



# POLY4 AS A MULTI-NUTRIENT FERTILIZER TO IMPROVE YIELD AND QUALITY OF CARROTS IN BRAZIL

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## Abstract

Polyhalite-based POLY4 is a multi-nutrient fertilizer containing potassium (K), sulphur (S) in sulphate form, magnesium (Mg) and calcium (Ca) ( $K_2SO_4 \cdot MgSO_4 \cdot 2CaSO_4 \cdot 2H_2O$ ). The objective of this study was to compare POLY4 efficiency on yield and quality of carrots with potassium chloride (MOP) and potassium sulphate (SOP) in São Paulo and Minas Gerais states of Brazil. The commercial yield increased significantly with POLY4 compared to MOP. POLY4 also had an improved flavour and significantly more carrots per m<sup>2</sup> than with the other treatments.

## Introduction

- Carrots are an important vegetable crop in Brazil. The cultivated area of carrots in Brazil is 25,000 ha with 780,000 tonnes of production per year.<sup>1</sup> São Paulo and Minas Gerais are the main carrot-producing states. A trial was conducted in Santo Antônio de Posse (2016), São Paulo and in Andradas, Minas Gerais (2017-2018).
- Soils in these regions typically have limited K and S availability. However, high K fertilizer application to carrots and other vegetable crops in the rotation can limit Ca and Mg availability. Carrots deficient in Ca can have reduced root size.
- POLY4, besides supplying essential macro and a range of micro nutrients to crops, is also low in chloride and pH neutral.
- The quality and yield of carrots was compared after application of POLY4 and other K fertilizers.

## Trial location



## Methodology

- The trial in São Paulo was conducted in 2016 in Santo Antônio de Posse. The trial in Minas Gerais was conducted in Andradas in the 2017 to 2018 season.
- The trials were a randomised complete block designs with four replications.
- All treatments received standard applications of N and P fertilizer from urea and MAP. The recommended  $K_2O$  rate of 180 kg  $K_2O$  ha<sup>-1</sup> was applied.
- All of the MAP and half of the other fertilizers were applied before planting and incorporated into the soil. The remaining fertilizer was applied across four top dresses at 25, 40, 60 and 75 days after emergence.
- Carrots were sown on 21 June 2016 in São Paulo and 17 August 2017 in Andradas. The crop was thinned 30 and 90 days after planting and irrigated throughout the growing season.
- Carrots were harvested on 28 October 2016 in São Paulo and 2 January 2018 in Andradas from four three-meter rows.

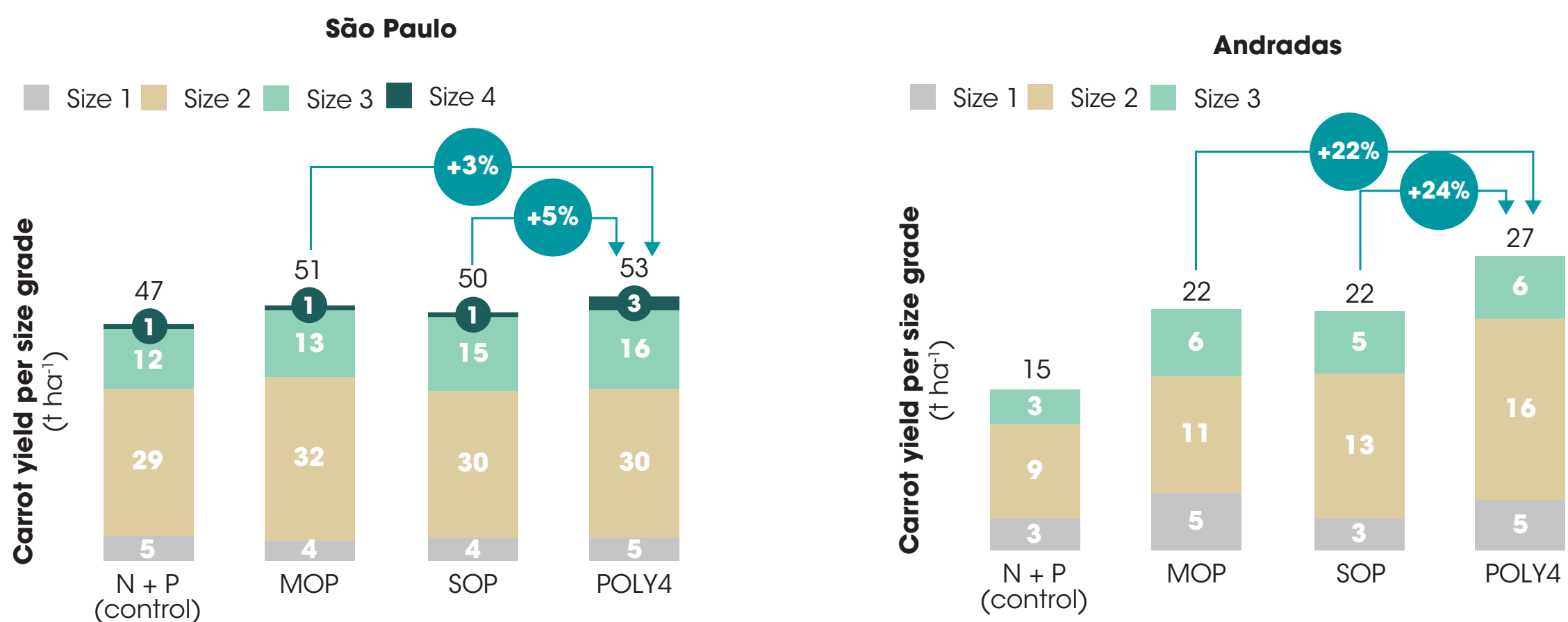
Treatments	Nutrient application rate (kg ha <sup>-1</sup> )			
	K <sub>2</sub> O	CaO	MgO	S
N + P (control)	0	0	0	0
MOP	180	0	0	0
SOP	180	0	0	61
POLY4	180	218	77	244

