.

MATERIAL AND METHOD

This experiment was conducted at Horticulture Research field (USAMV) in Bucharest during the summer season of the year 2016. The culture was performed in10 plastic greenhouse (3m long and 2m wide),each of them divided into 3 replicates.The experiment consisted of studying the effects of different sources of N fertilizers (organic and inorganic) on the growth and yield of two commercial cucumber

varieties Ansor F1 and Trilogy F1 (noted A and T respectively.Four nitrogen treatments with three replications and all the fertilizers resources (organic and inorganic) were bought from the local market. The controls were represented by the unfertilized soil. The combination of experimental factors (varieties, fertilizers and doses) resulted in 10 treatment variants, presented in table 1.

Table 1

Treatment variants

No	Treatments	Dose g/m^2	Symbol	No	Treatments	Dose g/m^2	Symbol
1	Control Ansor	0	CA	6-	Control Trilogy	0	CT
2	Ansor + NovaTec classic 12-8-16+3MgO	50 g/m^2	AN1	7	Ansor + NovaTec classic 12-8-1+63MgO	100 g/m^2	AN2
3	Ansor + Dix 10N (N:P:K=10:3:3, 72.5% (organic matter)	300 g/m^2	AD	8	Ansor + Orgevit 4-2.5-2.3+9.3%Ca + 1.1% MgO + organic matter 65%+ ME	200 g/m^2	AO
4	Trilogy + NovaTec classic 12-8-16+3MgO	50 g/m^2	TN1	9	Trilogy + NovaTec classic 12-8-16+3MgO	100 g/m^2	TN2
5	Trilogy + Dix 10N (N:P:K=10:3:3, 72.5% organic matter)	300 g/m^2	TD	10	Trilogy + Orgevit 4-2.5-2.3+9.3%Ca +1.1% MgO + organic matter65%+ ME	200 g/m^2	TO

The seeds were sowed in the nursery on 7\5\2016 and those 2commercial varieties were planted under experimental micro greenhouses on 4\6\2016. All fertilizers were divided and provided to the soil before planting and after planting by a month.

The results were recorded over 3-month period and the following determinations were performed:

The characteristics of the experimental soil were analyzed before and after applying the treatments, using the specific methods of determination of each studied parameter (EC ; PH ; N-NH4 ; N-NO3 ; P-PO4 ; K).

Yield parameters - number,the weight, the length and diameter of the fruit, total yield /plant (done by collect the fruits from each replicate, measuring them every 3 days, and take the average. All collected cucumbers in each replicate during growing season considered as total yield/plant.

At the end of growing season, 3 plants from each replicate selected to measure plant dry weight and root dry weight. The samples kept in oven for 24 hours in 105˚c. After 24 hours the samples weighted with a digital scale then obtained the percentage of plant and root dry matter (% for fresh matter).

Biochemical determinations were performed (leaves and fruits content in N-NO3 and N-NO2 according to Katrina , 2001 and for P-PO4 and K according to the regulations of the Ministry of Agriculture and Food Industry (Academy of Agricultural and Forestry Sciences, 1981).

The gas emissions into the atmosphere inside the plastic micro greenhouseswere analyzed by using CO2 and O2 gas analyzer devise.

Differences between treatments were determined by analysis of variance (ANOVA) and Tukey's multiple comparison tests using SPSS 18.0 statistical software and mean comparison was done by Dancan multiple range test at the 5% level of significance.

RESULTS AND DISCUSSION

Generally addition of N fertilizers (organic and inorganic) increased the soil N-NH4 ; N-NO3 ; P-PO4 and K levels compared to control (tab. 2).The highest N-NH4 concentration in soils (173.25 ppm) recorded in Trilogy F1 fertilized with NovaTec 100g/m^2 (TN2) treatment, while the maximum amount of N-NO3 content (1091.88 ppm) was recorded in Trilogy F1 fertilized with Dix10N (TD) treatment. The greatest soil concentration in P-PO4 (282.98 ppm) clearly represented by Ansor F1fertilized with NovaTec 100g/m^2 (AN2) and the highest K content (610 ppm) recorded in Trilogy fertilized with NovaTec 100g/m^2 (TN2) treatment.

