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AGRONOMIC PERFORMANCE AND FRUIT QUALITY OF YELLOW MELON FERTILIZED WITH DOSES OF NITROGEN AND POTASSIUM[1]

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ABSTRACT - The objective of this study was to evaluate the assimilated contents of mineral elements, yield characteristics and fruit quality of 'Goldex' yellow melon fertigated with different doses of nitrogen (N) and potassium (K) in two years of cultivation in the region of Apodi Plateau-CE. The design was randomized blocks in a 4x3 factorial scheme with four N doses (0%, 50%, 100%, 150% of the recommended dose) and three K doses (0%, 100%, 150% of the recommended dose). In the shoots of the melon plant, the highest levels of N (N Fert.) and K (K Fert.) fertilization promoted an increase in the assimilated N content up to 48 DAT and a reduction in the assimilated K content at the end of the cycle (62 DAT). The maximum shoot dry mass production was 3.23 t ha^{-1} with a fertilization of 150 and 100 kg ha^{-1} of N and K, respectively. The average marketable fruit yield obtained in the two years of cultivation was 34.68 t ha^{-1}, reaching a maximum value of 40.28 t ha^{-1} under 150 kg ha^{-1} N and K fertilization. Total soluble solids increased as a function of the increase in N Fert. and K Fert., with a maximum value of 8.07 °Brix. The models indicated that the K Fert. factor was decisive in the increase of this variable. In future studies it is necessary to increase the concentrations of the two factors in order to optimize the maximum viability of yield and °Brix.

keywords: *Cucumis melo L.*. Nutrient absorption. Mineral nutrition. Yield.

DESEMPENHO AGRONÔMICO E QUALIDADE DOS FRUTOS DE MELÃO AMARELO ADUBADO COM DOSES DE NITROGÊNIO E POTÁSSIO

RESUMO - O objetivo deste trabalho foi avaliar os teores assimilados de elementos minerais, características de produtividade e qualidade do fruto de melão amarelo 'Goldex' fertirrigado com diferentes doses de nitrogênio e potássio em dois anos de cultivo na região da Chapada do Apodi-CE. O delineamento foi em blocos ao acaso em esquema fatorial 4x3 com quatro doses de nitrogênio (0%, 50%, 100%, 150% da dose recomendada) e três doses de potássio (0%, 100%, 150% da dose recomendada). Na parte aérea do melão, os maiores níveis de adubação nitrogenada (N Fert.) e potássica (K Fert.) proporcionaram um aumento do teor assimilado de nitrogênio (N) até 48 DAT e redução do teor assimilado de potássio (K) no final do ciclo (62 DAT). A produção máxima de massa seca da parte foi de 3,23 t ha^{-1} com uma adubação de 150 e 100 kg ha^{-1} de N e K, respectivamente. A produtividade de fruto comercial média obtida nos dois anos de cultivo foi 34,68 t ha^{-1} chegando a um valor máximo de 40,28 t ha^{-1} em adubação de 150 kg ha^{-1} de N e K. O teor de sólidos solúveis totais aumentou em função do aumento da N Fert. e K Fert. apresentando máximo valor 8,07 °Brix. Os modelos indicaram que o fator K Fert. foi determinante no aumento desta variável. Em futuros estudos é necessário aumentar as concentrações dos dois fatores a fim de otimizar a viabilidade máxima da produtividade e °Brix.

Palavras-chave: *Cucumis melo L.*. Absorção de nutrientes. Nutrição mineral. Produtividade.

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INTRODUCTION

Melon (*Cucumis melo L.*) is a vegetable that occupies a prominent position in national agribusiness, with strategic economic importance for the Northeast region of Brazil. The states of Rio Grande do Norte and Ceará accounted for 80% of Brazilian exports in the last decade (IBGE, 2021). In all, these states accounted for 72.1% of the national production of 581478 t in 2018 and 587692 t in 2019 (IBGE, 2021) reinforcing their historical profile that concentrates production in the Apodi Plateau and Mossoró-Açu centers. This occurs due to the good edaphoclimatic conditions, and the high temperatures, low relative humidity and high luminosity during much of the year are favorable factors for the cultivation of this cucurbit (CAVALCANTI; DUTRA; MELO, 2015; CARVALHO et al., 2017).

The yield and final quality of melon fruits is the result of the conjunction of several factors, especially the individual and combined effects of nutrients (SILVA et al., 2014). Nitrogen (N) and potassium (K) are among the nutrients most required by melon (OLIVEIRA et al., 2020). N favors the growth of vegetative regions in plants, such as leaves and stems, besides exerting an effect on increasing the their photosynthetic capacity and production capacity (VAN BUEREN; STRUIK, 2017). K is absorbed by the roots in the form of K^+ ion and participates in the transport of sugars, being associated with the soluble solids content in the fruit (LESTER; JIFON; MAKUS, 2010). In addition, it is a fundamental element for growth and the increase of quality in the fruit post-harvest stage (SILVA et al., 2014). The concentrations of N and K absorbed are capable of promoting important morphophysiological changes in the plant, including the possibility of changing the number, mass and quality of melon fruits (DAMASCENO et al., 2012).