	São Paulo	Minas Gerais
pH	5.2	4.7
P (mg L <sup>-1</sup> )	-	5
K (mg L <sup>-1</sup> )	78	91
Mg (mg L <sup>-1</sup> )	138	84
Ca (mg L <sup>-1</sup> )	430	276
SO <sub>4</sub> (mg L <sup>-1</sup> )	5.5	7

## Results

### Yield performance

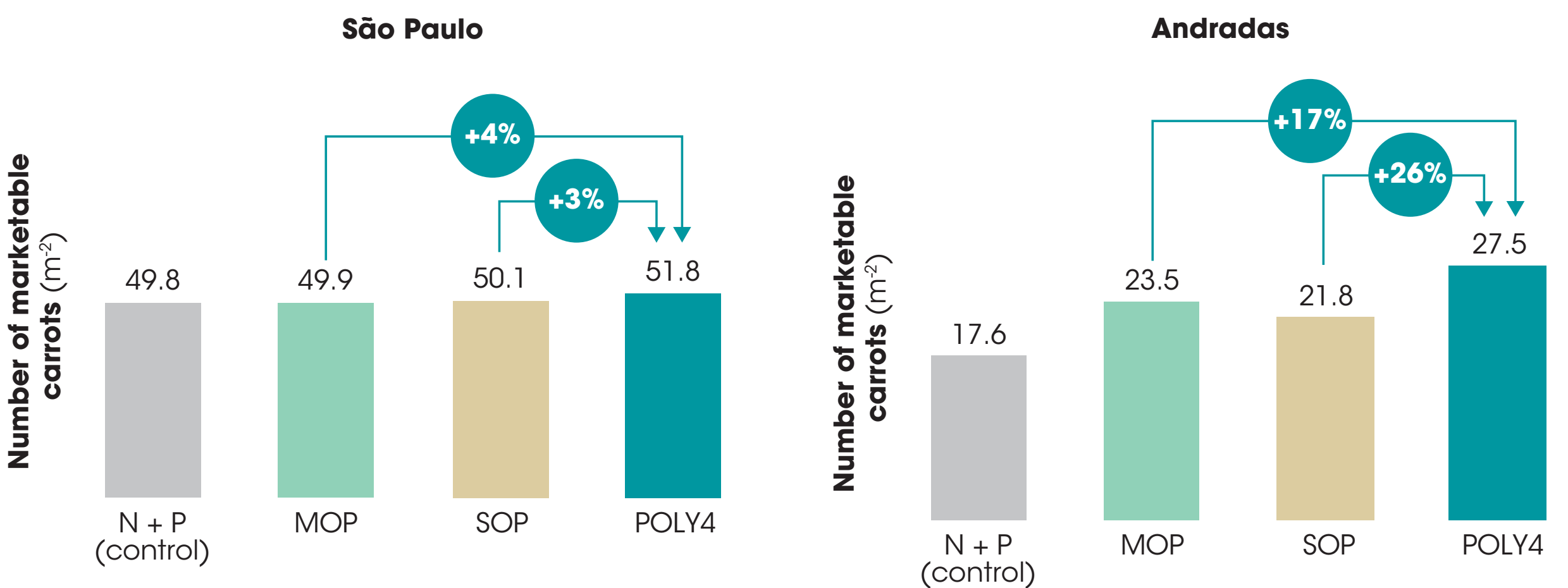
- São Paulo carrots were graded from size one to four. Andradas were graded from size one to three.
- Three is the most valuable size grade, followed by two. Sizes one and four are the lowest grades.
- Yield was significantly greater at São Paulo than Andradas. The lower yield in Andradas was due to the later sowing (August versus June).



