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PROPOSAL FOR A PROTOTYPE OF AN ERGONOMIC GLOVE FOR SHELLING CORN COBS

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Abstract—This project aims to design and develop an ergonomic glove whose primary objective is to facilitate the manual shelling of corn cobs. It is primarily focused on small-scale farmers in the northern region of Sinaloa, Mexico—a key region for corn production— where many people work shucking corn cobs for commercial sale or personal consumption using traditional methods. However, the traditional manual shucking process is very labor-intensive, slow, and exhausting, leading to fatigue, muscle injuries, skin injuries, and problems such as tendinitis due to repetitive movements, resulting in low work efficiency. The study presented here applies principles of ergonomics, anthropometry, and design, which are invaluable in guiding the glove development process.

The main objective is to design an ergonomic glove tailored to the anthropometric measurements of farmers in northern Sinaloa. The prototype features rounded and reinforced chain links, which will be bonded with Plasti-Steel adhesive to facilitate the shelling of corn cobs; this is aimed at minimizing physical exertion, reducing the risk of injury, and improving efficiency compared to the traditional methods currently used by small-scale farmers in northern Sinaloa. The prototype glove, based on locally conducted anthropometric studies, will be designed using two measurements—the 0.5th and 0.9th percentiles (hand 15–18 cm, palm 9–11 cm, etc.)—to ensure a universal fit (for both men and women).

The project is viable because it addresses fatigue and injuries that affect health and productivity, as existing tools are neither ergonomic nor accessible (mechanical tools are expensive); the anthropometric design improves working conditions, promotes sustainability, and respects agricultural traditions.

The project is technically feasible (low-cost local materials, size 7 and 9 gloves, stainless steel chain, plastic-steel; a simple, replicable rural process), economically feasible (low costs, savings in healthcare and labor time), practically feasible (intuitive top-down use, durability), and socially feasible (community acceptance, improved quality of life). Surveys were conducted with 15 producers: 100% manual labor, 92% experiencing pain or fatigue, and a high willingness to use the glove at an average cost of approximately $300 MXN.

The prototype glove, which uses 8x12 mm links and employs a downward motion technique for manual shelling, yielded the following results in the tests conducted: users reported experiencing less fatigue and less pain—primarily in their hands and wrists—as well as greater efficiency, safety, and comfort when using the prototype glove during their work.

As suggestions for improvement, it is recommended to consider using smaller-sized links, including a leather surface on the palm, reinforcing the seams that secure the links, and avoiding the use of plastic-steel for reinforcing them.

100% of users reported significant benefits from using the prototype glove.

Keywords—Anthropometry, shelling, ergonomics, fatigue, glove, hand tool, injuries, corn cobs, repetitive movements, prototype, effort reduction.

Abstract—This project aims to design and develop an ergonomic glove whose primary objective is to facilitate the manual shelling of corn cobs. It focuses primarily on small-scale agricultural producers in the northern region of Sinaloa, Mexico—a key area for corn production—where many people perform this activity for commercial purposes or personal consumption. Traditional shelling methods are used, but the conventional manual shelling process is highly labor-intensive, slow, and exhausting. As a result, it causes fatigue, muscle injuries, skin lesions, and problems such as tendinitis due to repetitive movements, ultimately leading to low labor efficiency.

This study applies principles of ergonomics, anthropometry, and design, which provide essential guidance for the glove manufacturing process.

The main objective is to design an ergonomic glove tailored to the anthropometric measurements of producers in northern Sinaloa. The prototype features rounded and reinforced chain links that are securely attached using Plasti-Steel adhesive to facilitate corn cob shelling. This design focuses on minimizing physical effort, reducing the risk of injuries, and improving efficiency compared to the traditional methods currently used by small-scale producers in northern Sinaloa. The prototype glove, based on local anthropometric studies, was developed using the 0.5 and 0.9 percentiles (hand length 15–18 cm, palm width 9–11 cm, etc.) to ensure a wide, comfortable fit for both men and women.

