Babycorn subjected to doses of nitrogen and potassium fertilization: agronomic and postharvest attributes

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ABSTRACT

The baby corn corresponds to the inflorescence of maize before its fertilization and early grain formation. The cultivation is carried out with directions available for production of corn. How young is collected in the stadium, it is assumed that the need for fertilization is less. This study aimed to identify the influence of fertilizers (N and K) on the agronomic characteristics and post-harvest corn. The experiment was conducted at the Experimental Farm Iguatemi - FEI in Maringá, Northwest of Paraná during summer and winter crop year 2010/2011. The design was randomized blocks in factorial scheme 4x4, with four nitrogen levels (0, 50, 75 and 100 kg ha^{-1}) and four levels of potassium (0, 20, 40 and 60 kg ha^{-1}). The plant material used was a simple hybrid popcorn in the breeding program of UEM. The characteristics evaluated were: number, diameter, length and weight of commercial spikelets peeled, and post-harvest attributes were:

pH of the brine, pH of baby corn, soluble solids, moisture, ash, fiber, carbohydrates, lipids, proteins, color and texture. The highest yields were obtained in the summer season. The control (00N-00K) showed yield kg ha^{-1} significantly lower than the others, in both seasons. All values were consistent with the literature and did not represent different nutritional gain in order that we can recommend a treatment on the basis of post-harvest attributes.

Key words: *Zea mays* L., baby corn, nutrients agronomic performance, chemical composition

{**Citation:** Simone Correia Molina, Edmar Clemente, Carlos Alberto Scapim, Mônica Regina da Silva Scapim, Roselene Ferreira Oliveira. Babycorn subjected to doses of nitrogen and potassium fertilization: agronomic and postharvest attributes. American Journal of Research Communication, 2013, 1(11): 1-22} www.usa-journals.com, ISSN: 2325-4076.

INTRODUCTION

Maize (*Zea mays* L.) is the most consumed grain in the world, due to its great versatility in forms of consumption, being used for both human and animal feeding. In Brazil, around 60 to 80% of grains are used for animal feeding and this percentage varies according to the market demand, especially in the industrial production of poultry and pork (Duarte et al., 2010).

In human nutrition, cooked and canned corns are the most common forms of maize consumption, being used in salads and other dishes. Another alternative that is little known in market is the baby corn. The baby corn corresponds to the maize inflorescence (spikelet) prior to fertilization and grain formation. It is sold in cans and consumed as appetizers, in salads and in more elaborate dishes such as risottos, soups, grilled meats and fish (Barbosa, 2009).

There is little statistical information on production and consumption due to the fact that many producing countries disregard it or do not have such information. Raupp et al. (2008) mentioned that baby corn is widely consumed as a vegetable in Asia and it represents a significant economic activity in countries such as Thailand, Sri Lanka, Taiwan, China, Zimbabwe, Zambia and Indonesia, and also in Central America, such as Nicaragua, Costa Rica, Guatemala and Honduras.

With respect to handling, cultivation including fertilization is performed with indications available for the production of corn grain. Since baby corn is harvested at a young stage, it is assumed that there is a lower need for nitrogen, which is an important element for the plant's growth and for the filling and maturation of grains.

Pereira Filho et al. (2008) reported that, in relation to the response to nitrogen, especially in coverage, the yield of baby corn increased with 160kg. ha^{-1} of nitrogen with the plant at a stage of four to five leaves in the winter, and in the rainy season, there was no increase in production with doses above 120 kg ha^{-1}. However, other studies show that doses of nitrogen, for the cultivation of baby corn, must be between 60 and 95 kg ha^{-1}, applying half of it at planting and the remainder between 25 and 30 days after plant emergence.

Regarding the need for potassium, its importance is in supplying the plant, as well as maintaining the equilibrium of the element in the soil for further cultures, since the cultivation of baby corn causes depletion of potassium in the soil. The plant is completely harvested and, in such cases, the baby corn is used for consumption and the straw is commonly used for animal feed.