Some important studies have been conducted to evaluate the impact of N and K fertilization on *i)* agronomic variables in melon crop (QUEIROGA et al., 2008); *ii)* dynamics of the rate of absorption of these nutrients (DAMASCENO et al., 2012; OLIVEIRA et al., 2020); and *iii)* evaluation of yield and final fruit quality (SILVA et al., 2014; PRECIADO-RANGEL et al., 2018; RODRIGUES et al., 2019). However, there are few authors who consider analyzing the interrelations of variables during all stages of the melon production cycle (OLIVEIRA FILHO et al., 2020).

The particularity of this study in the Apodi Plateau-CE lies in the recurrence of excessive application of N and K doses in melon cultivation in this region, disregarding the residual effect of fertilization applied in successive previous crops. Continuous production cycles and a wide range of mineral fertilizers deposited in the soil are also observed. Thus, these factors increase costs and favor the development of phenomena such as soil salinity (CONDÉ et al., 2012).

In view of the above, this study aimed to evaluate *i)* the assimilated contents of mineral elements (N and K); *ii)* yield characteristics; and *iii)* fruit quality of the 'Goldex' yellow melon fertigated with different doses of N and K in two years of cultivation in the region of Chapada of Apodi-CE.

MATERIAL AND METHODS

The experiment was conducted in an area of 0.30 ha, located in the Teaching, Research and Extension Unit (UEPE) of the Federal Institute of Education, Science and Technology of Ceará (IFCE), within the Jaguaribe-Apodi irrigated perimeter, in the municipality of Limoeiro do Norte, Ceará, Brazil (5º06"38' S; 37º52"21' W; altitude of 143 m). According to Köppen's classification, the climate of the region is BSw'h', with an average annual temperature of 28.5 °C. The soil of the area belongs to the order of *Cambissolos* (Inceptisols) (SANTOS et al., 2018), derived from limestone rocks. Its physical-chemical properties prior to the experimental cycles are shown in Table 1.

Table 1. Soil chemical properties in the experimental area in 2018 and 2019.

Cycles	pH H_2O	EC	C	OM	P	K^+	Na^+	Ca^{2+}	Mg^{2+}
		dS/m	g/kg		mg/dm^3	mmol/dm^3			
2018 (I)	7.37	0.76	5.92	10.21	12.25	16.52	1.22	49.07	22.65
2019 (II)	7.25	1.23	11.40	19.65	43.00	19.58	2.44	86.55	19.20

Yellow melon, 'Goldex' variety, was cultivated in two cycles from July to September 2018 (cycle I) and September to November 2019 (cycle II). Seedlings donated by the TOP PLANT® company, with two true leaves, were transplanted at 12 days after sowing into polystyrene trays used in the company itself.

Soil tillage before transplantation consisted of plowing, harrowing for breaking up clods, raising of planting ridges with a harrow in the soil strip and, finally, the ridges were covered with plastic (mulching).

Irrigation was carried out using a localized drip system with one central mainline and submains connected to drip tubes parallel to the planting rows with valves at the beginning of each line. Thus, it was possible to perform independent fertigation events for the experimental plots. Irrigation water management was based on the evapotranspiration of the class A pan of the agrometeorological station of IFCE - Limoeiro do Norte Campus, 200 m away from the experimental area. The amount of water was determined also considering the Kc values proposed by Costa et al. (2001) for melon in the different stages of development. Weekly, manual weeding was carried out between crop rows to keep the area free of invasive plants. Phytosanitary control was performed by applying insecticides and fungicides specific to this crop, sprayed with a backpack sprayer, in order to compromise harvest as little as possible. The applications were necessary because the presence of silverleaf whitefly (*Bemisia argentifolii*) and leaf miner fly (*Liriomyza sp.*), common pests in the region, were identified in the two experimental cycles.

This study was conducted in randomized blocks, under a 4x3 factorial scheme, with four N doses (0%, 50%, 100%, 150% of the recommended dose) and three K doses (0%, 100%, 150% of the recommended dose), with 4 replicates, totaling 48 experimental plots. Based on soil analysis and on the recommendation of the 5th Approximation (MARTINEZ; CARVALHO; SOUZA, 1999), the recommended dose of N and K was 100 kg/ha for each of these nutrients. Basal fertilization consisted of 20% of the recommended dose of N and 10% of the recommended dose of K, and the remainder was applied through fertigation, after reaching the initial growth stage (8 days after transplantation), with fertilization every 2 days and coinciding with irrigations. In addition, 120 kg/ha of P_2O_5 (MAP) and 30 t/ha of aged cattle manure. Micronutrient fertilization was performed according to the recommendation of Sousa and Lobato (2002).

