


**IMPLEMENTATION OF SISPREÇO - PRICE SURVEY SYSTEM RECEIVED BY RURAL PRODUCERS FOR STRATEGIC DECISION-MAKING IN STATE OF ESPÍRITO SANTO, BRAZIL**

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ARTICLE INFO	ABSTRACT
<p><b>Article history:</b>  <b>Received:</b> Dec, 2<sup>nd</sup> 2024  <b>Accepted:</b> Feb, 3<sup>rd</sup> 2025</p>	<p><b>Purpose:</b> This article highlights the importance of implementation of the Price Survey System Received by Rural Producers (SisPreço) at the Capixaba Institute of Research, Technical Assistance and Rural Extension (Incaper). The system was developed between 2022 and 2023 and implemented between December 2023 and August 2024, with the aim of systematizing the collection and dissemination of price data for the main agricultural products produced in Espírito Santo and providing timely information for Strategic Decision-Making.</p>
<p><b>Keywords:</b>  Systematization;  Data;  Prices;  Information;  Planning;  Agribusiness.</p>	<p><b>Framework:</b> The literature review cited cases of other institutions that carry out price surveys similar to Incaper. However, the focus of the study was to present the case of Incaper.</p>
	<p><b>Design/Methodology/Approach:</b> The methodology used was exploratory in nature, through a case study of the implementation of SisPreço at Incaper.</p>
	<p><b>Conclusions:</b> SisPreço is currently used to launch price quotations in 70 municipalities in the State and has proven to be an essential tool for professionals in the agricultural sector who wish to speed up the process of obtaining accurate information on the prices of agricultural products, as well as analyzing market trends. The use of the system allowed greater survey precision and price dissemination.</p>
	<p><b>Research, Practical &amp; Social Implication:</b> Price surveys are widely used as a reference for strategic decisions in various sectors of the economy and society, in addition to more precisely contributing to the planning of public policies and market analyses.</p>
	<p><b>Originality/Value:</b> Data systematization through SisPreço opens up new possibilities for advanced analysis, such as predictive modeling and integration with other agricultural databases, expanding the impact of price survey for government and business decision-making in agribusiness.</p>
	<p>Doi: <a href="https://doi.org/10.26668/businessreview/2025.v10i3.5345">https://doi.org/10.26668/businessreview/2025.v10i3.5345</a></p>

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## IMPLANTAÇÃO DO SISPREÇO - SISTEMA DE LEVANTAMENTO DE PREÇOS RECEBIDOS PELOS PRODUTORES RURAIS PARA TOMADA DE DECISÃO NO ESTADO DO ESPÍRITO SANTO, BRASIL

### RESUMO

**Proposta:** Este artigo evidencia a importância da implantação do Sistema de Levantamento de Preços Recebidos pelos Produtores Rurais (SisPreço) no Instituto Capixaba de Pesquisa, Assistência Técnica e Extensão Rural (Incaper). O desenvolvimento do sistema ocorreu entre 2022 e 2023 e sua implantação entre dezembro de 2023 e agosto de 2024, tendo por objetivo sistematizar a coleta e divulgação dos dados de preços dos principais produtos agropecuários produzidos no Espírito Santo e fornecer informações de forma tempestiva para a tomada de decisões estratégicas.

**Estrutura Teórica:** A revisão de literatura citou casos de outras instituições que realizam levantamentos de preços semelhantes ao do Incaper. Porém, o foco do trabalho foi apresentar o caso do Incaper.

**Projeto/Metodologia/Abordagem:** A metodologia utilizada foi de caráter exploratório, baseada no estudo de caso da implantação do SisPreço no Incaper.

**Conclusões:** O SisPreço atualmente é utilizado para lançamento das cotações de preços em 70 municípios do Estado e evidenciou-se como uma ferramenta essencial para profissionais do setor agrícola que desejam agilizar o processo de obtenção de informações precisas sobre os preços dos produtos agropecuários, bem como analisar as tendências de mercado. O uso do sistema permitiu maior precisão no levantamento e divulgação dos preços.