Considering the quality attributes, the appearance of the spike is very important to the consumer, since in canning processes, the bottling is done usually in clear glass so that the consumer appreciates features like color, shape, size and diameter (Raupp et al., 2008). The ears must show the following commercial standards: pearl white to light yellow coloring, cylindrical shape with small ovaries in uniform and symmetrical rows; diameter ~~of~~ between 10 and 18 mm, length from 40 to 120 mm. The harvest must be made in the morning, which is when the ears are more humid and the temperature is lower, thus maintaining the quality of the raw material. The ideal harvest is when the ears are two to three days of exposure of the styles-stigma (Raupp et al., 2008).

There is little information - mostly contradictory - about fertilizers and maize cultivars aiming at the production of baby corn in Brazil, and it suggests carrying out work in the area to meet the demand of producers who use this type of exploitation.

Given the above, the present study aimed at evaluating agronomic post-harvest characteristics and attributes of baby corn upon different levels of nitrogen and potassium. The experiment was carried out in Maringá, Paraná, during summer and winter crops in the agricultural year 2010/2011.

MATERIAL AND METHODS

The experiment was conducted at the Experimental Farm of Iguatemi (FEI) in Maringá, northwestern region of the state of Paraná latitude 23º 25' S, 51º 57' W, and altitude 550 meters (FEI, 2011). The climate of the area is a CFA type, according to Köppen's classification. The experimental area is classified as Distoferric Red Latosol. (EMBRAPA, 1999).

The experimental period corresponded to two seasons, summer and winter, during the agricultural year 2010/2011. The experimental design was a fully randomized blocks divided in a 4x4 factorial, with 4 levels of nitrogen (0, 50, 75 and 100kg.ha^{-1}) and 4 levels of potassium (0, 20, 40 and 60kg.ha^{-1}), being 50% applied at sowing 50% and 50% at coverage on V6 stage of development.

The plant material used was simple hybrid popcorn grown in the breeding program of UEM. Phosphorus fertilization was performed according to the interpretation of the soil test as recommended by Coelho (1992). The experimental plots were composed of 6 rows spaced 0.9 m from each other and 5.0 m long, totalizing 27 m^2. For data collection, both lateral lines were discarded as well as 1 m on each side along the length of the rows, totalizing 10.8 m^2.

The sowing of the summer crop was held on October 28th, 2010 and the winter harvest was made on February 23rd, 2011, both performed manually at a density of 15 plants/m, totalizing 166,666 plants/ha. Intensive cultivation controls (weeds, insects and diseases) were conducted as the crop needed and in accordance to recommendations for field corn.

The harvesting period started approximately 60 days after planting, and a total of seven harvests were made. Every three days, the material was collected and submitted to analysis. The agronomic variables analyzed were: number, diameter, length and weight of the commercial spikelets. The number of commercial spikelets was obtained by counting all spikelets which had diameter varying between 0.8 and 1.8 cm, length between 4 and 12 cm, color ranging from pearl white to light yellow, cylindrical shape and spikelets unfertilized in the area of the plot. The data regarding the number of spikelets were changed into number of commercial spikelets per hectare.

For the diameter of the spikelet, we considered the average diameter (in centimeters) of ten commercial spikelets from each parcel, measuring with a pachymeter, counting three centimeters from the base. As for the length of the spikelet, we considered the average length (in centimeters) of ten spikelets per parcel, measuring with a ruler. The commercial spikelets were weighed after each harvest and, afterwards, the results were summed in order to calculate productivity/ha.

For canning, we used Krolow's (2006) methodology. The harvest of baby corn was made in the early hours of the morning and transported to the laboratory in a Styrofoam box and kept under refrigeration at approximately 5ºC until the processing. The pre-washing of the spikelets was made in fresh water and later they were immersed in a solution of water with 100ppm of free chlorine (50mL of sodium hypochlorite at 2% for 10L of water) for 15 minutes. Glass flasks of 300mL were used as packaging; they were washed using fresh water and neutral detergent and later sterilized in hot water for 20 minutes (counting from the beginning of boiling). The lids were cleansed with fresh water and neutral detergent.