The sources of N and K used were urea and calcium nitrate ($Ca(NO_3)_2$), respectively with 82% and 18% of N fertilization, potassium chloride (KCl) and potassium sulfate (K_2SO_4) with 84% and 16% of K fertilization. More than one source of N and K were used to promote a nutritional balance in the soil with other nutrients present in fertilizers. The plots were 7.0 m long by 1.6 m wide with 0.5 m between holes, totaling 14 plants per plot.

To verify the relationship between N and K fertilization (N Fert. and K Fert.) with the capacity of absorption and accumulation of these nutrients in the shoots of the melon (leaves + stems), plants were collected at 48 DAT (onset of fruiting) and 62 DAT (harvest). The usable area of the plot was composed of 10 plants, where one plant per plot was selected in each collection. The individualized parts were dried in a forced air circulation oven with temperature between 65 and 70 °C until reaching constant mass, with subsequent measurement of shoot dry mass (SDM). In the Laboratory of Soil, Water and Plant Tissue Analysis (LABSAT) of IFCE - Limoeiro do Norte Campus, the plant material was crushed in a Willey mill to determine the contents of macronutrients and micronutrients. N contents were determined in sulfuric digestion extract, and K content was determined in nitric-perchloric digestion extract according to the methodology described by Malavolta (1997).

In both cultivation cycles, melon was harvested at 64 DAT, when four central plants representing the plot were chosen and the number of fruits per plant (F/P) was quantified. In the Post-Harvest Laboratory of IFCE, the fruits were individually weighed on a precision scale and classified as marketable fruits, those that were not deformed with weight greater than 0.550 kg. From this classification, yield was estimated in tons per hectare (t ha^{-1}). In order to determine the quality of the fruits, three days after harvest, the total soluble solids content was evaluated by taking samples from the their pulp and using a refractometer [RHB0-90], which allowed obtaining the °Brix values (COELHO et al., 2003).

Joint analysis of variance of the two years of cultivation was performed for all variables using the program Sisvar® (FERREIRA, 2011), observing compliance with the assumption that the ratio of the mean squares of errors of the two years of cultivation should not be greater than 7.0 (PIMENTEL-GOMES, 2009). Next, regression analysis was performed for all variables, performing a procedure to fit a response surface according to N and K fertilization, using Table Curve 3D® software (SYSTAT SOFTWARE, 2021).

RESULTS AND DISCUSSION

All variables analyzed in this study showed significant differences in relation to the two melon cultivation cycles in 2018 and 2019. N fertilization influenced all the variables under study, while K fertilization caused effects only on SDM, Yield and ° Brix. There was interaction between the years and the N Fert. factor for the contents of K (48 DAT), N (62 DAT) and K (62 DAT) in the shoots of the plants and between years and the K Fert. factor for yield. The interaction between N Fert. and K Fert. affected the contents of N (48 DAT) and K (62 DAT), SDM, Yield and °Brix. Additionally, there was a triple interaction between the years and N Fert. and K Fert. for N (48 DAT), N (62 DAT), K (62 DAT) and yield (Table 2).

Table 2. F values for nitrogen (N) and potassium (K) contents in the shoots at 48 and 62 DAT, shoot dry mass (SDM), fruits per plant (F/P), yield (YLD) and total soluble solids (°Brix) of melon in 2018 and 2019.

Sources of Variation	N (g kg^{-1}) 48 DAT	K (g kg^{-1}) 48 DAT	N (g kg^{-1}) 62 DAT	K (g kg^{-1}) 62 DAT	SDM (t ha^{-1})	F/P	YLD (t ha^{-1})	°Brix
Blocks (Agricultural years)	1.90 ns	0.84 ns	3.01 ns	0.84ns	0.32ns	0.41 ns	0.96 ns	1.36 ns
Agricultural years (Y)	365.35**	233.45**	16.71**	1701.79**	7.09**	15.87**	49.52**	22.84**
N Fert. (N)	8.79**	12.67**	20.13**	14.21**	12.37**	3.08*	10.87**	6.55**
K Fert. (K)	0.96ns	1.38ns	0.77ns	0.69ns	3.98*	1.12 ns	3.76*	46.77**
YxN	1.68ns	5.18**	9.15**	7.80**	1.13ns	1.40 ns	2.08 ns	0.59 ns
YxK	1.60ns	0.45ns	0.27ns	0.41ns	1.35ns	1.38 ns	7.62**	0.42 ns
NxK	2.43*	0.53ns	1.20ns	3.03*	4.13**	0.90 ns	3.56**	3.73 **
YxNxK	2.74*	1.27ns	3.06*	3.13**	0.37ns	0.32 ns	3.53**	0.88 ns
CV (%)	11.2	24.75	9.01	12.8	49.18	24.05	12.57	8.11
Means of agricultural years								
2018	25.87 b	65.07 a	35.51 b	74.24 a	1.97 b	2.19 a	37.81 a	7.17 b
2019	40.33 a	28.82 b	38.28 a	22.25 b	2.02 a	1.80 b	31.55 b	7.76 a

**=P<0.01; *=P<0.05; ns=P>0.05. †Means followed by different letters differ statistically by the F test at 5% probability level.