The results show that fertilization treatments did not cause significant changes in soil pH, but high fertilizer doses (NovaTec 100g/m2 and Dix10N 300 g/m^2) resulted in significant increases in EC% in both studied varieties.

The results presented in table 3 show thatfor both varieties studied all fertilizer treatments tended to increase the vegetative growth of cucumber (plant height and dry biomass) compared with the control, this was apparently due to improved nutrition of the plants.Although inorganic and organic fertilizers are not large differences, it can be noted that in both cases, the application of higher doses led to a more pronounced growth of plants.

The best plant height results were obtained by fertilization with inorganicfertilizer NovaTec classic at a dose of 100 g / m^2 (254.66 cm at AN2 and 252.00 cm at TN2, compared to 185.63 cm and 173.67 cm respectively at the CA and CT). In the case of organic fertilizers, the first place was Dix 10N at a dose of 300 g/m^2, at which the plants reached 245.33 cm.

Table 2

Soil analysis before and after treatment

Variety (symbol)	Fertilizers treatment (symbol)	PH	EC%	N-NH_4 ppm	N-NO_3 ppm	P-PO_4 ppm	K ppm
Before experiment		6.56	0.180	92.50	32.75	10.15	91.5
After experiment							
	Inorganic fertilizers						
Ansor (A)	NovaTec 50g/m^2 (N1)	6.40	0.293	65.25	268.24	36.95	310
	NovaTec100g/m^2(N2)	6.44	0.643	68.2	325.45	282.98	508
Trilogy (T)	NovaTec50g/m^2 (N1)	6.50	0.202	27.08	108.23	10.16	130
	NovaTec100g/m^2(N2)	6.26	0.649	173.25	830.85	31.11	610
	Control Trilogy(CT)	6.50	0.156	9.68	35.5	5.08	105
	Organic fertilizers						
Ansor (A)	Orgevit200 g/m^2(O)	6.43	0.235	9.55	369.27	7.62	261
	Dix10N 300 g/m^2(D)	6.43	0.452	55.70	869.05	10.15	235
	Control Ansor (CA)	6.53	0.117	7.95	26.91	6.34	112
Trilogy (T)	Orgevit 200 g/m^2(O)	6.56	0.224	9.55	256.25	5.08	195
	Dix10N 300 g/m^2(D)	6.30	0.570	25.46	1091.88	19.68	328

Regarding plant biomass, the same tendency of applied fertilizers is noted. The highest dry matter values of plants and roots were obtained at all fertilized treatments comparing with control but didn't notice difference variances between all fertilized treatments. All the organic fertilizer treatment had higher root dry matter % than the control, while the highest inorganic treatments represented by Ansor F1 fertilized with NovaTec 100g/m^2 (AN2) and Trilogy fertilized with NovaTec 100g/m^2 (TN2) where they were registered 12.92 and 12.95% respectively. Our results corresponding with Dynes (2003).

Table 3

Effect of fertilizer treatments on (plant length , dry weight % and root dry weight %)

Variety (symbol)	Fertilizers treatment (symbol)	Plant length (cm)	Plant dry matter (%)	Root dry matter (%)
	Inorganic fertilizers			
Ansor (A)	NovaTec 50g/m^2 (N1)	231.66ab	30.74ab	11.17bc
	NovaTec100g/m^2(N2)	254.66a	34.69a	12.92a
Trilogy (T)	NovaTec50g/m^2 (N1)	235.66ab	34.61a	11.71b
	NovaTec100g/m^2(N2)	252.00a	33.59ab	12.95a
	Control Trilogy(CT)	173.67c	29.53cb	10.78c
	Organic fertilizers			
Ansor (A)	Orgevit(O) 200 g/m^2	225.00b	35.78a	13.81a
	Dix10N (D) 300 g/m^2	245.33a	31.80ab	13.10a
	Control Ansor (CA)	185.63c	19.92c	10.20c
Trilogy (T)	Orgevit(O) 200 g/m^2	221.33b	31.84ab	13.00a
	Dix10N (D)300 g/m^2	226.00b	31.64ab	12.54a

The application of organic and inorganic fertilizers has influenced the content of cucumber leaf photosynthetic pigments and the results indicated significant differences among treatments (tab. 4). It was observed that the increase in N level has led to a significant increase in pigments content.