The following step was to bleach the spikelets, immersing them into boiling water for three minutes. Afterwards, they were taken out and immersed into cold water for three minutes and equally stored into glass flasks. Later, a solution made with 50% of water, 50% or alcohol vinegar and 3% of refined salt was added, aiming at establishing the pH at a lower level than 4.5, i.e., this is the necessary pH to prevent the proliferation of pathogens, such as *Clostridium botulinum* (RAUPP, 2008). Aiming at eliminating microorganisms that cause alterations on food, the flasks with baby corn were put in the pasteurizer, so that they could be fully immersed in water and kept at boiling for 30 minutes (Krolow, 2006).

A cooling process was made immediately after the pasteurization; cool water was slowly poured into the internal edges of the recipient where the materials were, until the temperature reached 40ºC. After that, the flasks were taken off of the water and dried, being later stored in a dark, clean and dry room, with good ventilation, for approximately four months.

After this period, the baby corn cobs of each sample were triturated and homogenized with the aid of a domestic microprocessor. The level of humidity was determined by a hothouse with air circulation at 60ºC and the percentage of humidity was calculated. Nitrogen content was determined by micro-Kjeldahl's method. Gross protein was calculated using the conversion factor 6.25 and expressed in percentage. For the ethereal extract, the extraction was made in a "Soxhlet"-type extractor and sulphuric ether was used as solvent. Ashes content was determined by a gravimetric method, after incineration in oven at 550 - 600ºC. Gross fiber contents (in percentage) were determined by gravimetric method after extraction by acid hydrolysis. It was possible to determine from the homogenize liquid (dilution 1:5) the content of soluble solids (in ºBrix) by digital refractometer. It was also possible to determine pH values in a digital measurer. The content of carbohydrates was determined by difference, subtracting from 100% the sum of the results obtained in the ethereal, fiber, proteins, ashes and humidity analyses, in accordance to the methodology used by Queiroz (2010), cited by Cecchi (2003) and Giuntini et al. (2006).

The determination of texture was made by means of a texturometer (shear resistance) and the color was determined by reflectance colorimeter Konica Minolta. The results obtained were submitted to Analysis of Variance, with probability at 5%, using SISVAR software. Student-Newman-Keuls' test was used for comparing the averages, at the level of 5% of probability.

RESULTS AND DISCUSSION

Regarding climatic conditions, the accumulated rainfall during the whole experiment was 686.5mm during summer and 508.3 during winter. According to Fancelli (2008) such conditions are favorable to development of corn cultures, since the plant demands a minimum of 400 - 600 mm of rainfall to maintain its productive potential.

In Table 1, it is possible to see the values of productivity (in $kg.ha^{-1}$) of commercial spikelets from the 16 treatments of summer and winter crops, cultivated in Iguatemi, district of Maringá, Paraná, in 2010/2011.

Table 1. Productivity of the crop treatments summer and winter 2010/2011

Treatments summer harvest	Productivity*	Treatments winter season	Productivity*
100N-40K	1178.97 **	75N-40K	660.50**
50N-00K	1112.78**	50N-40K	620.25**
75N-00K	1099.35**	50N-60K	581.67**
75N-60K	1071.54**	75N-00K	571.72**
75N-20K	1060.83	75N-20K	566.09
75N-40K	1055.15	100N-60K	562.94
50N-20K	1054.63	100N-40K	539.04
100N-00K	1048.51	100N-20K	525.95
50N-60K	1045.57	50N-20K	513.88
100N-20K	1016.85	75N-60K	506.88
50N-40K	937.46	50N-00K	486.13
100N-60K	907.80	100N-00K	439.06
00N-60K	880.23	00N-40K	339.83
00N-00K	773.69	00N-60K	305.77
00N-20K	772.69	00N-20K	269.09
00N-40K	754.26	00N-00K	257.10

* Commercial husked cobs kg ha^{-1}
**Treatments more productive

The four most productive treatments in summer were 100N-40K; 50N-00K; 75N-00K and 75N-60K. In winter, the following doses showed the best yield: 75N-40K; 50N-40K; 50N-60K and 75N-00K. Comparing the four most productive treatments in both crops, only 75N-00K was effective on both periods.