**Implicações Sociais, Práticas e de Pesquisa:** O levantamento de preços é amplamente utilizado como referência para decisões estratégicas em diversos setores da economia e da sociedade, além de contribuir para o planejamento de políticas públicas e análises de mercado de forma mais precisa.

**Originalidade/Valor:** A sistematização dos dados por meio do SisPreço abre novas possibilidades para análises avançadas, como modelagens preditivas e integração com outras bases de dados agropecuários, ampliando o impacto do levantamento de preços para tomada de decisão governamental e empresarial no agronegócio.

**Palavras-chave:** Sistematização, Dados, Preços, Informações, Planejamento, Agronegócio.

## IMPLEMENTACIÓN DEL SISPREÇO - SISTEMA DE ENCUESTA DE PRECIOS QUE RECIBEN LOS PRODUCTORES RURALES PARA LA TOMA DE DECISIONES EN EL ESTADO DE ESPÍRITO SANTO, BRASIL

### RESUMEN

**Propuesta:** Este artículo resalta la importancia de la implementación del Sistema de Control de Precios que Reciben los Productores Rurales (SisPreço) en el Instituto de Investigación, Asistencia Técnica y Extensión Rural de Capixaba (Incaper). El sistema fue desarrollado entre 2022 y 2023 e implementado entre diciembre de 2023 y agosto de 2024, con el objetivo de sistematizar la recolección y difusión de datos de precios de los principales productos agrícolas producidos en Espírito Santo y brindar información de manera oportuna para la toma de decisiones estratégicas.

**Estructura Teórica:** En la revisión de la literatura se citaron casos de otras instituciones que realizan encuestas de precios similares al Incaper. Sin embargo, el foco del trabajo fue presentar el caso del Incaper.

**Proyecto/Metodología/Enfoque:** La metodología utilizada fue de carácter exploratorio, basado en el estudio de caso de la implementación del SisPreço en Incaper.

**Conclusiones:** SisPreço se utiliza actualmente para lanzar cotizaciones de precios en 70 municipios del Estado y ha demostrado ser una herramienta esencial para los profesionales del sector agrícola que desean agilizar el proceso de obtención de información precisa sobre los precios de los productos agrícolas, así como el análisis de las tendencias del mercado. El uso del sistema permitió una mayor precisión en el relevamiento y difusión de precios.

**Implicaciones Sociales, Prácticas y de Investigación:** Las encuestas de precios son ampliamente utilizadas como referencia para decisiones estratégicas en diversos sectores de la economía y la sociedad, además de contribuir a la planificación de las políticas públicas y análisis de mercado de una manera más precisa.

**Originalidad/Valor:** La sistematización de datos a través del SisPreço abre nuevas posibilidades para análisis avanzados, como modelación predictiva e integración con otras bases de datos agrícolas, ampliando el impacto de las encuestas de precios para la toma de decisiones gubernamentales y empresariales en la agroindustria.

**Palabras clave:** Sistematización, Datos, Precios, Información, Planificación, Agronegocios.

## 1 INTRODUCTION

Incaper has carried out a weekly survey of prices received by rural producers in the State of Espírito Santo for decades. Historically, these surveys were conducted manually via electronic spreadsheets across municipalities, making data collection labor-intensive, slow, and prone to errors. In response, Incaper developed and implemented the SisPreço system between 2022 and 2024 to digitize and systematize this process.

The price survey covers the main agricultural products of Espírito Santo and products covered by public policies of the rural credit program, Food Acquisition Policy (PAA), National School Meal Program (PNAE) and the Minimum Price Guarantee Program - PGPM, implemented by the National Supply Company (CONAB) (Galeano, *et al.*, 2016).

Currently, 70 different agricultural products are monitored, whose prices are used as a reference in various government spheres. The survey also supports state and municipal GDP calculations carried out by the Brazilian Institute of Geography and Statistics (IBGE) and the Jones dos Santos Neves Institute (IJSN), in addition to being widely demanded by rural producers and traders to plan their activities (Galeano, *et al.*, 2016).

The integration of SisPreço with other databases will allow a more complete view of agricultural performance in Espírito Santo, enabling the creation of dynamic and interactive indicators.

