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Labor management through sustainable agro-nutritional educational projects with statistics and indicators of legume harvests

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Introduction: The project to integrate technical education with pea cultivation as a flagship product allows for agro-industrial skills and learning descriptive statistics through the collection, analysis and colorful graphs referring to pea grain data. **Objective:** To integrate agro-nutritional technical knowledge with the learning of statistics, promoting sustainability and job options. **Methodology:** A quantitative approach with descriptive analysis on the performance and nutritional quality of pea crops is used. **Results:** By applying statistical concepts to manage crops and evaluate their performance, the consumption of nutritious foods was promoted through the example of creating sustainable educational projects, providing job options that combine studies to determine within a spectrum of pea lines, the one with the greatest weight of the pea pod and the number of grains per pod. **Conclusion:** It was possible to integrate agro-nutritional technical knowledge with the learning of statistics, promoting sustainability and job options.
Keywords: Labor management, projects, educational, agro-nutritional, sustainable, statistical, legumes

Gestiones laborales mediante proyectos educativos agro-nutriconales, sostenibles con estadísticas e indicadores de cosechas de legumbres

Introducción: El proyecto de integrar la educación técnica con el cultivo de arvejascomo producto bandera permite habilidades agroindustriales, y aprendizaje de estadística descriptiva mediante recolección, análisis y graficas coloridas referentes a datos de granos de arvejas. **Objetivo:** Integrar conocimientos técnicos agro-nutricionales con el aprendizaje de estadística, fomentando la sostenibilidad y opciones laborales. **Metodología:** Se emplea un enfoque cuantitativo con análisis descriptivo sobre el rendimiento y la calidad nutricional del cultivo de arvejas. **Resultados:** Al aplicar conceptos estadísticos para gestionar cultivos y evaluar su rendimiento, promovió el consumo de alimentos nutritivos mediante ejemplo de creación de proyectos educativos sostenibles, brindando opciones laborales que combinan estudios para determinar dentro de un espectro de líneas de arveja, la de mayor peso de la vaita de arveja y el número de grano por vaina. **Conclusión:** Se logró integrar conocimientos técnicos agro-nutricionales con el aprendizaje de estadística, fomentando la sostenibilidad y opciones laborales.
Palabras clave: Gestiones laborales, proyectos, educativos, agro-nutriconales, sostenibles, estadísticos, legumbres

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Gestões Laborais por Meio de Projetos Educacionais Agro-Nutricionais, Sustentáveis com Estatísticas e Indicadores de Colheitas de Leguminosas

Resumo. Introdução: O projeto de integrar a educação técnica com o cultivo de ervilhas como produto principal permite o desenvolvimento de habilidades agroindustriais e o aprendizado de estatísticas descritivas por meio da coleta, análise e gráficos coloridos relacionados aos dados dos grãos de ervilha. **Objetivo:** Integrar o conhecimento técnico agro-nutricional com o aprendizado de estatísticas, promovendo a sustentabilidade e opções de emprego. **Metodologia:** Utiliza-se uma abordagem quantitativa com análise descritiva sobre o desempenho e a qualidade nutricional do cultivo de ervilhas. **Resultados:** Ao aplicar conceitos estatísticos para gerenciar os cultivos e avaliar seu desempenho, promoveu-se o consumo de alimentos nutritivos por meio do exemplo de criação de projetos educacionais sustentáveis, oferecendo opções de emprego que combinam estudos para determinar, dentro de um espectro de linhas de ervilha, aquela com maior peso da vagem de ervilha e o número de grãos por vagem. C**onclusão:** O conhecimento técnico agro-nutricional foi integrado com o aprendizado de estatísticas, promovendo a sustentabilidade e opções de emprego.
Palavras-chave: Gestão laboral, projetos, educacional, agro-nutricional, sustentável, estatístico, leguminosas.

1. Introduction

Handling data related to pea cultivation offers students the opportunity to learn basic statistical concepts. Torres et al. (2022) point out that when analyzing crop yield, students can apply statistical techniques such as mean and variance, which facilitates practical learning of statistics. This approach promotes a deeper understanding of data analysis, which benefits students both in their academic training and in their future careers in the agribusiness.