The summer crop (sowing in October) resulted in a superior productivity if compared to the winter crop. Studies carried out by Carvalho et al. (2002) point out that the production of baby corn was superior when sowed from October to December. In the south of Brazil, the most adequate period for sowing corn is between mid-September and the end of October, due to solar radiation (Sangoi et al., 2007).

In Table 2, it is possible to see the results of number, diameter, length and weight of commercial spikelets of the four most productive treatments + control treatment of summer and winter crops, cultivated in Iguatemi, district of Maringá, Paraná, in 2010/2011.

The variables diameter and length of the spikelets showed no significant differences in summer or winter crops. The values founds were compatible to the ones established as commercial standards, which demand a cylindrical shape, diameter ranging from 1.0 to 1.8cm and length ranging from 4.0 to 12.0cm (Pereira Filho and Cruz, 2001).

These characteristics are considered good phytotechnical quality indicators for baby corn, since bigger diameters are directly related to a better development of cobs and, consequently, to a higher accumulation of dry matter, higher shear resistance and reduction of palatability, as well as smaller diameters result in losses due to fragility of the raw material, depreciation of visual quality and reduction of final yield of baby corn (Sandoval Junior et al., 2009).

The values obtained were close to the ones found by Emygidio et al (2009) in a study with different baby corn cultivars in hydromorphic soils. The values for length of spikelets without straw ranged from 4.6 to 5.6cm and their diameters ranged from 0.8 to 1.0cm. Rodrigues et al. (2004), while studying families prolific to baby corn production, found length values between 6.4 and 8.5cm and diameters of strawless spikes between 1.11cm and 1.32cm.

Table 2. Results of the average diameter, length, number and productivity of spikelets commercial peeled from summer and winter harvest 2010/2011

Treatments	diameter spikelets (cm)	Spikelet length (cm)	Number of spikelets ha^{-1}	Productivity kg ha^{-1}
		Summer harvest 2010/2011		
100N-40K	1.18 a	9.52 a	152,592.59 a	1178.97
50N-00K	1.13 a	9.13 a	148,888.88 a	1112.78
75N-00K	1.21 a	9.50 a	146,666.66 a	1099.35
75N-60K	1.17 a	9.34 a	140,555.55 a	1071.54
00N-00K	1.10 a	8.52 a	117,407.41 a	773.69
CV%	6.67	5.98	16.75	15.52
General average	1.16	9.20	141, 222.22	1,047.66
		Winter harvest 2010/2011		
75N-40K	1.16 a	8.66 a	128, 333.33 a	660.50 a
50N-40K	1.13 a	8.17 a	116, 666.66 a	620.25 a
50N-60K	1.13 a	8.28 a	116, 296.29 a	581.66 a
75N-00K	1.14 a	8.31 a	112, 407.41 a	571.72 a
00N-00K	1.16 a	7.95 a	57,962.96 b	257.10 b
CV%	4.33	5.10	18.05	18.44
General average	1.14	8.27	106,333.33	538.24

Means in columns followed by the same letter do not differ by Student's test-Newma-Keuls at 5% probability.

In a study carried out by Sandoval Junior et al. (2009), while evaluating hybrids of popcorn, they observed the variations in growth of strawless spikes between 8.41 and 12.08cm. As for the diameter of spikes, the smallest average diameter observed was 1.09 and the biggest, 1.52cm.

