



Seasonal Variation of Lettuce Supply and Prices in Minas Gerais¹

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ABSTRACT

In economic terms the lettuce (*Lactuca sativa* L.) is considered relevant among the vegetable crops. The diversity of cultivars available today, their varying climatic requirements and climatic differences between the different producing regions, lettuce may present seasonal variations in supply and prices during agricultural years. The aim of this work was to study the seasonal variation of lettuce supply and prices practiced in the state of Minas Gerais, in the period between January 2012 and December 2017. The data were obtained from CeasaMinas and processed by the centralized moving geometric mean methodology, obtaining the minimum, average and maximum indexes for supply and prices practiced. Lettuce showed a marked seasonal variation in supply and prices, and Ceasa Great-BH presented the highest seasonal variation of price and supply indices practiced. The variations in supply and prices in the hot and rainy season, in relation to the dry season, are markedly more accentuated. It was observed that there is a relationship that follows the “Law of supply”, where in the cold periods of the year the lowest prices associated with the lowest offers were presented and in the hot periods of the year, the highest prices associated with the largest offers were presented.

Keywords: *Lactuca sativa* L.; horticulture; marketing channels; seasonality.

INTRODUCTION

Lettuce (*Lactuca sativa* L.) is considered the main leafy vegetable in Brazil and also in the world, representing one of the most expressive crops in economic terms. Its consumption is carried out mainly fresh, as a basic component of salads, in domestic or commercial use (Chitarra & Chitarra, 2007; Sala & Costa, 2012).

Lettuce is cultivated in all Brazilian regions and is considered the main salad consumed by the population, both for its flavor and nutritional quality and for the reduced price for the consumer. The evolution of cultivars, management systems, cultural practices, irrigation, spacing, harvesting techniques and post-harvest conservation, as well as changes in eating habits, boosted its cultivation and made lettuce the most consumed leafy vegetable in the country (Resende *et al.*, 2007). The growing is typically of

winter, but there are genetic materials with good tolerance for summer cultivation, so that in high altitude regions it is possible to cultivate it all year round (CNA, 2017).

The genetic breeding of lettuce allowed the species to adapt to the tropical climate, with the development of plants resistant to higher temperatures, without causing damage to growth and flavor (Sousa *et al.*, 2021). Another technology that increased the production of this hardwood was protected cultivation, making it possible to offer the product in periods of low supply. Due to these two great technical evolutions that occurred in the lettuce crop, allied to the increase in consumption in the country, its cultivation expanded to the entire national territory, mainly, close to large urban centers such as Belo Horizonte, Brasília, Curitiba, capitals of the northeast, and large cities in the interior

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of São Paulo that in the past depended on the production of the green belt of the capital of that state (CNA, 2017). Among the lettuce varieties produced, there has been a change in Brazilian production and consumption patterns in recent decades, either because of a demand from the productive sector for new cultivars more adapted to the Brazilian climate, or to meet consumer needs. From this, several cultivars emerged in an attempt to meet these demands (Lorenzi, 2015).

According to Filgueira (2012), the prices paid at the source of production, as well as those practiced in urban retail, depend on wholesale market prices, especially in Ceasas (supply centers). Thus, when substantial changes occur in the supply or demand of a certain product, a sensitive mechanism changes wholesale price, causing high or low prices paid at source or at retail.

Lettuce is sold in Minas Gerais mainly at CeasaMinas supply centers, which comprise the following regional units: Great-BH (Belo Horizonte), Barbacena, Caratinga, Governador Valadares, Juiz de Fora and Uberlândia (CeasaMinas, 2021).

In terms of production, the vegetable market shows marked seasonality caused by large fluctuations in supply and prices. Knowing the demand per season of a vegetable and the behavior of the prices of a vegetable, a detailed production planning can be carried out, which can result in significant economic gains (Jordão & Silva, 2021).

Studies on the seasonal behavior of agricultural species are important sources of research for the analysis of time series of production and prices (Silva *et al.*, 2014). The study of demand, supply and price indices can be used to make production management decisions, organizing the production system in order to obtain products in the desired quantity and quality.