The project is viable because it directly addresses fatigue and injuries that affect health and productivity. Existing tools are neither ergonomic nor accessible (mechanical options are expensive), while the anthropometric design improves working conditions, promotes sustainability, and respects traditional agricultural practices.

The project demonstrates high viability from a technical perspective (using locally available, low-cost materials: size 7 and 9 gloves, stainless steel chain, Plasti-Steel adhesive; a simple process easily replicable in rural settings), an economic perspective (low production costs and savings in healthcare and labor time), a practical perspective (intuitive downward-motion use and high durability), and a social perspective (strong community acceptance and improved quality of life).

Surveys were conducted with 15 producers: 100% use manual methods, 92% experience pain or fatigue, and there is a high willingness to adopt the glove at an average acceptable cost of approximately $300 MXN.

The prototype glove, which uses 8×12 mm chain links and employs a downward-motion technique for manual shelling, was tested by users who reported experiencing significantly less fatigue, reduced pain (especially in the hands and wrists), greater efficiency, improved safety, and enhanced comfort during their work.

Suggested improvements include using smaller chain links, adding a leather surface to the palm, reinforcing the seams that secure the links, and avoiding the use of Plasti-Steel for link reinforcement.

100% of users reported significant benefits when using the prototype glove.

Keywords-- Anthropometry, shelling, ergonomics, fatigue, gloves, hand tools, corn cobs, repetitive movements, prototype, injuries, effort reduction.

INTRODUCTION

Corn is one of the most important crops for humanity, especially in Mexico, where its production has been central to the economy and food supply since pre-Hispanic times. In the state of Sinaloa, corn production is not only a fundamental source of income but is also deeply rooted in local agricultural traditions. Despite advances in agricultural technology

, many small-scale farmers and rural workers continue to use manual methods and rudimentary tools to shell corn cobs—a strenuous and repetitive task that can lead to physical problems due to the effort required (Kumar, A., & Tiwari, P., 2011).

The process of shelling corn cobs involves removing the kernels from the cob and remains one of the most common activities among small-scale farmers. When performed without the proper tools, this manual labor causes muscle fatigue and repetitive strain injuries, particularly in the hands, wrists, and lower back (Singh et al., 2011). The scientific literature has shown that intensive manual activities, such as traditional corn husking, are associated with high musculoskeletal loads and an increased risk of repetitive strain injuries if they are performed over an extended period without appropriate ergonomic interventions (Workman et al., 2015).

In many rural communities where maize is a key crop and serves as both a dietary and economic staple, the corn-de-cobber glove and other specialized hand tools can be of great assistance to farmers. Although the manual shelling process has not changed much over thousands of years and has required significant energy and human exertion for generations, it remains a vital practice; however, it can also lead to chronic fatigue and long-term muscle injuries (Ergonomic Assessment of Hand-Intensive Agricultural Tasks, 2018).

Consequently, various solutions have been sought to perform manual corn husking (removing kernels from cobs) in a less strenuous and more effective manner, primarily for small-scale farmers. These include improved ergonomic designs for manual shellers that reduce physical exertion, lessen worker fatigue, and increase productivity without relying exclusively on expensive machinery (Ergonomic Studies on a Hand-Operated Sheller, 2014). The adoption of ergonomic tools and more efficient operating methods not only promotes the health and well-being of those involved in shelling but can also help maintain the sustainability of traditional agricultural practices in rural communities, where full mechanization is still inaccessible or is not a priority, either economically or culturally. These strategies represent a pragmatic response to a persistent challenge in small-scale maize production. (Singh et al., 2011)

DEVELOPMENT

Problem Statement

In northern Sinaloa, Mexico—a region renowned for its maize production—small-scale farmers face significant challenges in the process of shelling maize ears, an essential activity for preparing the grain for sale or personal consumption. Traditionally, shelling is done by hand or with rudimentary tools, making it a labor-intensive, slow, and physically exhausting task.