The integration of SisPreço with other databases will allow a more complete view of the performance of agriculture in Espírito Santo, enabling the creation of dynamic and interactive indicators. Therefore, SisPreço supports the formulation of more effective public policies, enhancing market transparency and predictability, ultimately promoting balanced and sustainable agricultural development in Espírito Santo.

The wide use of Incaper's price survey demonstrates the responsibility of the work in order to guarantee the price survey, processing and dissemination of reliable information, which reflects the reality of the markets researched. Therefore, the survey is characterized as a guiding instrument for public commercialization and rural credit policies in the State.

The price survey was manually carried out in the municipalities through Incaper's Local Rural Development Offices (ELDRs) in electronic spreadsheets until August 2024. In September 2024, Incaper made SisPreço available. The System aims to contribute to the systematization of Incaper price survey data to make it more precisely available to the public.

The importance of SisPreço transcends the collection and dissemination of agricultural price data, becoming a potential instrument for formulation of public policies in Espírito Santo. The systematization of information allows government decisions to be based on concrete data, allowing the implementation of more effective strategies for rural development, agricultural credit, product commercialization and food security. Thus, the system strengthens the transparency and predictability of agricultural markets, benefiting producers, consumers, researchers and public managers in the construction of a more balanced and sustainable economic environment.

## 2 THEORETICAL FRAMEWORK

Price surveys are carried out by several institutions that work in agricultural research, such as the Institute of Applied Economics – IEA and the Center for Advanced Studies in Applied Economics – CEPEA of the Luiz de Queiroz College of Agriculture – Esalq of the University of São Paulo – USP (Pinatti *et al.*, 2008; Barros *et al.*, 2019), the Center for Socioeconomics and Agricultural Planning – CEPA from the Agricultural Research and Rural Extension Company of Santa Catarina – Epagri (Varaschin *et al.*, 2004), and the Department of Administration and Economics (DAE) of the Federal University of Lavras - UFLA (Caetano, 2017).

The prices of agricultural products suffer large fluctuations depending on variations in the quantity produced, and this, in turn, is affected by climatic adversities. Research by Lima & Margarido (2008) showed that food prices were above their historical average levels. According to Daniel *et al.* (2010), the rise in food prices has a major impact on purchasing power and represents a barrier to food security and income distribution, especially for families with lower income, which corresponds to a significant part of the population.

Agriculture is subject to unpredictable losses due to extreme climatic factors such as drought, excessive rain, hail, frost, or even biological factors, such as the incidence of diseases and pests, or even market price fluctuations and agricultural policies, making farmers in general extremely vulnerable (Marques *et al.*, 2013).

The view that high prices generate major problems is especially associated with consumer protection organizations once, for producers, as highlighted by Dall'Agnol and Hirakuri (2008), if the price recovery did not occur, there would probably be a lack of food, as there would be no one interested in producing it.

Daniel *et al.* (2010) highlight that the rise in prices of agricultural products is favorable for Brazilian economic growth, mainly through food production, especially in regions with low levels of development. However, rising food prices is harmful to global food security, as a function of the large number of people who have low or minimal income. Therefore, the importance of international public policies to at least alleviate the food security problem becomes clear, in addition to eliminating possible distortions and economic crises that imbalances in food commodity markets can cause.

The drought in Espírito Santo in recent years has caused significant losses in agriculture. In addition to water deficit, there was poor rainfall distribution, great sunshine and very high temperatures for long periods, above the average maximum, coinciding with these high temperatures, with periods of greatest demand for water from plantations (Incaper, 2015). The estimate made by Galeano *et al.* (2021) shows that, between 2014 and 2017, monetary losses in agriculture in Espírito Santo totaled more than R\$ 11.2 billion in 2017 values. This period was considered the worst water crisis in history, since the beginning of the meteorological data series in Espírito Santo. The global amount of lost revenue during the drought period was almost 18% in relation to the Gross Value of Agricultural Production in 2017, which was R\$9.2 billion, a year that is considered the resumption of climate normality, even with negative effects on a large part of agricultural activities. In other words, in approximately four years of water anomaly, the agricultural sector of Espírito Santo failed to earn the equivalent of more than a year of productive activities, considering an expected production without more serious effects inherent to the drought. The biggest losses were in non-irrigated conilon coffee planting areas, where drought for two consecutive years associated with high temperatures, led to significant reductions in production, with consequent loss of income for farmers and great variability in market prices (Galeano *et al.*, 2021).