Due to the scarcity of recent data on the seasonality of production in the lettuce crop, the aim of this work was to study the seasonal variation of lettuce supply and prices in the state of Minas Gerais.

MATERIAL AND METHODS

The experimental data are referring to the price and production of lettuce destined for CeasaMinas, in the period between January 2012 and December 2017 (CeasaMinas, 2021).

Lettuce supply data (in kg) in the different CeasaMinas units (Ceasas – Great-BH, Barbacena, Caratinga, Governador Valadares, Juiz de Fora and Uberlândia) were totaled and expressed in terms of percentage for each regional unit. With data on lettuce prices practiced at CeasaMinas units,

the annual average of the studied period of each unit was calculated. The average prices practiced at CeasaMinas were obtained from the weighted arithmetic average, considering the representative percentage of the offer of each regional unit of CeasaMinas and its respective price practiced in the commercialization, thus obtaining the representative average price of the lettuce commercialization in the state of Minas Gerais by CeasaMinas.

Municipalities of relevant production or main producing municipalities were considered to be those responsible for offering 1,000kg or more of lettuce to CeasaMinas in a period of one year. Data referring to the main producing municipalities and their respective offers to CeasaMinas were obtained, and grouped according to their respective geographic region in the state of Minas Gerais. The geographic regions were subdivided into twelve mesoregions according to the Brazilian Institute of Statistical Geography (IBGE, 2016).

The data were processed by the INDEVES program (program for calculating seasonal price variation indices, from the Department of Rural Economics and Sociology; ESALQ/USP, 1987), having obtained the minimum, average and maximum indices for the total supply of lettuce in the set of the six CeasaMinas units, from January 2012 to December 2017. The mathematical procedure was based on the centralized moving geometric mean method, which is recommended for calculating production seasonality of production and prices in the form of annual data or biannual (Hoffmann, 1991). Firstly, the centralized moving geometric mean (MGM) is calculated for each month of the data series of the desired period of months/years. Assuming the month of January 2017 as an example, taking the Neperian logarithm of the production averages for the period, the MGM is given by:

$$\text{MGM}_{\text{jan2017}} = [(\ln P_{\text{jul2017}} \times 0.5) + (\ln P_{\text{ago2017}}) + \dots + (\ln P_{\text{jun2018}}) + (\ln P_{\text{jul2018}} \times 0.5)]^{-12}$$

Where MGM is the moving geometric mean and $\ln P$ is the Neperian logarithm of the production data for the month. To perform the calculation, the production data of the month (January in the example) and the production data of the six previous and six months were considered, with the first and the last month (July 2017 and July 2018 in the example) are multiplied by 0.5 to obtain the result over twelve months. After taking the moving geometric averages, the variation between the production data for each month and its moving average were calculated. The averages of these variations were also determined for each month of the year, resulting

in average values from January to December, from which the arithmetic averages are computed.

Calculation that resulted in values other than zero were corrected by eliminating the respective arithmetic mean from each mean of the monthly difference. The seasonal indices were determined by raising the results to the base of the Napierian logarithm and multiplying by 100. To determine of the irregularity indices (maximum and minimum indices), the standard deviations were initially calculated for the results of the seasonal indices of each month and then raised to each result to the base of the Napierian logarithm. The results when multiplied by the seasonal index found resulted in superior indices and when divided they resulted in inferior indices. The results were presented in graphs.

Based on the same method, the minimum, average and maximum indices of prices practiced were also obtained, from the indices of prices practiced in each unit of CeasaMinas.