Regarding the number of spikelets per hectare in summer crop, there were no significant differences. However, in the winter crop, the control treatment showed the lowest number of spikelets. As for the productivity in both crops, only the control treatment showed significant inferior values, when compared to the other treatments. Such result can be due to the fact that baby corn demands more nutrients from the soil and depends on its fertility and less fertilization than the culture of corn for grain production. In such cases, big amounts of fertilizer do not correspond to productivity and profit.

Between 60 to 80 days after emergence, the spikelets are harvested and prepared for consumption. In this period, only K would be in its almost full demand, while N would be in 50%. Therefore, only part of the plant's nutrition would be complete (Vasconcellos et al., 2001).

The results obtained are in accordance to the ones found by Pereira Filho and Cruz (2001) who studied the handling of fertilizers in different cultivars of baby corn and concluded that the total and the commercial productions of baby corn were not influenced by the levels of potassium (50 and 100 $kg.ha^{-1}$) in planting and by the levels of nitrogen (60 and 120 $kg.ha^{-1}$) in covering, but by the studied cultivars.

Regarding Nitrogen, Vasconcellos et al. (2001) pointed out that the curve that decreases the plant's dependence on nutrients and time shows an S format, i.e., there is a slow growth in the beginning, followed by a quick growth phase, between 35 and 50 days after germination, and a period of stabilization without gains or losses.

While studying the effect of sowing density, levels of nitrogen and detasseling on baby corn productions, Pereira Filho and Karan (2008) concluded with the results obtained in a two years' work, that the weight of baby corn, with and without straw, were the same, even with different levels of oxygen. Furthermore, the authors cite that nitrogen in covering must be between 60 and 95kg.ha^{-1}, being half of it applied in planting and the rest after 25 to 30 days after the emergence of plants.

Data on pH of brine, pH of baby corn and the content of soluble solids are shown on Table 3.

After storage, it was possible to observe that the pH of brine and of the spikelets, within the same treatment, were in balance. The control treatment (00N-00K) in both crops differed showing the lowest averages.

The acidification procedure can be considered successful because it resulted in a pH lower than 4.5 and this value is the one recommended by good practices in manufacture of acidified canned products subject to pasteurization. Moreover, this pH value does not damage the pleasant texture of the product and results in a canned product that is safe for consumption (Raupp, 2004).

The content of total soluble solids showed no significant differences and the results obtained were close to the ones found by Emygidio et al. (2009), who found concentrations of 6.0.

The results of centesimal composition of the materials in both crops (summer and winter), after approximately 4 months of canning preparation are shown in Table 4 and expressed in percentage.

Table 3. Mean values of pH of brine, babycorn pH, soluble solids and treatments summer crops and winter 2010/2011

	Summer harvest 2010/2011		
Treatments	Brine pH	pH Corn	^{0} Brix
100N-40K	3.57 a	3.58 a	5.32 a
50N-00K	3.60 a	3.63 a	5.56 a
75N-00K	353 a	3.52 a	4.99 a
75N-60K	3.62 a	3.65 a	4.11 a
00N-00K	3.19 b	3.17 b	3.68 a
CV%	4.21	4.65	18.58
General average	3.50	3.51	4.73
	Winter harvest 2010/2011		
75N-40K	3.36 a	3.36 a	3.70 ab
50N-40K	3.48 a	3.47 a	4.00 ab
50N-60K	3.57 a	3.57 a	3.72 ab
75N-00K	3.54 a	3.42 a	3.35 a
00N-00K	3.07 b	3.08 b	3.45 a
CV%	5.42	3.61	7.08
General average	3.40	3.38	3.64

Means in columns followed by the same letter do not differ by Student's test-Newma-Keuls at 5% probability.

In summer, the values for humidity did not differ statistically. However, in winter, the treatments 75N-40K and the control treatment differed from the others with values 93.51 and 93.97%, respectively. This variation can be due to the canning preparation process, because of the relation between the volume of brine and the mass of the spikelet present in the flask.

These values are in accordance to Von Pinho et al. (2003), who evaluated the physical and the chemical characteristics of baby corn cultivars and found values that ranged between 90.2 and 94.5%. In a similar study, Raupp et al. (2008) found variations between 90.3 and 90.8% of water.