Price surveys are also necessary to prepare price indices. Having an index available that measures price variations in the first stage of agricultural and livestock production is fundamental for economic planning (Margarido, 2000; Pinatti *et al.*, 2008). The use of a single national index may not portray the reality experienced in regions that have production that is completely different from the national average (Souza *et al.*, 2019). Furthermore, it can generate distorted interpretations of the price behavior received by producers in the region and also lead to the disuse of the index (Ostapechen, 2021).

The oldest agricultural index in Brazil started in 1948 by the Department of Rural Economy of the Secretariat of Agriculture of the State of São Paulo, which in 1968 was



transformed into the Institute of Agricultural Economics (IEA). The Average Monthly Prices Received by Agricultural Producers in the State of São Paulo (PMR) included the prices of vegetable products and in 1954 began to include products of animal origin (Bini *et al.*, 2013).

SisPreço is aligned with the strategic guidelines of PEDEAG 4 (Capixaba Agriculture Development Strategic Plan 2023-2032), reinforcing the need for innovation and sustainability in the agricultural sector. The system directly meets the objectives of modernizing data collection, improving agricultural competitiveness and strengthening the information base for decision making. Furthermore, it contributes to the efficient governance of the agricultural sector, helping formulate public policies aimed at food security commercialization and support for small and medium-sized rural producers.

According to Vianna (2015), communication then involves the transmission and interpretation of data or information, commonly with a purpose and generally stored on a support (repository) and also involves storage, retrieval and processing processes. Still according to the same author, data needs to be transformed into information so that it is useful in decision-making in organizations. Information can generate knowledge and knowledge, in turn, can generate and improve information in an intense interaction. The accumulated information starts to generate knowledge, which in turn improves the same information. Knowledge, in turn, becomes a critical success factor and certainly a competitive differentiator (Vianna, 2015).

In view of the above, it is important to monitor changes in prices received by agricultural producers in Espírito Santo and to systematize this data. Such systematization will result in information that will provide support for the producer's decision-making, mainly regarding planting, processing and commercialization, in order to contribute to their planning. This information is also essential for planning public policies.

The systematization of price data received by rural producers also allows the development of predictive models to analyze seasonal fluctuations and climate impacts on the agricultural market. The use of Business Intelligence (BI) techniques can improve trend analysis, identifying price variation patterns and correlating them with external factors, such as public policies and macroeconomic changes.

### 3 INCAPER PRICE SURVEY METHODOLOGY

Currently, two different price surveys are carried out on Incaper: a weekly survey of a list of 70 products and a daily survey of the price of ox and Cow.

#### 3.1 WEEKLY PRICE SURVEY

The weekly price survey is carried out in municipalities through Incaper's Local Rural Development Offices (ELDRs). The prices collected in the weekly survey in the municipalities are the average prices received by the producer and/or fishermen, exempt from freight, fees, taxes and any other factor. The survey is carried out every Wednesday, totaling 4 or 5 surveys per month and requires the collaboration of several employees. Currently included in the weekly survey is a list of 70 different agricultural products. The list of products is available on the Incaper website <https://incaper.es.gov.br/sispreco>.

To define the municipalities included in the survey, two criteria are considered:

Criterion 1 - For each product, the municipalities with the greatest participation in state production will be selected, until they add up to at least 60% of the total volume produced in the state.

Criterion 2 - For each product, at least three municipalities must be included in the survey. In cases where for a given product, a municipality has a production that corresponds to approximately 60% or more, two more municipalities must be included.

Operationally, the statewide weekly average price of each product results from three steps: The first is the determination of the average price of each product in the municipality by the simple average of the prices collected in the production systems; the second consists of determining the state weekly average of each product considering the weight or weighting of the municipalities by their production; and finally, in the third stage, the average prices of each product are obtained considering the weekly averages.