From the quantitative analysis it was possible to obtain the response surfaces and significant regression functions ($p \leq 0.05$ and $p \leq 0.01$) representative of the interaction between the factors (N Fert. and K Fert.) and of these factors (N Fert. vs. K Fert.) in the Years. The maximum value reached by N in the shoots of melon at 48 DAT was 38.35 g kg^{-1} with N and K fertilizations of 150 and 100 kg ha^{-1}, respectively (Figure 1A).

The maximum contents of leaf N obtained at 48 DAT in 2018 and 2019 were 26.95 and 46.07 g kg^{-1} with N and K fertilizations of 150 and 100 kg ha^{-1} (Figures 1B and 1C), respectively. At 62 DAT, the maximum leaf N contents were 36.64 and 42.45 g kg^{-1} with N and fertilizations of 100 kg ha^{-1} of K, in 2018, and 150 and 100 kg ha^{-1} of N and K, in 2019 (Figures 1D and 1E), respectively.

The N content accumulated in the shoots at 48 DAT increased with the increase of the factors, mainly N fertilization. The results of this study in relation to the increase of N in the phytomass corroborate those obtained by Oliveira et al. (2009), who studied the accumulation and partition of dry mass, N and K by melon under fertigation management in the Apodi Plateau and observed a linear and increasing trend in the N concentration in the shoots with the increase of N fertilization. Among the treatments used, the highest N and K accumulations were obtained at doses of 126 kg ha^{-1} of N and 322 kg ha^{-1} of K. In general, N accumulation is highly conditioned on N fertilization, especially until the end of the vegetative stage, as observed by Aguiar Neto et al. (2014), who obtained maximum N content in the shoots of 1.71 g plant^{-1} at 49 DAT, considering the entire crop cycle.

The mean N contents in the shoots at 48 DAT showed statistical differences, with values of 25.87 and 40.33 g kg^{-1} for the years 2018 and 2019, respectively. Significant differences were also observed in the N content at 62 DAT, with mean values of 65.07 and 28.82 g kg^{-1} in the years 2018 and 2019, respectively (Table 2). Such means are within the limits presented by Dechen and Nachtigal (2006), who consider the ideal N content in the shoots ranging from 20 to 50 g.kg^{-1}. Oliveira Filho et al. (2020) observed different values from the means presented in this study for N; when studying the yield and leaf concentration of nutrients of the melon crop fertigated with N and K, the authors obtained an average of 47.54 g kg^{-1} at 35 DAT.

In the first cycle, there was an accumulation of the amount of N in the shoots throughout the development of the melon crop, while in the second cycle there was a slight reduction. Medeiros et al. (2008), studying the ‘Orange Flesh’ melon hybrid in the region of Mossoró-RN, observed that the N content in the total phytomass is cumulative up to 61 DAT. Paula et al. (2011), in nutritional determinations of ‘Gália’ melon, observed that the accumulation of N in the plant was increasing with N fertilization, obtaining a maximum value when applying N doses of 126 kg/ha.

Considering only the vegetative part (leaves and stems), Damasceno et al. (2012) analyzed the absorption rate of the melon variety ‘Cantaloupe’ as a function of N and K doses and verified that N accumulation occurs gradually up to 45 DAT. Subsequently, there was a reduction of this element in vegetative phytomass, and it was redirected to fruit formation. Results similar to that of the present study were reported by Araujo, Oliveira, and Oliveira (2016), who studied the partition of nutrients in ‘Goldex’ melon and obtained average N contents of 25.48 and 20.95 g kg^{-1} at 49 DAT and 63 DAT, respectively.