This process not only consumes a considerable amount of time and effort but can also lead to muscle or skin injuries due to repetitive friction and the lack of ergonomic tools. Small-scale farmers, who represent a significant portion of the agricultural sector in Sinaloa—approximately 2.4 million production units with untapped potential in Mexico, according to data from Mata—typically operate with limited resources and low levels of mechanization. This contrasts with commercial producers who use high-tech equipment, which widens the gap in productivity and profitability. Manual threshing reduces efficiency, increases production costs (in terms of time and labor), and limits small-scale producers' ability to compete in the market or efficiently meet their own consumption needs.

Furthermore, the agroecological context of Sinaloa—where sustainable practices such as those described by Claudio Beltrán (2020) are being adopted (agrochemical-free corn production with yields of 14.8 metric tons per hectare)—highlights the need for tools that complement these practices by reducing dependence on labor-intensive manual processes. The lack of access to affordable technologies tailored to the needs of small-scale producers perpetuates a cycle of low productivity and high operating costs. This line of reasoning leads to the central question: What characteristics must a corn-shelling glove have to be functional, ergonomic, and affordable for small-scale producers in northern Sinaloa?

General Objective

The general objective of this project is to design an ergonomic glove that facilitates the shelling of corn cobs, optimizing physical effort and reducing the risk of injury.

Specific Objectives

- To design a glove that fits the anthropometric measurements of small-scale farmers in northern Sinaloa.

- To propose a manual tool designed to reduce the physical effort required to shell corn cobs.
- To reduce the risk of injuries related to repetitive movements in the hands and wrists.
- To validate the glove's acceptance and comfort among participating users.

As a first step in our research, we designed and administered a questionnaire to 15 experienced farmers in northern Sinaloa to identify what tool they needed to facilitate the manual shelling of corn cobs. This instrument is presented below, as shown in Survey 1.

Questionnaire

How many ears of corn do you currently shell on average per hour?

a) 50
b) 100
c) More than 100

What is the average time it takes to shell one ear of corn?

a) 10 seconds
b) 20 seconds
c) More than 20 seconds

What are the main problems that corn shellers face when shelling corn?

Do you experience pain or fatigue in your hands, wrists, or arms, etc.?

a) Yes b) No

Have you suffered any injuries as a result of manual shelling?

a) Yes
b) No

If you answered yes, how many times in the past year

What would you need to make manual shelling easier and less risky?

a) Gloves **b)** A fixed wooden base for support c) A movable base for deburring

Have you ever used a tool to perform manual dehusking?

Yes___ No____ Which ones?

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Have you had problems with deburring efficiency and turnaround times?

Yes___ No____ Which ones?

Would you use a tool like an inlaid glove to deburr faster and with less fatigue?

Yes___ No_____

What features do you think a manual deburring tool should have?

a) Easy to grip b) Efficient de-hulling c) Comfortable to use Other_____

How much would you be willing to pay for a tool that meets these needs?

a) 200 b) 300 c) More than 300

RESULTS

Table 1. *Charts showing the results of the questionnaires administered to farmers.*