The average monthly price of the product is calculated at the end of each month, by the simple average of the average weekly prices obtained during the month. Basically, the steps for determining average prices, according to Galeano *et al.* (2016), are:

1. Obtaining the average price of each product in the municipalities (simple average);
2. Calculation of the state weekly average price considering the weight of municipalities in production;

3. Obtaining the average monthly price of each product (simple average of weekly prices);

The volume produced by the municipality must be used as weight in weighted average price calculations. In equation 1,  $P_{ms}$  is the average weekly price;  $P_i$  is the price of the product in a given municipality;  $Q_i$  is the volume of product production in a given municipality.

$$P_{MS} = \frac{\sum_{i=1}^n P_i \cdot Q_i}{\sum_{i=1}^n Q_i}$$

(1)

The average weekly state price of each product is equal to the sum of the production value of each product divided by the sum of the quantities produced by the municipalities that entered the survey. Production data is obtained from IBGE and is updated annually in the system.

### 3.2 DAILY PRICE SURVEY

The daily survey refers to the daily price of castrated fat cattle, whole fat cattle and fat cows. In this survey, each arroba was considered equal to 15 kilos. This price survey is carried out directly with slaughterhouses operating in the state.

The daily survey, carried out at slaughterhouses, aims to quote the price paid to the producer for each arroba of whole fat cattle and fat cows. We currently have 10 slaughterhouses registered in Espírito Santo, of which 7 participate in the research.

The definition of the list of slaughterhouses included in the survey is based on information received from the Institute for Agricultural and Forestry Defense of Espírito Santo - IDAF, which provides the list of registered slaughterhouses and the number of heads slaughtered per slaughterhouse each year.

Currently, the list of products quoted daily includes three products: Arroba of the castrated ox (Bc); Whole ox arroba (not castrated) (Bi); Arroba of the fat cow (Va). Prices for each product in each refrigerator are quoted daily.



The volume produced by each slaughterhouse (number of heads slaughtered) is used as weight in the state average price calculations for each product. The animals slaughtered are divided into: Number of males slaughtered (Nb) and Number of females slaughtered (Lv).

The prices of variables (Bc, Bi and Va) that are not quoted on the day are considered null and are not considered in the calculations of the average price for the day.

The Value of production corresponds to the price quoted times the quantities slaughtered. To calculate the average state price of each product, the sum of the production value of each product divided by the sum of the quantities slaughtered by the slaughterhouses that participated the survey is considered. Production data is obtained from IDAF and is updated annually in the system.

Calculation of the weighted average price (Mp)

$$\text{Castrated fat ox } Mp(Bc) = \frac{\sum(Nb \times Bc)}{\sum Nb} \quad (2)$$

$$\text{Whole fat ox } Mp(Bi) = \frac{\sum(Nb \times Bi)}{\sum Nb} \quad (3)$$

$$\text{Fat cow } Mp(Va) = \frac{\sum(Nv \times Va)}{\sum Nv} \quad (4)$$

Average prices are published daily on the Incaper website (according to equations 2, 3 and 4), maximum prices (highest value recorded on the day, for the price per arroba of castrated cattle, whole cattle and fat cow) and minimum prices (lowest value recorded on the day, for the price per arroba of castrated cattle, whole cattle and cow).

#### 4 DEVELOPMENT OF SISPREÇO

Prices were manually surveyed in the municipalities through Incaper's ELDRs in electronic spreadsheets until August 2024. SisPreço was developed between 2022 and 2023 by the company Adaline Sistemas & Tecnologias and Incaper. In September 2024, Incaper made the System available for internal use by public servants who collaborate in the research. The System aims to contribute to the systematization of Incaper price survey data with the purpose of speeding up price collection, as well as making price data timely available to the public. After the

implementation of SisPreço, the collection process began to be digitized and systematized, reducing errors and streamlining the availability of information for different users.