RESULTS AND DISCUSSION

The total supply of lettuce sold at CeasaMinas units between January 2012 and December 2017 was 7,777,908kg, with an annual average of 1,944,477kg. The most expressive mesoregions of the state of Minas Gerais in the marketing of lettuce destined for CeasaMinas in that period were:

a) Belo Horizonte Metropolitan Region: responsible for supplying 34% of the lettuce sold at CeasaMinas (supplied an annual average of 654,913kg). The main producing municipalities that make up this region are: Baldin, Betim, Brumadinho, Caeté, Contagem, Esmeraldas, Florestal, Fortuna de Minas, Ibirité, Igarapé, Itatiaiuçu, Jaboticatubas, Mário Campos, Nova União, Pedro Leopoldo, Rio Manso, São Joaquim from Bicas, Sarzedo.

b) Vale do Rio Doce: responsible for supplying 26% of the lettuce sold at CeasaMinas (supplied an annual average of 500,099kg). The producing municipalities that make up this region are: Alpercata, Caratinga, Entre Folhas, Governador Valadares, Inhapim, Piedade de Caratinga, Santa Bárbara do Leste, São Domingos das Dores, Fardoa, Ubaporanga.

c) Triângulo Mineiro and Alto Paranaíba, are responsible for supplying 24% of the lettuce sold at CeasaMinas (supplied an annual average of 460,590kg). The producing municipalities that make up this region are: Araguari, Estrela do Sul, Patrocínio, Uberaba and Uberlândia.

d) Campo das Vertentes, responsible for supplying 13% of the lettuce sold at CeasaMinas (supplied an annual average of 262,252kg). The producing municipalities that

make up this region are: Alfredo Vasconcelos, Antônio Carlos, Barbacena, Carandaí, Coronel Xavier Chaves, Lagoa Dourada, Ressaquinha, Santa Bárbara do Tugurio, São João Del Rei.

These four Minas Gerais mesoregions were responsible for 97% of the lettuce sold at CeasaMinas. The remaining 3% (annual average of 51,596kg) came from less representative regions in terms of supply.

There was a marked seasonal variation in the supply and price indices of lettuce practiced at Ceasa in Minas Gerais. The trading unit Great-BH presented the highest seasonal variation of the price indices practiced during the years studied (Figure 1), that is, the difference found in prices in the hot and rainy season compared to the dry season is markedly more pronounced than in the other trading units. It can be seen that, from January to May, Ceasa Great-BH has the highest average prices among CeasaMinas units. As of that month, the average prices decrease, being close to the average price of the other CeasaMinas units, rising again from the month of October. More strictly, considering only the average monthly price, we can say that sales during the summer are more profitable at Ceasa Great-BH, when compared to other units.

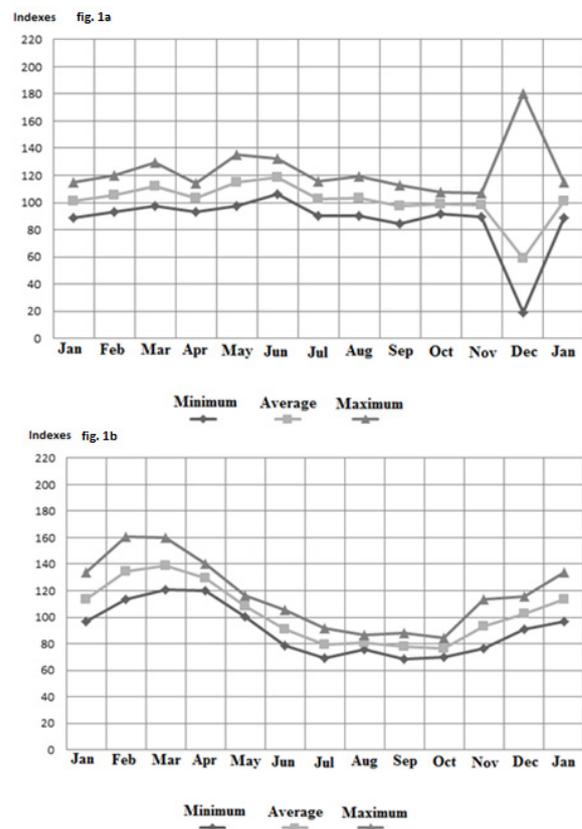


Figure 1: Seasonal supply indexes (Figure 1a) and prices (Figure 1b) of lettuce destined for Ceasa Greater Belo Horizonte.