Table 4. Results of the mean chemical composition of canned baby corn harvests of summer and winter 2010/2011

Summer harvest 2010/2011						
kg ha $^{-1}$	%					
Treatments	Moisture	Ashes	Fibers	Lipids	Proteins	Carbohydrates
100N-40K	92.75 a	0.69 a	0.60 a	0.64 a	1.38 c	3.92 a
50N-00K	92.20 a	0.77 a	0.57 a	0.62 a	1.49 b	4.34 a
75N-00K	93.35 a	0.59 a	0.65 a	0.54 a	1.27 d	3.57 a
75N-60K	91.28 a	0.99 a	0.72 a	0.71 a	1.63 a	4.65 a
00N-00K	93.10 a	1.14 a	0.71 a	0.43 a	1.46 b	3.14 a
CV%	1.22	30.10	17.08	41.24	3.50	26.74
General average	92.50	0.83	0.65	0.59	1.45	3.92
Winter harvest 2010/2011						
75N-40K	93.51 a	1.10 a	0.54 b	0.15 ab	1.13 b	3.55 b
50N-40K	92.20 b	1.04 a	0.65 b	0.27 a	1.28 a	4.54 a
50N-60K	92.30 b	1.14 a	0.85 a	0.08 b	1.35 a	4.18 ab
75N-00K	92.08 b	1.54 b	0.63 b	0.28 a	1.32 a	4.13 ab
00N-00K	93.97 a	1.00 a	1.00 a	0.28 a	1.07 b	2.66 c
CV%	0.59	16.10	13.45	41.58	4.44	11.55
General average	92.83	1.16	0.73	0.21	1.23	3.81

Means in columns followed by the same letter do not differ by Student's test-Newma-Keuls at 5% probability.

As for the ash content, there was no difference in the summer crop and the results are pursuant to the ones found by Tomé et al. (2001), who found 0.9% of ash. In the winter crop, the treatment 75N-00K differed from the others with 1.54%.

In products canned with brine, the variations in ash content can be explained by the exposition of the product to brine (Raupp et al., 2008).

The values for fiber did not differ in the summer crop. In the winter crop, however, the control treatment and treatment 50N-60K were significantly superior to the other with values 0.85 and 1.00%, respectively. Such values are close to the ones found by Tomé et al (2001), who found 0.8% of fiber.

Regarding the lipid content, there was no difference among the treatments in the summer crop. In the winter crop, the treatment 50N-60K showed inferior results to the treatments 50N-40K, 75N-00K and control, with values 0.08, 0.27, 0.28 and 0.28%, respectively. The concentrations found in the winter crop are in accordance to the ones found by Raupp et al. (2008) and Queiroz and Pereira Filho (2010), who found values for lipid corresponding to 0.23 to 0.28%.

For proteins, the highest value was obtained by treatment 75N-60K with 1.63%, which was significantly superior to the others in the summer crop. In the winter crop, the treatments 50N-60K, 75N-00K and 50N-40K differed from the others with 1.35, 1.32 and 1.28%, respectively. However, all values are close to the ones found in literature, such as Raupp et al (2008), with 1.2 to 1.565; Tomé et al. (2001) with an average of 1.9%; Queiroz et al. (2010), with 1.68 to 1.85% and Von Pinho et al. (2003), with 0.86 to 1.53%.

The values for protein are low in baby corn because before fertilization, the rate of nutrient translocation to the cob is still very low, when compared to ears in which the ovules were already fertilized (VON PINHO et al., 2003).

Comparing to sweet corn, for example, the values varied from 10.36 to 12.88%, at the 25th day after fertilization (Kwiatkowsky and Clemente, 2008).