1.1.Management of Career Options and Sustainable Investment Projects

Knowledge about pea cultivation opens up new job opportunities in agribusiness. Students can develop investment projects based on sustainability and local agribusiness. According to Castillo et al. (2022), these types of projects encourage entrepreneurship and business creation in the agricultural sector, promoting local economic development. In addition, students acquire skills for data-driven decision-making and resource management, allowing them to lead sustainable initiatives in their communities.

1.2. Educational, sustainable and nutritious projects

The project to integrate technical education with the cultivation of pea as a flagship product seeks to teach students practical skills and raise awareness about the nutritional importance of legumes. Rich in protein, fiber, and micronutrients, peas are essential for public health, especially in rural areas where access to nutritious foods is limited (Martínez et al., 2022). Furthermore, they have high agro-industrial potential due to their versatility and adaptability (González et al., 2022). This approach promotes the consumption of nutritious foods over less healthy options, such as fast foods, and encourages the use of local products, supporting biodiversity and a sense of belonging (Castillo et al., 2022).

1.3. Nutritional options management of peas

The nutritional impact of peas in a variety of options are accessible to the extent of the management and dissemination of preparation and consumption; thus, boiled green peas are nutritious, including the shells, they offer several nutritional benefits, since the shells contain dietary fiber, essential for digestion and intestinal health, as well as important vitamins and minerals. González et al. (2022) highlight that this consumption increases fiber intake, which helps control cholesterol and prevent cardiovascular diseases. In addition, the shells provide antioxidants that contribute to the prevention of chronic diseases. This way of consuming peas also favors the absorption of key nutrients such as iron and potassium, vital for the cardiovascular and nervous systems.

1.3.1. Peas in nutritious soups

Using peas in soups is a healthy alternative to fast foods, which are often high in trans fats and sodium. Pea soups provide plant-based protein, fiber, and B vitamins, helping to reduce the risk of metabolic diseases (Martínez et al., 2022). Replacing processed meals with nutritious pea soups can promote a more balanced diet and reduce the prevalence of obesity and cardiovascular disease, especially in young populations that consume fast food.

2. Methodology

The research methodology used in this project is based on a quantitative approach, through the collection, analysis and presentation of colorful bar graphs to facilitate the learning of descriptive statistics, referring to the characteristics of the harvested pea grain.

2.1. Data selection and representation

Pea plantations in rural areas were selected, where variability in harvested grain conditions was observed. A stratified sampling was designed, ensuring that different types of grain were considered based on weight and quantity of grains per pea pod.

Data collection was a structured process, with a quantitative approach to ensure the objectivity and accuracy of the information obtained. The following tools and procedures were used:

- Data Collection Tables: For each pea plant, the variables of interest were recorded in standardized statistical tables. These variables included:
- Pea grain weight: Random samples of grains were weighed per plant, using a precise digital scale.
- Number of grains per pod: The number of grains present in a predetermined number of randomly selected pods was counted.
-Pod size:The length and thickness of the pods were measured in the selected samples.
-Total plantation yield: The yield per hectare was determined by evaluating the total pea production based on the cultivated area.

Samples were collected at regular intervals throughout the crop cycle, with the aim of analyzing the evolution of these variables over time.

2.2. Statistical Analysis of Data

Once the data was collected, specialized statistical software was used to process and analyze the information. The steps followed were:

- Data Organization: The data were organized in statistical tables that facilitated the visualization of the variables and their comparison between different cultivation conditions.
- Descriptive Analysis: Descriptive statistical measures (mean, median, mode, standard deviation) were calculated for each of the collected variables, allowing for a clear view of the general trends of the crops.
- Inferential Analysis: Hypothesis tests and analysis of variance (ANOVA) were performed to determine whether the differences observed in the data were statistically significant. This allowed us to identify which cultivation practices or conditions most significantly influenced pea yield.
- Correlation of Variables: Correlations between variables were analyzed, for example, the relationship between pod size and the number of grains per plant or grain weight and overall crop yield.