At Ceasa in Uberlândia (Figure 2), it is observed that variations in supply are more pronounced than variations in price. It is noteworthy that this is the CeasaMinas unit with the most stable prices during the period studied. Despite the stability in prices, it is clear that the highest prices refer to the months of December and February, that is, the summer period, associated with a low supply. In this unit, the offer is more representative in the summer period, which can be explained by the increase in consumption by the population in the period in question. In the cold period of the year, when the crop becomes favorable, there is a noticeable reduction in supply (Figure 2a), either because of the drop in consumption by the population, or even the increase in production by less productive producers specialized services, which do not use Ceasa as a sales channel, selling directly to the retailer. Thus, it is believed that the demand for lettuce at Ceasa by retailers is lower, consequently the supply of producers who sell at Ceasa is also reduced.

It is also observed at Ceasa in Uberlândia that average prices do not vary in the same way as in other CeasaMinas units, remaining relatively stable (Figure 2b) and high.

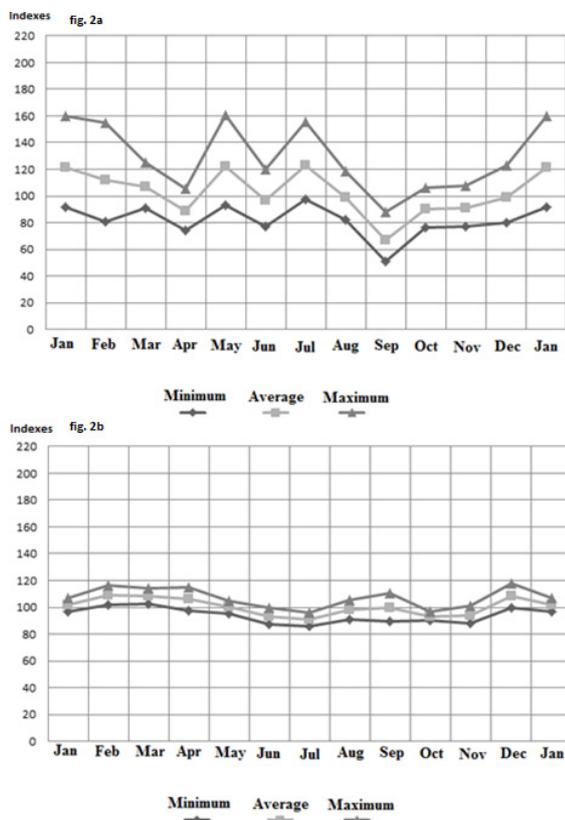


Figure 2: Seasonal supply indexes (Figure 2a) and prices (Figure 2b) of lettuce destined for CEASA in Uberlândia.

This fact can be explained by the region where the “cost of living” as well as the purchasing power of the population are high, and therefore goods are sold at higher prices. In places where purchasing power is high, consumption tends to be less variable due to price fluctuations, when compared to regions where purchasing power is low. The Human Development Index (HDI) of Uberlândia, according to 2010 data, is 0.789, considered high by the United Nations, being the third municipality with the best HDI in Minas Gerais. The city has all indicators high and above the national average (IBGE, 2014).

At Ceasa in Governador Valadares, it is observed that prices are higher in the summer and autumn seasons, also associated with a period of greater oscillation between the years studied (Figure 3b). This situation can be explained by the difficulty in producing in the period in question (Figueira, 2012), that is, there is a reduction in the supply of lettuce through the various marketing channels. Likewise, there are fluctuations in the supply of substitute leafy vegetables, which are also responsible for influencing lettuce prices.