In addition to having the specific objective of systematizing the current price survey and streamlining the collection and dissemination of price data for agricultural products from Espírito Santo, the system also provides historical price data, data on prices quoted in municipalities, and, in general, contributes to the improvement and continuity of the price survey service carried out by Incaper.

SisPreço was developed using the programming languages PHP (Hypertext Preprocessor) and JavaScript, with the database structured in MySQL, a database management system (DBMS) that uses the SQL language (Structured Query Language). Furthermore, it follows the MVC (Model-View-Controller) architecture pattern, which facilitates system maintenance and organization. SisPreço makes use of APIs (Application Programming Interface) to access existing records in Incaper, such as products, producers and users. Data via API is updated daily.

Among the main features of SisPreço are:

- Main screen with dashboard: offers a summary of price quote data and allows the selection of products included in the survey (Figure 1).

**Figure 1**

*SisPreço screen – dashboard.*



Source: Incaper SisPrice System.

- Weekly quote screen and daily quote screen: allows the input of prices for agricultural products (Figure 2). The prices collected in the ELDRs are released in the SisPreço System. The system calculates the average state price for each product, using weekly and daily quotes. When calculating state price averages, production data provided by IBGE and IDAF are considered.

**Figure 2**

*SisPreço Screen – Weekly product quotation.*

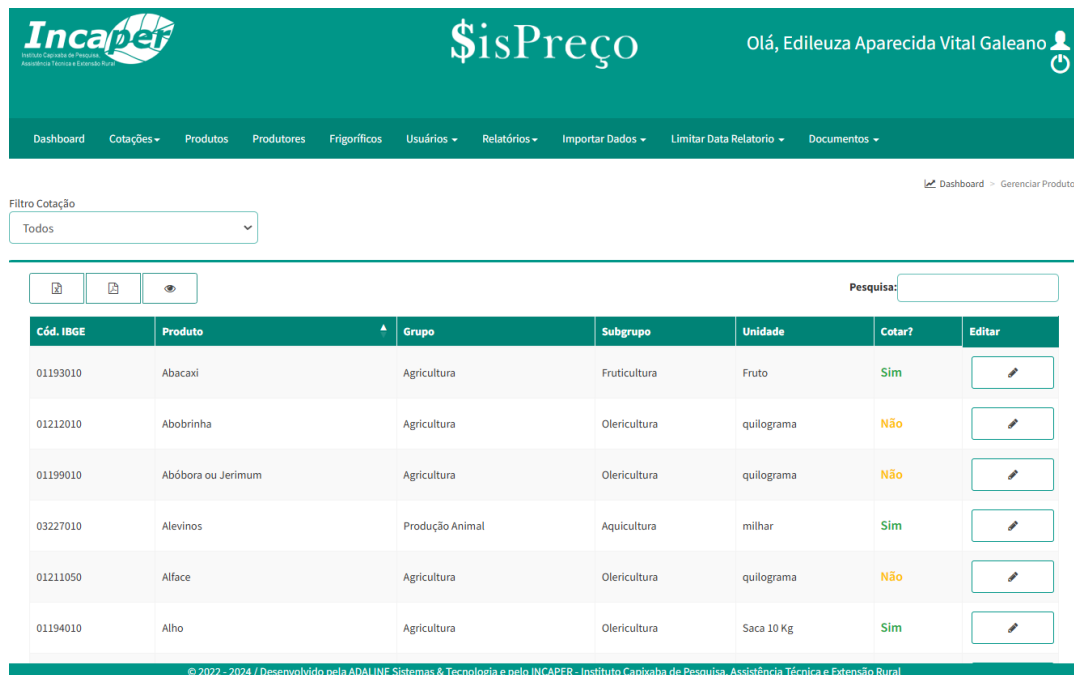
The screenshot shows the SisPreço web application interface. At the top, there is a green header with the Incaper logo on the left, the title '\$isPreço' in the center, and the user name 'Olá, Edileuza Aparecida Vital Galeano' on the right. Below the header is a navigation menu with items: Dashboard, Cotações, Produtos, Produtores, Frigoríficos, Usuários, Relatórios, Importar Dados, Limitar Data Relatorio, and Documentos. A sub-menu for 'Produtos' is open, showing 'Semanal dos Produtos' and 'Diária do Boi'. The main content area displays a form for product quotation. The form includes fields for 'Produto' (Mamão Havaí), 'Unidade' (quilograma), 'Município' (Pinheiros), 'Mês de Referência' (Fev/25), 'Semana de Referência' (Semana 3), and 'Data' (19/02/2025). Below these fields, the 'Situação' is 'Pendente'. There are three rows of input fields for 'Nome do Produtor', 'Telefone', 'Celular', and '(Preço R\$)'. A 'Sem Cotação' checkbox is visible at the bottom left of the form area.