2.3. Presentation and Visualization of Results

Once the data was processed, the results were presented. The findings were organized and presented in a way that was easily understandable for both the educational community and the agro-industrial producers and other stakeholders involved. The main tools used to present the results were:

- Graphs and Diagrams: Colorful bar graphs, scatter diagrams, and comparison tables were created to illustrate concepts related to pea grains.
- Visual Reports: Results were presented in visual reports with tables and graphs showing the relationships between grain weight, number of grains per pod, and overall yield.

3. Results

3.1. Pea pod weight (grams). Table 1 shows the analysis of variance

Table 1 . Analysis of variance of pea pod weight (grams)

Source of Variation	Degrees of Freedom	Sum Squares	Mean Squares	F Calc	F Tab	Next at 5%
Block	3	1.5	0.50	0.90	2.99	No Next Stats
Treatments (Lines)	9	58.5	6.50	11.69	2.28	* Next Stat.
Error Exp	27	15.0	0.56			
Total	39	75.0				
	CV (%)	8.32		Average:	8.99	

Interpretation of Table 1: The analysis of variance is shown, where no significant differences were found for the source of variation of blocks and for treatments there were statistically significant differences, the coefficient of variation being 8.32% and the general average being 8.99g.

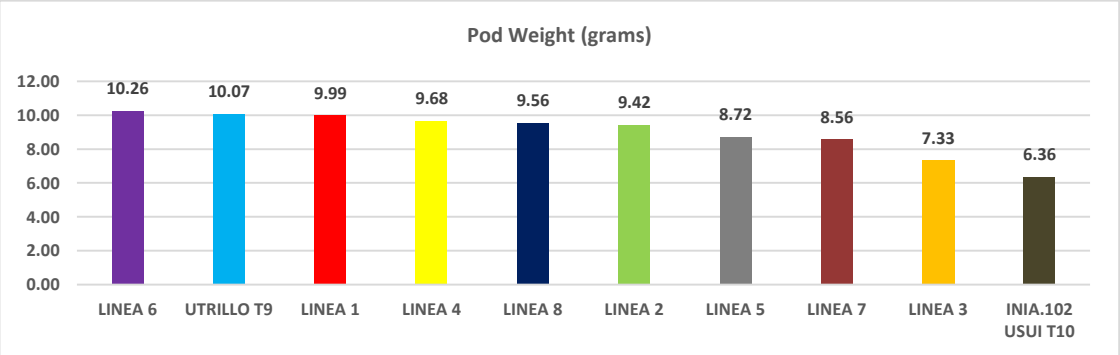
Table 2 . Duncan Test Pod Weight (grams)

Treatments	Pod Weight (grams)	Next at 5%
Line 6	10.26	to
Utrillo T9	10.07	to
Line 1	9.99	to
Line 4	9.68	ab
Line 8	9.56	ab
Line 2	9.42	ab
Line 5	8.72	b
Line 7	8.56	b
Line 3	7.33	c
INIA.102 Usui T10	6.36	c

Source: Field Work

Interpretation of Table 2: According to the Duncan comparison test at 5%, it was determined that for pod weight (g), there was significance between Line 6, UtrilloT9 and Line 1, they were similar expressed by the same letter (a), with yields of 10.26 gr. 10.07 gr and 9.99 gr, respectively. Lower weight per pod was obtained from the INIA 102 Usui T10 line with only 6.36 gr.

Figure 1: Pod weight (grams) in 8 lines and 2 pea parents



3.2. Grain/pod weight (grams), Table 3 shows the analysis of variance, where for the source of variation of blocks and for treatments there were statistically significant differences, the coefficient of variation being 10.29% and the general average being 4.45 g.