Table 4

Effect of fertilizer treatments on plant pigments (mg/l)

Variety (symbol)	Fertilizers (symbol)	Chlorophyll A	Chlorophyll B	Total Chlorophyll	Carotene
	Inorganic fertilizers				
Ansor (A)	NovaTec 50g/m^2 (N1)	125.72bc	143.07b	268.79b	29.51c
	NovaTec100g/m^2(N2)	166.97a	162.44a	319.41a	38.98b
Trilogy (T)	NovaTec50g/m^2 (N1)	127.34b	127.72bc	255.06b	26.58c
	NovaTec100g/m^2(N2)	128.67b	166.67a	295.34ab	35.65b
	Control Trilogy(CT)	93.48d	91.54d	185.03c	10.19d
	Organic fertilizers				
Ansor (A)	Orgevit200 g/m^2(O)	126.40bc	134.85bc	261.25b	32.12b
	Dix10N 300 g/m^2(D)	188.73a	152.06a	290.79ab	59.02a
	Control Ansor (CA)	96.47d	79.15d	175.62c	12.78d
Trilogy (T)	Orgevit 200 g/m^2(O)	146.33b	115.73cd	262.06b	39.17b
	Dix10N 300 g/m^2(D)	169.660a	154.24a	323.90a	58.30a

The data showed that the maximum concentration of chlorophyllA, chlorophyll B andtotal Chlorophyll occurred with the AN2, AD and TD treatments while the greatest content of carotene represented by AD and TDwhich were obtained 59.02and 58.30mg /lrespectivelycompared to the others treatment variants and non-fertilized controls CA and CT which had minimal concentrations (12.78mg/L, 10.19 mg/L respectively).

In table 5 results show that all fertilizer treatments significantlyincreased of minerals in the leaves comparing with control.Inorganic fertilizer treatments gave highest content of N-NO3while the highest content of P-PO4 represented by TN2 and TO (657.86 and 728.93 ppm respectively) and the greatest K content represented by AN2 and TN2 (4513 and 4640 ppm).

Table 5

Effect of fertilizer treatments on minerals content in leaf (ppm)

Variety (symbol)	Fertilizers (symbol)	$N\text{-}NO_3$	$P\text{-}PO_4$	K
	Inorganic fertilizers			
Ansor (A)	NovaTec 50g/m^2 (N1)	177.00a	589.28b	3140b
	NovaTec100g/m^2(N2)	171.00a	539.33b	4513a
Trilogy (T)	NovaTec50g/m^2 (N1)	164.60a	571.52b	3580b
	NovaTec100g/m^2(N2)	190.00a	657.86a	4640a
	Control Trilogy(CT)	112.760c	365.74d	3620b
	Organic fertilizers			
Ansor (A)	Orgevit200 g/m^2(O)	145.81ab	467.36c	3420b
	Dix10N 300 g/m^2(D)	137.70b	354.51d	3720b
	Control Ansor (CA)	101.20c	354.21d	3420b
Trilogy (T)	Orgevit 200 g/m^2(O)	143.62b	728.93a	3620b
	Dix10N 300 g/m^2(D)	140.01b	467.35c	3660b

The analysis of fresh fruit cucumber (tab. 6) showed different variable between the treatments. The greatest concentration of $N\text{-}NO_3$ represented by TN2 (253.33 ppm) while the highest content of $P\text{-}PO_4$ recorded by TN1and TN2 (274.32 and259.18 ppm respectively). It is important to note that all the data recorded for $N\text{-}NO_3$ and $P\text{-}PO_4$were including the normal concentration.

With regard to $N\text{-}NO_2$ and K in fruit, it is found superior content and above the normal concentration to all inorganic fertilizer for both varieties.