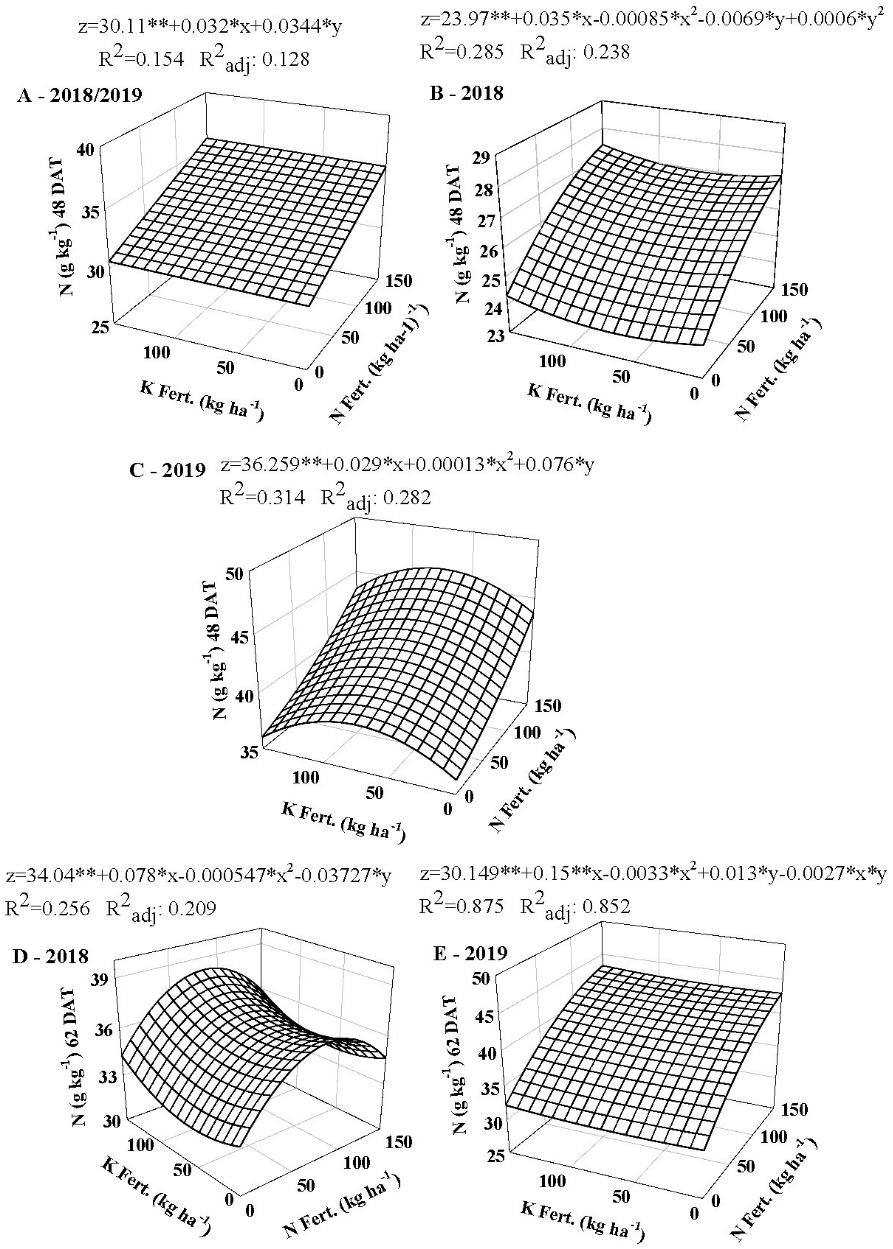

Figure 1. Nitrogen (N) content at 48 DAT: A - years of cultivation 2018/2019; B - Year 2018; C - Year 2019; Nitrogen (N) content at 62 DAT: D - Year 2018 and E - Year 2019 as a function of nitrogen (N Fert.) and potassium (K Fert.) fertilization.

At 62 DAT (Figure 2A), K showed a maximum value of 49.91g kg^{-1} with N and K fertilization of 50 and 15 kg ha^{-1}, respectively. In the N x K x years interaction, the maximum K contents in the shoots were 81.86 and 23.36 g kg^{-1}, in the years 2018 and 2019 (Figures 2B and 2C), respectively, with complete absence of fertilization. Thus, the dynamics of leaf accumulation of K, at 62 DAT, shows a behavior inverse to the increase of factors, with the highest contents identified at the lowest levels of fertilization. This behavior in all cases shown in Figure 2 is much more associated with N variation than with K variation in the soil, as indicated by the response surface and the slope coefficients of N and K in the regression equations.

The reduction of leaf K contents with the increase of N fertilization is probably associated with competition in the soil between the $NH4^+$ and K^+ ions supplied via fertigation, as pointed out by Dantas Neto et al. (2013). The absorption of the ammoniacal form (NH_4^+) inhibits the absorption of cations (K^+) and favors the absorption of anions, hence explaining this antagonism between the two nutrients (MALVI, 2011). These results are also similar to those obtained by Nascimento, Nascimento, and Cecílio Filho (2020), who recently studied the relationship of N and K supply in each phenological stage of melon and observed that the increase of N doses in the vegetative stage promoted an increase in leaf contents of N, P and S and reduction of K, Ca and Mg. Oliveira Filho et al. (2020) came to the conclusion that fertilization with N and K – via fertigation in melon – alter the concentrations of K, Fe and B in the leaves, but not to the point of causing nutritional deficiency.