Table 3 . Analysis of variance of grain/pod weight (grams)

Source of Variation	Degrees of Freedom	Sum Squares	Mean Squares	F Calc	F Tab	Next at 5%
Block	3	5.1	1.71	8.08	2.99	* Next Stat.
Treatments (Lines)	9	20.9	2.32	10.93	2.28	* Next Stat.
Error Exp	27	5.7	0.21			
Total	39	31.8				
	CV (%)	10.29		Average:	4.45	

Source: Field work

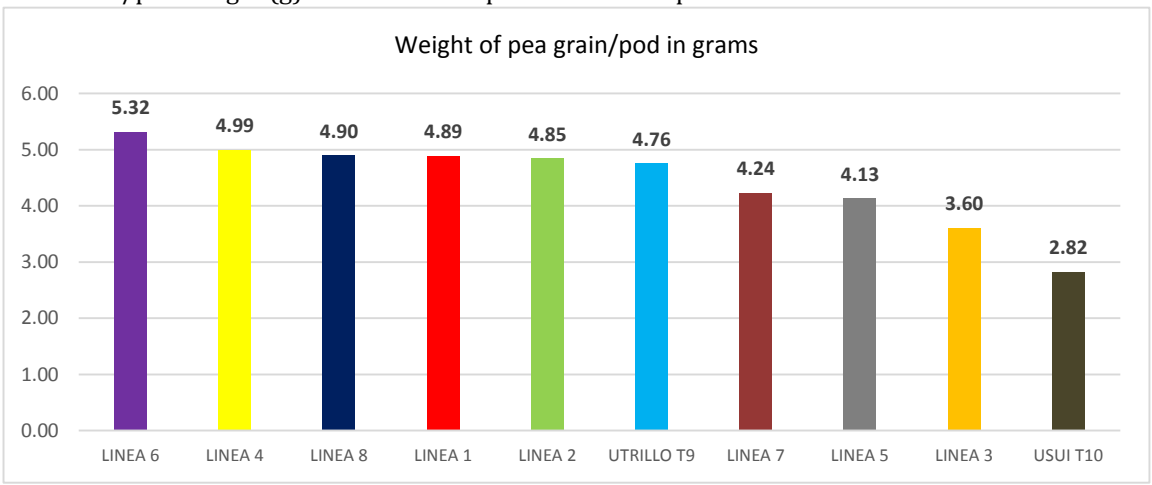
Table 4 . Duncan Test Grain/pod Weight (g)

Treatments	Grain weight (grams)	Next at 5%
Line 6	5.32	to
Line 4	4.99	to
Line 8	4.90	ab
Line 1	4.89	abc
Line 2	4.85	abcd
Utrillo T9	4.76	abcdef
Line 7	4.24	bcdefg
Line 5	4.13	defgh
Line 3	3.60	gh
INIA-102 Usui T10	2.82	h

Source: Field Work

Interpretation of Table 4: According to the Duncan comparison test at 5%, it was determined that for grain weight (g), there was significance between Line 6 and 4, which had a weight per pod of 5.32 gr. and 4.99 gr. The lowest weight was obtained, INIA-102 Usui T10, with 2.82 gr. per pod.

Figure 2: Grain/pod weight (g) in 8 lines and 2 parental lines of pea



3.3. Number of grain/pod, Table 5 shows the analysis of variance, where for the source of variation of blocks no significant differences were found and for treatments there were significant differences, the coefficient of variation being 13.1% and the general average being 6.87 grains.

Table 5 . Analysis of variance of number of grains/pod

Source of Variation	Degrees of Freedom	Sum Squares	Mean Squares	F Calc	F Tab	Next at 5%
Block	3	6.6	2.20	2.73	2.99	No Next Stats
Treatments (Lines)	9	22.7	2.53	3.13	2.28	* Next Stat.
Error Exp	27	21.8	0.81			
Total	39	51.1				
	CV (%)	13.1		Average:	6.87	

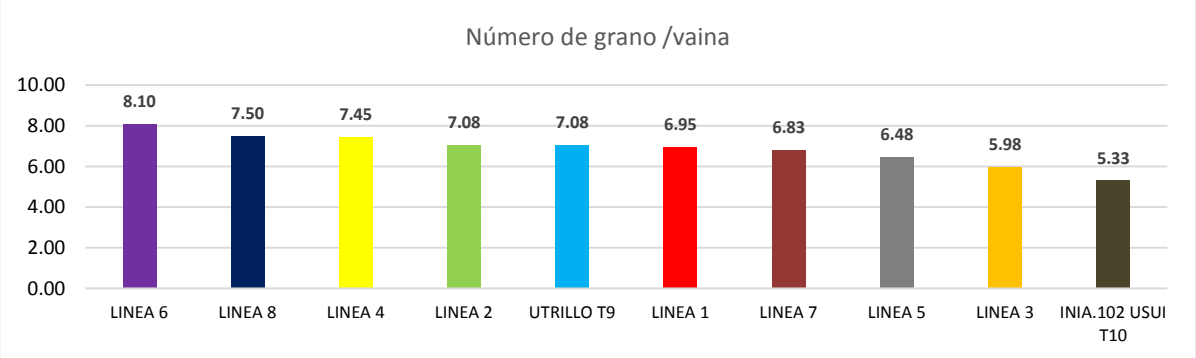
Source: Result of statistical processing