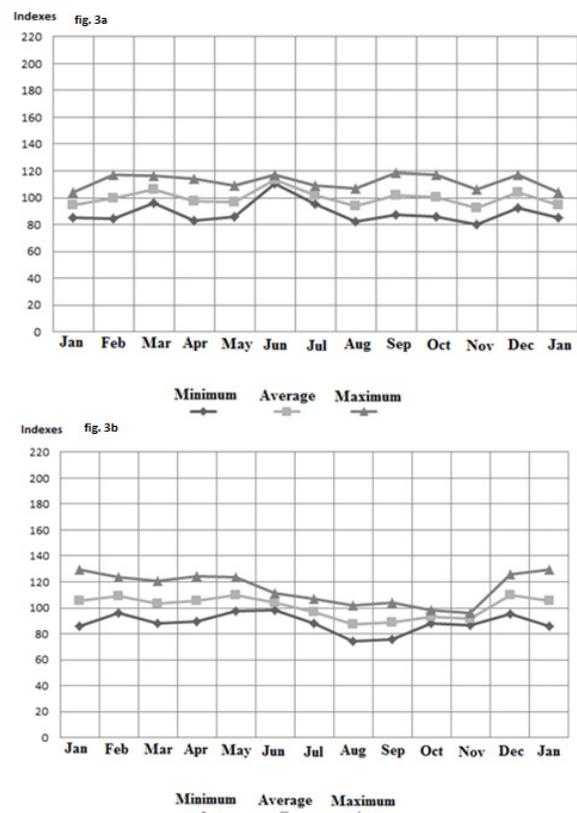


Figure 3: Seasonal supply indices (Figure 3a) and prices (Figure 3b) of lettuce destined for Ceasa in Governador Valadares.

The supply also varies during the year and between the years studied, mainly in the months referring to the spring and summer seasons (Figure 3a). It is in this period (“season of the waters”), when the cultivation of leafy vegetables in general (especially lettuce) is difficult, either by high rainfall and high humidity or by the higher incidence of pests and diseases.

At Ceasa in Caratinga, supply changes (Chart 4a) are more pronounced than price changes (Chart 4b). It is worth mentioning that it is in the Caratinga unit that the greatest variations in supply are found between the years studied, when compared to the other CeasaMinas units.

Similar to the other units, Ceasa in Caratinga also has better lettuce sales prices in the summer period. The Caratinga and Governador Valadares units are both located in the Vale do Rio Doce mesoregion, and their prices vary similarly.

The supply at the Caratinga unit is variable, with fluctuations in supply indexes (Figure 4a) between the various years of the period considered. Such variations can be explained by situations such as the increase or reduction of cultivated areas by less specialized producers, drops in productivity, and/or variable supply of hardwood alternatives to lettuce.

Analyzing the seasonal supply and price indexes for the three main producing mesoregions (Metropolitan of Belo Horizonte, Vale do Rio Doce and Triângulo Mineiro/Alto Paranaíba), represented by four CeasaMinas units (Belo Horizonte, Uberlândia, Governador Valadares and Caratinga), it is observed that at Ceasa Great-BH, price variations throughout the year are more pronounced than supply variations, except for the month of December. The months of February and March have the highest price indices, associated with a high supply.

The results show that in the autumn and winter seasons the price drop is pronounced, starting to rise again in October, while the offer shows a reduction in June and starts to grow again in November. Therefore, in the cold period of the year, prices fall, associated with a reduction in supply. This situation is probably due to the decrease in lettuce consumption and the elevation in the supply of alternative leafy vegetables. In summer, the situation is the opposite of the cold season: prices rise, associated with a greater supply of lettuce, a fact that is due to the increase in lettuce consumption and the reduction in the supply of alternative leafy vegetables.

According to Sala & Costa (2012), high temperatures associated with high rainfall cause lettuce growers to lose up to 60% due to high relative humidity, which favors the attack of fungi and bacteria. The early bolting induced by high temperatures aggravated the problem of losses in the summer, reflecting directly on the price and supply of the product on the market, due to the greater demand for consumption in this period.

Transformations and changes are constant in the various productive sectors, which also occurs in the production chain of lettuce and other vegetables in general. An alternative in the marketing of lettuce is the direct action of the producer in the retail, reducing the flow of supply and the intermediary of the Ceasas in the supply of lettuce (Yokoro & Pereira, 2020). The Ceasas were responsible for marketing a large part of all vegetables consumed in Brazil. This situation has been changing due to several factors, mainly the greater demand on the part of the final consumer, who has increasingly demanded freshly harvested vegetables, of excellent quality and with a constant supply in retail exhibitors, which in many of the sometimes it is not possible due to the perishability of the product, the inconstant supply at Ceasas and the inconstant demand by end consumers (CNA, 2017).