These results confirm Herencia *et al.* (2011) remarks after which the release of nitrogen in organic fertilizers is slower than that inorganic fertilizers since organic fertilization typically does not provide nitrogen in a readily accessible form.

Table 6

Effect of fertilizer treatments on minerals content in fruit

Variety (symbol)	Fertilizers(symbol)	N-NO_3ppm	N-NO_2 ppm	P-PO_4 ppm	K ppm
	Inorganic fertilizers				
Ansor F1(A)	NovaTec 50g/m^2 (N1)	183.66b	6.33*a	205.74b	2220*a
	NovaTec100g/m^2(N2)	164.66bc	5.66*ab	175.26c	2026*b
Trilogy F1(T)	NovaTec50g/m^2 (N1)	145.66c	6.33*a	274.32a	2300*a
	NovaTec100g/m^2(N2)	253.33a	7.00*a	259.18a	2270*a
	Control Trilogy(CT)	152.05c	3.75b	160.02c	1786c
	Organic fertilizers				
Ansor F1(A)	Orgevit200 g/m^2(O)	182.43b	3.66b	190.50b	1806c
	Dix10N 300 g/m^2(D)	139.67c	2.66d	137.16d	1926b
	Control Ansor (CA)	114.30d	3.33bc	216.70b	1740c
Trilogy F1(T)	Orgevit 200 g/m^2(O)	182.16b	4.33b	210.82b	1906b
	Dix10N 300 g/m^2(D)	177.33bc	3.66b	170.18c	1886bc

After David (1999) the maximum admissible levels for minerals in fruit are: N-NO_3 = 0 - 400ppm; N-NO_2 = 0-5ppm; P-PO_4 = 200-400ppm; K = 1000-2000ppm

The results presented in table 7 show that all N fertilizer treatments produced significantly increase to fruit length, fruit diameter and totalyield per plant compared with control variants, for both varieties. Taking into account the standards for the size of type gherkins cucumber fruit, we can appreciate that good results were obtained at AD and TD variants, to which fruits have minimum length (10.16 cm and 9.73cm). For the fruit diameter, the highest diameter recorded to TN1 and TN2 (3.06cm and 3.04cm). Due to nitrogen in fertilizers can induced protein production that causes more meristem cells and cell division that finally led to higher cucumber diameter and cucumber length compared with control treatments our results agree with Tisdale and Nelson (1975), Salardini and Mojtahedi (1988), Salardini (1993).

The results highlight the differences between the organic and inorganic fertilizer treatments but all the organic treatments showed significantly more cucumber yield per plant. The best results were obtainedto TD (4.10 Kg), AO (4.05Kg) and TO (4.04 Kg).

Our results agree with Shafiee Zargar (1996), Baybordi *et al*. (2000), Ghosh *et al*. (2004), Kamkar and Mahdavi (2008), according to which, due to the organic fertilizers improved the soil conditions for crop establishment as well as released adequate nutrient elements for yield enhancement and finally causes higher yield production with higher dry weight.

Table 7

Effect of fertilizer treatments on fruit characters (length and diameter) and on total yield per plant

Variety (symbol)	Fertilizers (symbol)	Fruit length cm	Fruit diameter cm	Yield\plant Kg
	Inorganic fertilizers			
Ansor (A)	NovaTec 50g/m^2 (N1)	10.24a	2.79b	3.21b
	NovaTec100g/m^2(N2)	10.39a	2.82b	3.65ab
Trilogy (T)	NovaTec50g/m^2 (N1)	10.77a	3.06a	3.36b
	NovaTec100g/m^2(N2)	10.52a	3.04a	3.72ab
	Control Trilogy(CT)	9.42c	2.60bc	2.36c
	Organic fertilizers			
Ansor (A)	Orgevit(O) 200 g/m^2	10.38a	2.83b	4.05a
	Dix10N (D) 300 g/m^2	10.16a	2.77b	3.92ab
	Control Ansor (CA)	9.62bc	2.57c	2.13c
Trilogy (T)	Orgevit(O) 200 g/m^2	10.30a	2.91ab	4.04a
	Dix10N (D)300 g/m^2	9.73bc	2.91ab	4.10a