Table 6. Duncan 's test for grain/pod number

Treatments	Number of grain/pod	Next at 5%
Line 6	8,10	to
Line 8	7.50	ab
Line 4	7.45	abc
Line 2	7.08	abcd
Utrillo T9	7.08	abcde
Line 1	6.95	abcdef
Line 7	6.83	abcdefg
Line 5	6.48	bcdefgh
Line 3	5.98	defghi
Inia.102 Usui T10	5.33	gh i

Interpretation of Table 6: According to the Duncan comparison test at 5%, it was determined that for grain number there was significance between Line 6, Line 8, Line 4, Line 2, Utrillo, Line 1 and Line 7, in which more than 6.83 grains per pod were obtained; but it was observed that it did differ from Line 5, Line 3 and INIA.102 Usui, in which less than 6.46 grains per pod were obtained, as shown in Table 6 and Figure 3, these results are explained because those with greater pod length have a greater number of grains, a character inherited from the parent "Utrillo".

Figure 3: Number of grains/pod in 8 lines and 2 pea parents



Interpretation of Figure 3: This is confirmed in the figure, the values for the highest number of grains/pod correspond to lines 6 and 8.

4. Discussion

In this research, the pea is presented as a flagship product, not only nutritionally valuable, but also from an agro-industrial point of view. Its efficient cultivation and the complete use of the plant, including the pod, offer a sustainable alternative to improve food security in rural communities. It is easy to grow, economical and versatile, which makes it key to local agroindustry (González et al., 2022). Its consumption as an alternative to processed foods can reduce chronic diseases such as obesity and cardiovascular problems (Martínez et al., 2022).

4.1. Technology management for crop optimization

The implementation of advanced technologies, such as sensors and digital monitoring, optimizes pea production and improves natural resource management. These technologies contribute to crop sustainability and improve efficiency in the use of water and nutrients. Integrating these tools into the educational curriculum allows students to acquire technical skills relevant to a more digitalized and sustainable labor market, promoting innovation and local economic development (Pérez et al., 2022; Torres et al., 2022).

The best pod weight was obtained by line 6, also in number of grains per pod, obtaining 8 grains per pod. Which coincides with Muñoz (2013) with the PLS 182 (Pure line seed), the second highest number of grains per pod was line 8; situations that will allow learning quantities, using a colorful number of bars perceived in all figures 1 to 3 of the present investigation.

4.2. Social and economic impact of the educational project

The impact of this project goes beyond technical training. By integrating agro-industrial education with sustainable and nutritious projects, the aim is not only to improve students' productivity, but also to raise their quality of life. The possibility of accessing a growing agro-industrial market and actively participating in the production of healthy food has a direct positive effect on the rural economy. The adoption of sustainable agricultural practices can generate higher incomes for farmers, while contributing to the overall well-being of the community. According to Martínez et al. (2022), strengthening agro-industrial training in rural areas is crucial for the creation of sustainable jobs, which not only improve working conditions, but also promote food security in communities.

determining factor in students' ability to carry out sustainable investment projects in the agro-industrial field, managing both academic demands and practical work; and Torres-Flores & Sánchez (2023) discuss how job saturation affects the management of working conditions in health institutions. This study offers valuable lessons for students faced with the combination of studies and work in agro-industrial projects. Efficiency in the management of human resources and working conditions can be applicable in the agro-industrial field, allowing students to acquire key skills to manage their future projects.