When evaluating the yellow melon variety 'Goldex', Araujo, Oliveira, and Oliveira (2016) obtained in the mean K contents in the shoots of 36.88 and 26.63 g kg^{-1} at 49 DAT and 63 DAT, respectively. The authors also concluded that K is the nutrient most extracted from the soil by melon, especially in the vegetative stage. In the present study, the mean K contents were 65.07 and 74.34 g kg^{-1} at 48 and 62 DAT in 2018 and 28.82 and 22.25 g kg^{-1} at 48 and 62 DAT in 2019, respectively. The means of the second cycle were well below those of the first cycle, possibly there was lower absorption of this element by the plants and greater redirection from the shoots to the fruits in 2019, compared to 2018, a behavior corroborated by the literature, which demonstrates a reduction of K in the shoots close to harvest (AGUIAR NETO et al., 2014). According to Damasceno et al. (2012), this can be explained by the fact that this nutrient has its maximum absorption in the vegetative stage of melon, up to 49 DAT. Then, this element begins to accumulate in the fruits, reaching 84.6% of the total extracted by the plant, according to the authors.

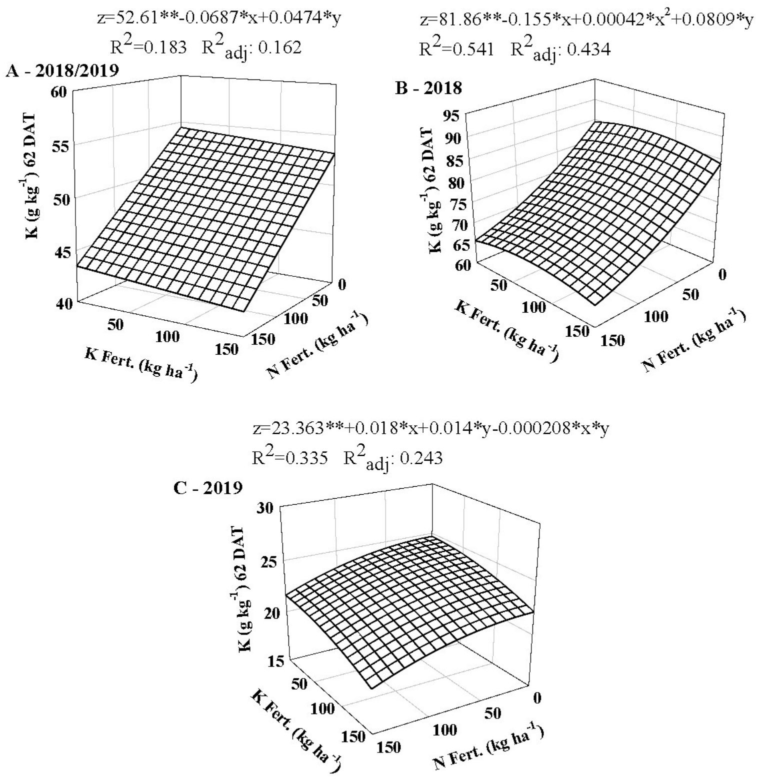

Figure 2. Potassium (K) content in the shoots of melon at 62 DAT: A – years of cultivation 2018/2019; B - Year 2018; C - Year 2019 as a function of nitrogen (N Fert.) and potassium (K Fert.) fertilization.

Shoot dry mass (SDM) production showed a maximum value of 3.23 t ha^{-1} with N and K fertilizations of 150 and 100 kg ha^{-1}, respectively (Figure 3). This variable is highly related to the amount of nutrients accumulated throughout the crop cycle, especially N. Sousa et al. (2005) verified a significant influence of N and K_2O doses and their interaction (N x K_2O) on the shoot dry mass of melon. When studying 'Cantaloupe' melon, Damasceno et al. (2012) observed that this variable was not influenced by the N and K doses applied by fertigation. Araujo, Oliveira, and Oliveira (2016) identified that the accumulation of shoot dry mass in 'Goldex' melon shows a quadratic behavior, with maximum value occurring at 56 DAT. The authors found an average dry mass of 2.01 t ha^{-1} at 63 DAT, hence corroborating the results of the present study, in which, at 62 DAT, the mean dry mass was 2.00 t ha^{-1} for the two cycles (2018 and 2019). These results are also similar to those obtained by Oliveira et al. (2020), who evaluated the nutrient absorption rate in fertigated 'Goldex' melon.

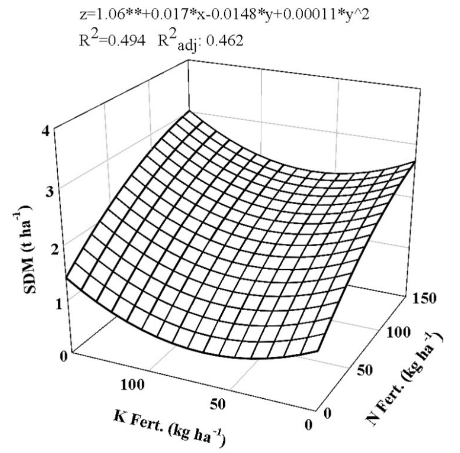

Figure 3. Shoot dry mass (SDM) of melon as a function of nitrogen (N Fert.) and potassium (K Fert.) fertilization.