Source: Incaper SisPrice System.

- Registration of products, producers and users: these registrations are available via API and are essential for the system to function. Data updates via API are made daily. Figure 3 shows the product registration access screen.

**Figure 3**

*SisPreço screen – product registration.*



Source: Incaper SisPrice System.

- Automatic updating of price parameters: the system automatically updates, in predefined routines, the minimum and maximum prices of the products quoted. These price parameters aim to prevent the insertion of incorrect price data into the system (Figure 4).

**Figure 4**

*SisPreço screen – price parameters in product registration.*



Source: Incaper SisPrice System.

- Historical reports and graphs: allows the generation of monthly, weekly and annual average price reports, as well as historical series graphs of monthly average prices. Users can customize reports by selecting parameters such as municipality, product and reference date (Figure 5).

**Figure 5**

*SisPreço screen – weekly state average price report*



Source: Incaper SisPrice System.

Historical series of monthly state price averages are available, as well as historical series of monthly average prices by municipality. The price data used in the historical series graphs are updated by the IGPM (General Market Price Index) of Fundação Getúlio Vargas (Figure 6).

**Figure 6**

*SisPreço screen – historical series graph of monthly average prices.*



Source: Incaper SisPrice System.

- Data import and update: the system allows the import of production data obtained from sources such as IBGE and IDAF and inflation data from FGV. The production data is used to calculate state average prices weighted by the production of each municipality.

## 5 SISPREÇO IMPLEMENTATION

During the SisPreço implementation phase, historical data on weekly average prices of around 70 products was organized. This data was included in the system via data import. Among the activities carried out, there was the organization of spreadsheets of historical data on the weekly quotations of the municipalities, covering the period from 2002 to 2024. Organization of spreadsheets of historical data on state average daily prices of cattle for the period from 2015 to 2024. Tests of price quotations, standardization of price parameters, checking of parameterized reports in SisPreço and usability tests of the system were carried out.

The study included the collaboration of Incaper's Information Technology team and also several scholarship holders. The research carried out by the scholarship holders was essential for the systematization of historical data and also for the successful implementation of the system.

To begin using the system, training was carried out with 60 Incaper public servants, who collaborate in price surveys.



## 6 CONCLUSION

SisPreço is currently used in 70 municipalities in Espírito Santo and has proven to be an essential tool for professionals in the agricultural sector who need quick and accurate access to information on the prices of agricultural products. It allows analysis of market trends and provides information that supports decision-making in different sectors of the economy. The rapid collection and dissemination of updated data on agricultural prices helps in the formulation of public policies, marketing and rural credit, in addition to contributing to the state's economic development.

Despite significant advancements, SisPreço still needs many collaborators to carry out price surveys with rural producers, representing a limitation. Future improvements could involve further automation of data collection processes and expanded integration with advanced analytics tools, such as artificial intelligence and machine learning, to enhance predictive capabilities and reduce dependence on manual efforts. Additionally, expanding the system to other regions or states could further maximize its impact on Brazilian agribusiness.

Besides contributing to improving the price survey process, the project also played an important role in training the scholarship holders who worked on the project, awakening their interest in scientific, technological and innovation activities.

## ACKNOWLEDGMENTS

State Secretariat for Agriculture, Supply, Aquaculture and Fisheries (Seag); Capixaba Institute of Research, Technical Assistance and Rural Extension (Incaper); Espírito Santo Research and Innovation Support Foundation (FAPES).

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