Silva Herrera et al. (2023) also propose innovative strategies to improve institutional image. This approach is crucial in agro-industrial educational projects, where public perception and communication of results play a fundamental role in obtaining support and financing. Students can learn how to develop communication strategies to promote sustainable projects and improve their social impact, and Filios & Chávez (2023) examine the evaluation and management of ten pea lines in arable valleys. This study provides a practical example for technical education students, who can apply statistical concepts to manage crop yield, while promoting food security and sustainability. The analysis and management of agro-industrial crops are essential in the training of students in rural areas.

Furthermore, the project fosters a change in students' attitudes and perspectives towards the agro-industrial sector. By incorporating advanced technical knowledge into their studies and

working with key agricultural products such as peas, students acquire skills that can transform their productive environment, improving the profitability and sustainability of their crops. This type of educational approach not only responds to current labour market needs, but also has the potential to prepare future generations to face global challenges related to climate change, food security and public health.

The study by Gonzales et al. (2023) also reflects on the importance of multifunctional educational infrastructures in the prevention of health emergencies. This approach is essential for technical education students, as it promotes awareness of infrastructure in critical situations and its relationship with public health. The knowledge acquired can be applied to sustainable projects, such as the implementation of educational spaces in rural areas to promote crops such as peas, contributing to food security.

Similarly, other research linked to this research:

Rosales et al. (2023) explore the impact of communication between educational institutions and local governments on the well-being of the population. This study highlights the importance of communication in the management of health emergencies and the inclusion of technical education. The integration of communication technologies can also enhance the teaching of descriptive statistics to students to manage agro-industrial projects, supporting decision-making in their future work roles.

Ayvar et al. (2023) conduct a study on the administrative management of health sports activities by public health program coordinators. This analysis is relevant to health-related educational projects, as it illustrates how the organization and administration of activities impact work efficiency. Technical education students can apply these lessons to the management of sustainable agro-industrial projects, improving their ability to manage and administer projects in the agro-industrial sector.

Aguilar Chávez, Delgado Sánchez, De la Cruz Montoya, and Saldaña Barboza (2023) explore the understanding and application of digital skills to improve learning in the post-Covid-19 era. This study highlights the importance of integrating digital skills in technical education, facilitating students to collect and analyze data for decision-making in agro-industrial projects. The use of digital tools allows students to optimize resource management in sustainable projects.

4.3. Alternative solutions and contributions:

Integration of technology into the educational curriculum: Including the use of advanced agro-industrial systems in the training of students will allow them to understand how to efficiently manage pea crops, improving both the yield of the plantation and its nutritional quality (Pérez et al., 2022).

Nutrition and healthy consumption education: Teaching students about the nutritional benefits of peas, including eating the whole pod, will help them understand the importance of a balanced diet and how they can take advantage of this local resource to improve their health (González et al., 2022).

Promoting investment in local agribusiness: Encouraging students to view agribusiness as a viable avenue for investment by creating training opportunities in advanced agricultural techniques and promoting sustainable business models related to pea cultivation (Núñez et al., 2022).

The methodological approach and the treatment and presentation of results contributed not only to improving the technical training of students, but also to promoting investment in sustainable and profitable agricultural practices.

5. Conclusion

The Project *on Labor Management for Students with Sustainable and Nutritious Projects through Legume Knowledge* offers a valuable opportunity to integrate agro-industrial technical education with sustainable and nutritional development in rural communities. Through the promotion of products such as peas, the aim is not only to improve the technical skills of students, but also to contribute to the well-being of rural communities by strengthening food security and promoting a balanced diet. This educational approach, which combines practical, technical and nutritional aspects, is aligned with the objectives of modern agro-industrial education, and has the potential to transform the rural landscape, improving quality of life, generating sustainable employment and promoting the adoption of more responsible and sustainable agricultural practices.

Analysis of the collected data allowed key conclusions to be drawn on best practices for pea cultivation, both in terms of yield and nutritional quality. The implications of this study were clearly presented to students, farmers and other agents in the agro-industrial sector to encourage the adoption of practices to understand the characteristics and make appropriate decisions in the selection of pea grains.

It was possible to integrate agro-nutritional technical knowledge with statistical learning, promoting sustainability and job options

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