As retail entrepreneurs, they have opted for different

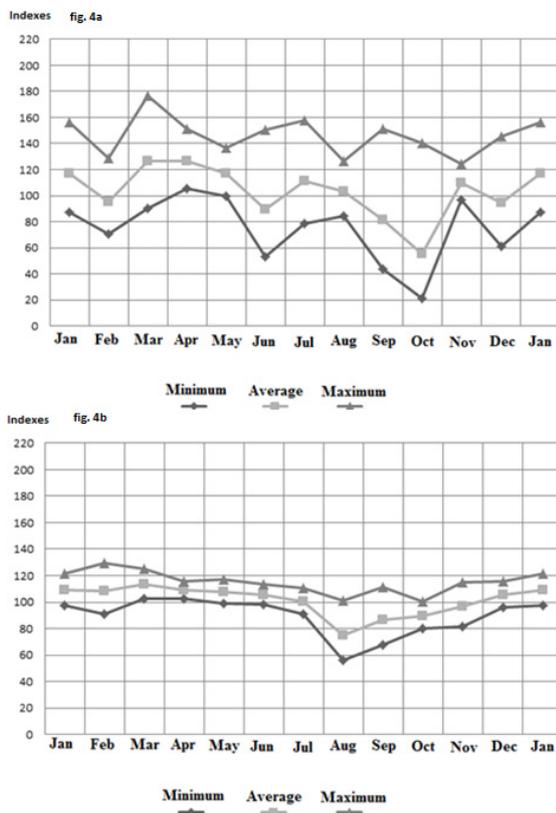


Figure 4: Seasonal supply indexes (Figure 4a) and prices (Figure 4b) of lettuce destined for Ceasa de Caratinga.

alternatives that improve logistics and consequently the quality of the lettuce sold. Hypermarket chains, which currently hold about 50% of the commercialization of fruit and vegetables in Brazilian metropolises, have reduced their purchases at Ceasas, betting on a new commercialization channel, the “own purchasing centers”, where purchases are made directly with the rural producers or specialized wholesalers (CNA, 2017). According to Lourenzani & Silva (2004), good results are observed for both parties, when the system of own purchase center is adopted. In this system, lettuce and other vegetables meet pre-established criteria by buyers (hypermarkets), therefore they present a certain quality standard, which consequently reduces losses and thus specialized producers and wholesalers are more remunerated.

In the cold seasons of the year (especially in winter), the marketing of lettuce and other hardwoods is reduced for several reasons. The main one is the reduction in temperature, which is responsible for reducing the consumption of lettuce and hardwoods in general. The habit of Brazilians in the cold season is usually to choose other vegetables that are not leafy and consume them in soups, broths and typical foods of the time in question. Another reason would be the size of lettuce sold in cold periods, which is relatively larger when compared to hot periods, which directly reduces marketing, since the same lettuce will be consumed for a longer period, reducing demand, in addition to of the different hardwood alternatives available in the period in question (Sala & Costa, 2012).

It is in the spring months (mainly September, October and November) that the lowest offers of lettuce are observed at CeasaMinas. The same months are responsible for presenting the lowest prices practiced at CeasaMinas in the period studied. The opposite situation occurs in the summer period (December to March), when the highest offers and the highest prices are observed.

Probably the supply and prices of lettuce at CeasaMinas are characterized by the “Law of supply” which says that: the quantity supplied of a good varies directly with its price (Fontes, 2012), that is, prices and quantities go in the same direction, “*coeteris paribus*”, that is, all other factors remaining constant. Therefore, in cold seasons, lettuce growers adopt the strategy of reducing the supply of their products to Ceasas, due to the expected reduction in prices practiced in the commercialization: in this period the cultivation of lettuce is favored by climatic conditions, allowing the cultivation is reduced, which minimizes the

surplus provided by the fall in commercialization, still obtaining the same productions if compared to the larger areas cultivated in the summer. This situation can be explained by the reduction in precipitation and air humidity, which significantly reduces phytotechnical and phytosanitary problems. It is noteworthy that in cold periods (especially in winter) production costs are reduced, as a result of the satisfactory development of the crop, reducing expenses with fertilizers, pesticides and consequently in labor. At this time, the lettuce cycle is prolonged, when compared to its development in the summer, which is also reflected in the reduction of commercialization (Filgueira, 2012).