The average number of fruits per plant (F/P) in 2018 was higher than in 2019 (Table 2), but there was no interaction between the factors studied for this variable.

The maximum marketable yield obtained was 40.28 t ha^{-1} with N and K fertilization of 150 kg ha^{-1}, that is, the maximum amount of fertilizers tested in this study (Figure 4A). In the first cycle, the maximum marketable yield was 43.03 t ha^{-1}, obtained with the combination of 100 and 150 kg ha^{-1} of N and K, respectively (Figure 4B), while in the second cycle the maximum yield was 36.79 t ha^{-1}, obtained with fertilization of 150 kg ha^{-1} of N and 150 kg ha^{-1} of K (Figure 4C).

These results indicate that the maximum limit of fertilization with N and K can be increased, suggesting an increase in yield. However, Damasceno et al. (2012), when evaluating the growth and nutrient absorption rate of 'Cantaloupe' melon fertigated with doses of N and K, proposed very high levels of these nutrients and verified that the increase in their supply to the plants tends to increase their accumulation in the leaves. This behavior highlights a luxury absorption, since it did not translate into a significant increase in yield. In addition, the application of fertilizer in excessive doses promotes accumulation of salts in the soil that, if repeated in successive cycles, can compromise yield (OLIVEIRA FILHO et al., 2020).

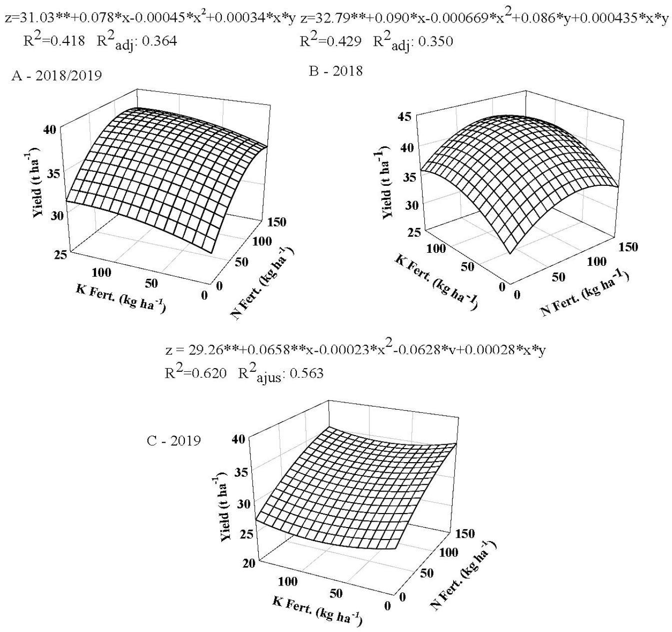

Figure 4. Yellow melon yield: A - cultivation years 2018/2019; B - Year 2018 and C - Year 2019 as a function of nitrogen (N Fert.) and potassium (K Fert.) fertilization.

The means of marketable yield of the experiment showed statistical differences, with values of 37.81 and 31.55 t ha^{-1} in 2018 and 2019, respectively (Table 2). In the second cycle, there was an intense attack of whitefly (*Bemisia argentifolii*) and leaf miner fly (*Liriomyza huidobrensis*), which substantially compromised the development and yield of the crop. Dalastra et al. (2016) obtained maximum yield of 23 t ha^{-1} when plants were grown with two fruits, thus lower than the results of the present study. Lima et al. (2017) obtained yield higher than 50 t ha^{-1} for the cultivar 'BRS Araguaia', when conducted in a greenhouse using fertilization with N, K and phosphorus (P).

When evaluating production characteristics of melon fertilized with N and K, Silva et al. (2014) observed that yield was positively and linearly influenced by N and K doses, although there was no interaction between the factors. Castellanos et al. (2011), evaluating melon yield using N fertilization, obtained quadratic response and higher yield when using N doses between 93 and 148 kg ha^{-1}. Freitas et al. (2014) found no interference of this nutrient in melon yield.

When studying the yield of the 'Gold Mine' hybrid under irrigation depths and K fertilization, Sousa et al. (2010) obtained yields between 19.7 and 34.7 t ha^{-1} and concluded that the highest irrigation depths increased yield, although K doses did not alter yield. Azevedo et al. (2015), in a similar study with yellow melon, observed a positive influence of K and recommended to double fertilization with this element to maximize marketable yield of fruits, provided that fertilization is applied via fertigation.

The content of total soluble solids (TSS) expressed in ºBrix increased as fertilization increased, with coefficients of determination of R^2=0.759 (Figure 5). Only K Fert. had significant linear and quadratic coefficients ($p \leq 0.05$ and $p \leq 0.01$) in the model, indicating the importance of this factor for the response variable. The maximum value of °Brix was 8.07, obtained with maximum combination of fertilization (150 kg ha^{-1} of N and 150 kg ha^{-1} of K). In this case, the increase in nutrient doses (N Fert. and K Fert.) promotes a significant increase in the °Brix of the fruits. However, this can lead to waste by excessive fertilization and interference in the next cycle due to the residual effect of these elements, which was not observed with the levels applied in this experiment (Table 1).