Analyzing the data for carbohydrates, there were no differences in summer crop. As for the winter crop, the treatment that showed the lowest value was the control treatment, with 2.66% of total carbohydrates. These values were close to the ones found by Von Pinho et al. (2003), who found 4.12 to 7.23%, justifying why sugars are so important to the flavor of baby corn and why they vary in accordance to the cultivar and to environmental conditions.

In Table 5, it is possible to observe the values for coloration and texture in both crops (winter and summer), when canned.

In relation to the coloration, the summer crop showed a minimum significant difference in b, which is the most representative parameter for baby corn (yellow specter), highlighting that treatment 00N-00K provided them with a clearer shade of yellow than the others. In the winter crop, only the treatment 75N-40K showed difference with the lowest average for luminosity. The values found are in accordance to what is determined by the commercial standards, which demand coloration between pearl white to light yellow.

The L values are in accordance to the ones obtained by Reis et al. (2005), who found average values for luminosity of 72.57, and by Teles and Nascimento (2010), who found L values between 61.1 and 71.9.

With respect to texture, only the control treatment showed significantly different values in the summer crop. In the winter crop, we did not run tests with the control treatment due to problems in the sampling volume. Among the analyzed treatments, there were no significant differences.

Table 5. Stain Mean values (a, b C, H and L) of baby corn and texture preserved crop summer and winter 2010/2011

Treatments	a	B	C	H	L	Texture (gf*)
Summer harvest 2010/2011						
100N-40K	-1.78 a	+30.62 a	30.68 a	93.54 a	71.67 a	1.45 a
50N-00K	-1.16 a	+32.00 a	32.03 a	92.11 a	72.29 a	1.44 a
75N-00K	-1.66 a	+29.27 a	29.35 a	93.45 a	71.91 a	1.48 a
75N-60K	-1.49 a	+32.04 a	32.07 a	92.60 a	73.55 a	1.42 a
00N-00K	-1.84 a	+12.91 b	26.54 a	61.25 a	80.54 a	1.01 b
CV %	28.47	23.26	13.81	18.80	6.84	11.81
General average	1.59	27.37	30.13	86.59	73.99	1.36
Winter harvest 2010/2011						
75N-40K	-1.97 a	+31.11 a	31.13 a	93.52 a	65.87 b	1.20 a
50N-40K	-2.03 a	+34.10 a	34.48 a	93.44 a	73.29 a	1.15 a
50N-60K	-1.68 a	+34.68 a	34.75 a	92.88 a	72.98 a	1.26 a
75N-00K	-2.19 a	+31.51 a	31.51 a	94.06 a	71.27 a	1.21 a
00N-00K	-1.72 a	+30.61 a	30.69 a	93.31 a	71.97 a	------
CV%	29.06	6.69	6.53	1.13	2.08	20.21
General average	1.92	32.40	32.51	93.44	71.08	1.21

Means in columns followed by the same letter do not differ by Student's test-Newma-Keuls at 5% probability.
* gram force

In order to compare data on texture obtained in this study, two brands that are commercialized in Brazil, herein named “Brand 1” and “Brand 2”, were analyzed. The tests were carried out in the same conditions as those used in the field experiment. The results were 1.73 and 2.26 (gf), respectively.

In a comparative study of sweet corn cultivars for the production of baby corn, Teles and Nascimento (2010) identified values (gf) between 1.87 and 2.98. It is worth mentioning that the authors used a penetrometer to run the tests.

The results on coloration and texture point out that the treatments of bleaching and acidification were successful and did not affect the sensorial and visual characteristics of the baby corn. Moreover, all the values are in accordance to the commercialization standards for canned products.

CONCLUSION

The highest productivity was obtained in the summer crop.

Only the control treatment (00N-00K) showed a significantly lower productivity (kg.ha^{-1}) than the others.

Regarding the post-harvest characteristics, all the values found were compatible to the ones found in literature and did not represent a nutritional gain, so that one treatment can be recommended (fertilization dose) over the post-harvest attributes.

ACKNOWLEDGEMENT

To the State University of Maringá (UEM), CAPES and CNPq, for structural and financial support.

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