In the autumn, winter and spring seasons (cold periods), the relative number of people who cultivate lettuce rises substantially, from small producers who interrupt their lettuce cultivation in the summer period, to the final consumer who starts cultivation in their own residence (home gardens). In the latter case, although the production is non-profit, its surplus can still be distributed to close people, which indirectly reduces commercialization via Ceasas.

Another possible explanation for the reduction in supply and prices at CeasaMinas in cold periods is the increase in the number of producers in this period: consequently, the local offer of lettuce in the cities where the producers are located is greater, causing prices to fall, so that all or a large part of the production is sold to local retailers. In addition, there is a greater supply of leafy vegetables as alternatives to lettuce at this time (CeasaMinas, 2021).

With the increase in the supply of lettuce in cities, retailers in general start to opt for a new marketing channel, which is the acquisition of lettuce directly from the producer, which is an excellent option for the retailer in the cold season. The lettuce grower is responsible for delivery at the point of sale, he also helps in controlling the lettuce on the display shelf, which reduces losses. The buyer also ends up purchasing the products at values equal to or less than those charged at Ceasas, and most of the time they are of superior quality, due to the reduction in transport and time between the lettuce harvest and delivery to the place of sale. This fact can reduce the demand and consequently the supply of lettuce at CeasaMinas (CNA, 2017).

According to Lemos (2020), the price instability observed in agriculture is caused by little control over the elements that influence agricultural production. In the case of lettuce, a drop in consumption can also be observed, influencing price variations. In protected crops, supply

variations are smaller due to the control of some environmental factors that can limit production, since prices are subject to the same variations as other cropping systems (Fernandes *et al.*, 2020).

In the summer months is the critical period of lettuce production, in which the cultivation becomes limited due to the intense rainfall associated with high temperatures, which favors the appearance and spread of diseases and pests, reducing the quality of the product and raising prices (CNA, 2017). It is in this period that production costs rise due to the greater use of fertilizers, pesticides and, consequently, labor.

Differently from what would be expected, in the summer months the highest lettuce offers were observed at CeasaMinas, associated with the higher prices practiced at CeasaMinas. In the referred summer months, it is evident the great reduction in the planting of lettuce and hardwoods in general, mainly by small producers and final consumers responsible for the cultivation in small gardens and home gardens (CNA, 2017). Retailers who in the cold periods enjoyed a large supply of lettuce in the city itself by local producers, now at this time of year (summer), no longer find such availability of supply, which becomes restricted and of lower quality, which can have been reflected in the increase in planted areas and volumes sold at Ceasas by more technified growers.

With the reduction in the local supply and the greater demand by consumers, lettuce also begins to have increases in its price. Consequently, the more specialized growers, in the perspective of rising prices, also increase the cultivated area, in order to supply more lettuce to the Ceasas in the critical period of the year, when they receive better remuneration (CNA, 2017).

The market information obtained in this work can be useful for producers looking to maximize their profits and reduce costs and losses. Therefore, it is necessary a programmed planning of the plantations to be carried out during the year, so that the periods of greater harvest coincide with the periods of higher prices, also determining the periods of growth or reduction of the cultivated area.

CONCLUSIONS

Lettuce showed considerable seasonal variation in supply and prices in the annual period. The variations in supply and prices in the hot and rainy season, in relation to the dry season, are markedly more accentuated. It was observed that there is a relationship that follows the “Law

of supply”, where in the cold periods of the year the lowest prices associated with the lowest offers were presented and in the hot periods of the year, the highest prices associated with the largest offers were presented.

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DECLARATION OF CONFLICT OF INTEREST

With the knowledge and agreement of all authors, it is declared that there is no conflict of interest. The funding bodies and sponsoring companies did not play a role in the acquisition, manipulation and understanding of the information obtained, in writing the work and in the decision to publish the results.

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