### Carrot flavour

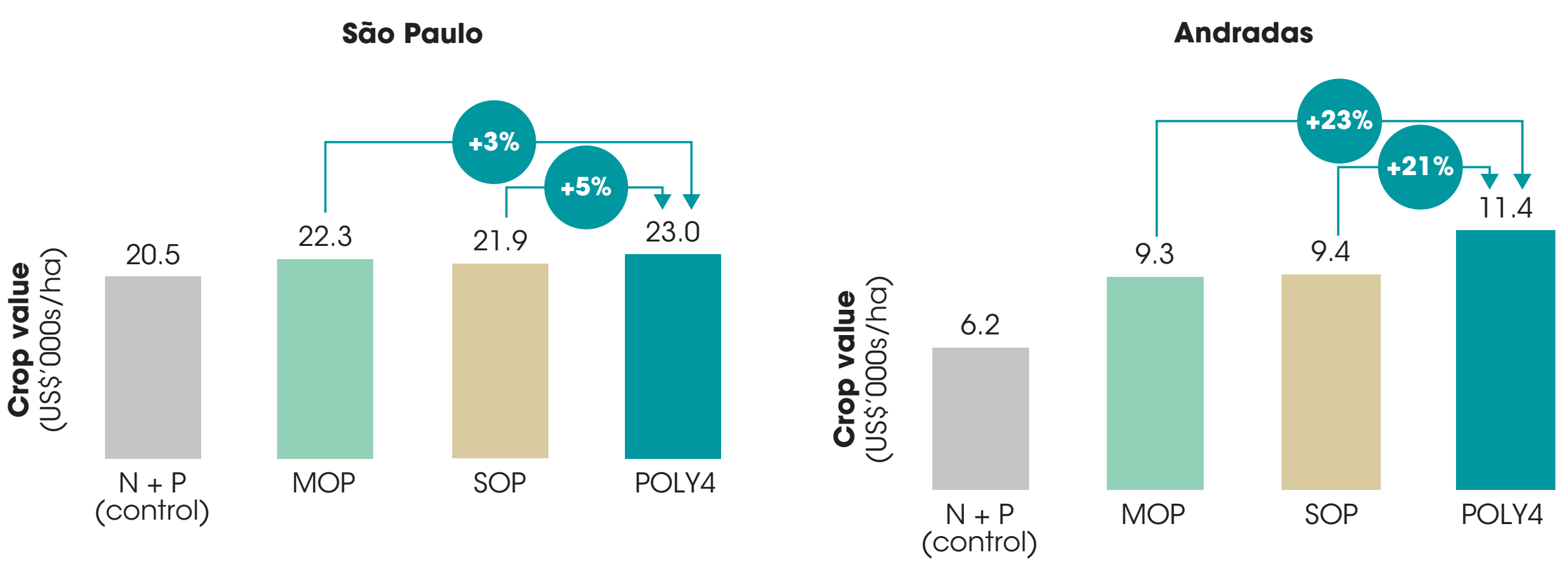
- A sensory panel of 30 judges evaluated the flavour of carrots.
- In São Paulo, POLY4-treated carrots were preferred by most judges.
- In Andradas, the flavour was evaluated to be better in SOP and POLY4-treated carrots than the N + P (control) or MOP.

### Root numbers



### Crop value

- At both sites POLY4 treated carrots had the greatest value.<sup>2</sup>



## Conclusions

- POLY4 improved marketable yield, yield composition and crop value.
- The value improvements from POLY4 treatment were due to more marketable carrots per m<sup>2</sup>.
- In the São Paulo trial, POLY4-fertilized carrots were considered to have the most preferred flavour.
- In the Andradas trial, carrots grown with POLY4 were evaluated to have better flavour than MOP and the N + P (control), and similar flavour to SOP.

## Notes

Notes: 1) Production statistics from EMBRAPA HORTALIÇAS - CNPH. Situação das Safras de Hortalças no Brasil - 2000-2012; 2) Carrot prices were US\$339/t for Class 1, US\$428/t for Class 2, US\$501/t for Class 3; Reference price for carrots from July 2018: <http://www.ceagesp.gov.br/entrepotos/servicos/cotacoes/#cotacao>.

Sources: 4000-USP-4020-16 and 4000-USP-4027-17.

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