The resultspresented in table 8 indicate that all fertilizer treatments improves the leaf gas exchange. In the plants treated with fertilizer (organic and inorganic) the photosynthesis rate was significantly higher compared with the control plants in both varieties. Application of N fertilizer resulted significantly highest O_2 concentration with decrease of CO_2 concentration at atmosphere of the micro greenhouse foralltreatments. Comparing with other treatments, the lowest concentration of CO2 at atmosphere represented by AD treatment (972.86 ppm) and the highest concentration of O2 was recorded in TD treatment (21.98 ppm. The lowest concentration of O2 and highest concentration of CO_2 were recorded to unfertilized controls: CA (18.59 ppm O_2 and1449.97 ppm CO_2) and CT (18.74 ppm O_2 and 1516.76 ppm CO_2).

Table 8

Effect of fertilizer treatments on respiration

Variety (symbol)	Fertilizers (symbol)	CO_2 (ppm avrage24h)	O_2 (ppm avrage 24h)
	Inorganic fertilizers		
Ansor (A)	NovaTec 50g/m^2(N1)	1317.76ab	20.68a
	NovaTec100g/m^2(N2)	1244.40b	20.94a
Trilogy (T)	NovaTec50g/m^2 (N1)	1301.73ab	20.84a
	NovaTec100g/m^2(N2)	1136.66b	21.55a
	Control Trilogy(CT)	1516.76a	18.74b
	Organic fertilizers		
Ansor (A)	Orgevit200 g/m^2(O)	1104.40b	20.56a
	Dix10N 300 g/m^2(D)	972.86c	21.56a
	Control Ansor (CA)	1449.97a	18.59b
Trilogy (T)	Orgevit 200 g/m^2(O)	1198.30b	20.59a
	Dix10N 300 g/m^2(D)	1135.50b	21.98a

These results indicate that along with the stomata conductance, the increased pigment content is one of the reasons for the higher photosynthetic rate in plants treated with N fertilizer.

CONCLUSIONS

1. The administration of N fertilizers (organic and inorganic) has determined the modification of some physical and chemical characteristics of the soil.It was recorded a slight reduction of the soil PH, and at high fertilizer doses resulted in significant increases in EC%. Organic fertilizer NovaTec determined the highest increases in soil content for $N\text{-}NH_4$, $P\text{-}PO_4$ and K, while the maximum amount of $N\text{-}NO_3$ was recorded to inorganic fertilizer Dix10N.

2. All fertilizer treatments tended to increase the growth characters (plant height, dry biomass) of cucumber compared with the control. Between treatments with organic and inorganic fertilizers there were no significant differences but in both cases, the application of higher doses (NovaTec100g/m^2 and Dix10N 300 g/m^2) led to a more pronounced growth of plants.

3. There are significant variations between varietiesAnsor F1 and Trilogy F1 in responding to the fertilizer treatments due to the genetic factor.

4. Organic and inorganic fertilizers has influenced the content of cucumber leaf photosynthetic pigments and the increase in N level has led to a significant increase in pigments content. In both varieties, high fertilizer doses have significantly increased the content in chlorophyll A, chlorophyll B, total chlorophyll and carotene.

5. Fertilization has affected the contents in mineral substancesof cucumber leaves and fruits.The recorded values in fruitsfor $N\text{-}NO_3$ and $P\text{-}PO_4$ were including within the permissible limits, while for $N\text{-}NO_2$ and K the content wereover the normal and healthy concentration to all inorganic fertilizer for both varieties.

6. All fertilizer treatments produced significantly increase to fruit length, fruit diameter and total yield per plant compared with control variants, for both varieties. Organic fertilizers have resulted in significantly higher yields of cucumbers per plant (up to 4.04 - 4.10 Kg, compared to 2.13 Kg in control).

7. Applying of N fertilizer improved the leaf gas exchange and photosynthesis rate, resulting significantly highest O_2 concentration with decrease of CO_2 concentration at atmosphere of the micro greenhouse for all treatments.

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