K is one of the main nutrients for fruit growth and development as it is involved in important vital functions, including enzymatic activation, balance of charges and plant osmoregulation. Preciado-Rangel (2018) argues that K influences the variables that determine fruit quality and the concentration of the element present in food; for this reason it defines the preferences of the consumer. This increase in the concentration of sugars in the fruit may be associated with the role that K plays in apoplastic co-transport during the sucrose loading between the mesophyll and the phloem (WHITE; KARLEY, 2010). The literature is rich in approaches that confirm the positive effect of an increase of K on TSS in this crop, as found in Lin, Huang and Wang (2004), Demiral and Köseoglu (2005), Bouzo, Céccoli, and Muñoz (2018), Yang et al. (2019) and Oliveira et al. (2021). Thus, maintaining an adequate supply of K for melon plants ensures a better quality of the fruits, with regard to the degree Brix. The soluble solids content is the characteristic traditionally used to determine fruit quality. In the case of yellow melon, fruits with values within the range from 9 to 11 °Brix are marketed abroad (CAMILI et al., 2011). The means obtained in this experiment differed in relation to the years of cultivation and did not exceed the minimum value (9 °Brix), with values of 7.17 ° Brix in the first cycle and 7.76 °Brix in the second cycle (Table 2). For this reason, these fruits are not considered marketable because total soluble solids are one of the main quality criteria for melon fruits (BUDIASTUTI et al., 2012). Probably, the inefficiency in the translocation of sugars that resulted in the low TSS value is due to inefficient water management in the period preceding fruit harvest. Irrigation should have been ended 8 days before, causing water stress in the crop, as observed by Andrade et al. (2017). On the other hand, several researchers have found TSS contents for yellow melon ranging from 6.3 to 8.83 °Brix (SANTOS et al., 2011), from 6 to 9.3 °Brix (SILVA et al., 2014) and also from 6.7 to 7.5 °Brix (LOBO et al., 2019).

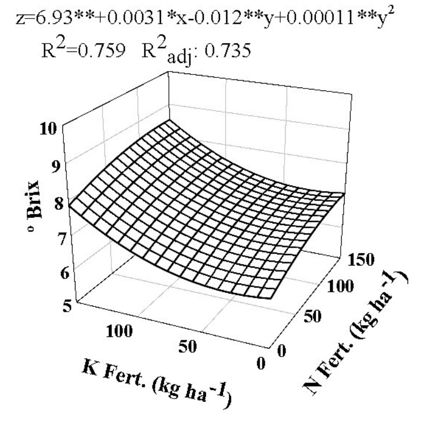

Figure 5. Total soluble solids (TSS) expressed in °Brix for yellow melon as a function of nitrogen (N Fert.) and potassium (K Fert.) fertilization.

When investigating the quality of fruits of netted melon fertilized with N and K, Silva et al. (2014) verified single effects of fertilization on soluble solids content, with linear and quadratic fits for N and K fertilization, respectively. Although significant in the interaction, the results of the present study revealed little influence of N fertilization on soluble solids content (regression model in Figure 5). This behavior is justified by the indirect influence of N on this variable, which depends on the alteration of other characteristics in the plant, such as leaf area (BARDIVIESSO et al., 2013). There are several studies in the literature in which this relationship between N fertilization and soluble solids content was not found, as in the studies conducted by Morais et al. (2018), Castellanos et al. (2011) and Nowaki et al. (2017).

Regarding K fertilization, despite not reaching acceptable values, the response in terms of °Brix in melon fruits was very significant. Azevedo et al. (2015) obtained quadratic fit for °Brix as a function of K fertilization. Rangel et al. (2018) verified a linear increase in soluble solids in melon fruits with increased K concentration in the irrigation solution. When combining fertilization between K and calcium, Bouzo, Céccoli, and Muñoz (2018) also verified positive linear effect on soluble solids content with increase of these nutrients in the soil.

CONCLUSIONS

Nitrogen assimilation in the shoots of ‘Goldex’ yellow melon was cumulative until the beginning of fruiting and is related only to N fertilization. The maximum level of this fertilization also promoted a reduction of K in the shoots of the crop and an accumulation of shoot dry mass. The assimilated amount of K in melon shoots could not be explained by the increase of fertilization with this element.

The maximum combination of N and K fertilizations was responsible for the highest yield. Therefore, in future studies, the authors intend to increase the concentrations of the two factors in order to enable the maximum level of production.

The content of total soluble solids (°Brix) increased with the increase of the two fertilizations; however, potassium fertilization has greater influence on the maximum levels of this variable.

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