GRAFICA 1: CANTIDAD DE MAZORCAS DESGRANADAS POR HORA

GRAFICA 2: TIEMPO DE DESGRANE DE UNA MAZORCA

GRAFICA 3: PRINCIPALES PROBLEMAS AL REALIZAR EL DESGRANE MANUAL DE MAZORCAS

GRAFICA 4: SÍNTOMAS PRESENTADOS EN EL DESGRANE MANUAL DE MAZORCAS

Source: Compiled by the author

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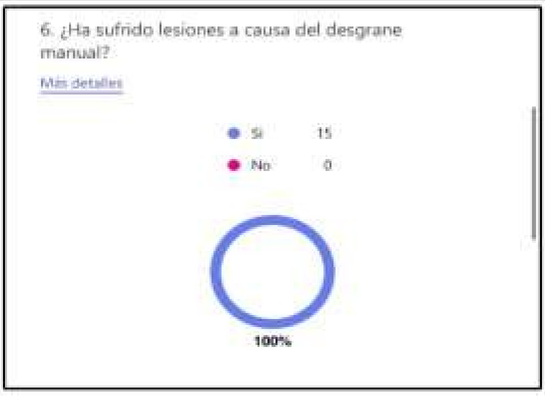
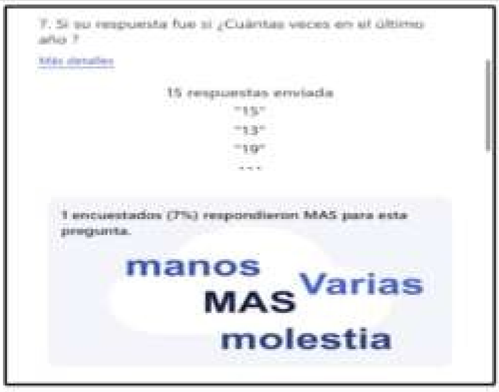
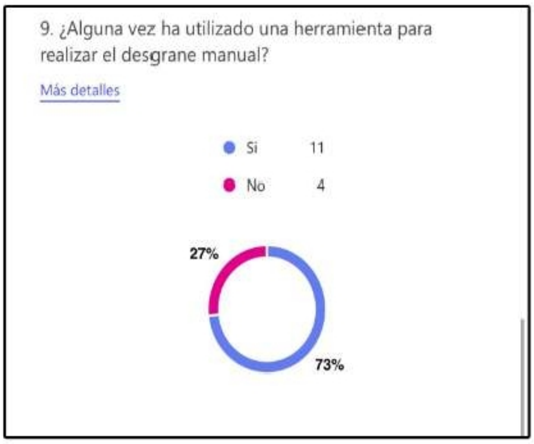


GRAFICA 5: LESIONES PRESENTADAS AL REALIZAR EL DESGRANE MANUAL DE MAZORCAS

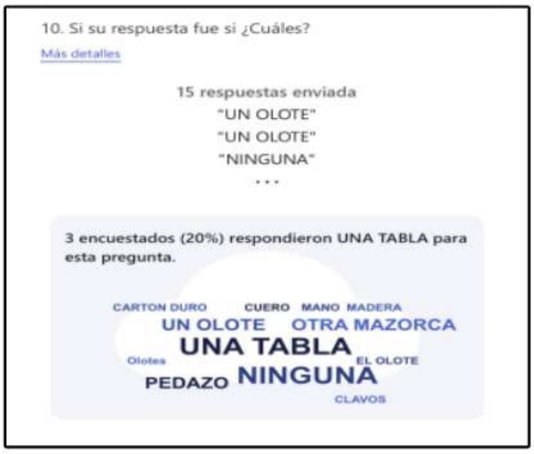


GRAFICA 6: CUANTAS OCASIONES SE HUBO LESIONES EL ÚTIMO AÑO

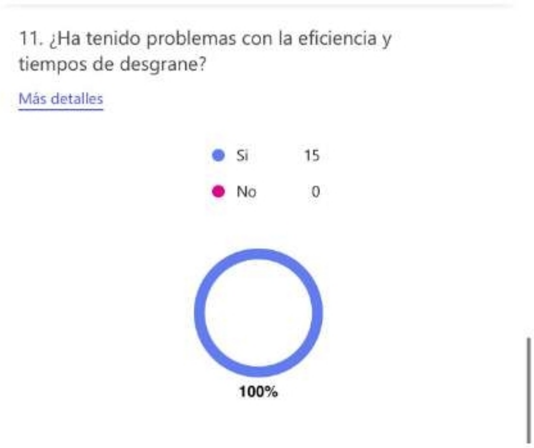
GRAFICA 7: QUE HERRAMIENTA SERÁ LA ADECUADA PARA REALIZAR EL DESGRANE MANUAL



GRAFICA 8: INDICE DE UTILIZACIÓN DE OTRAS HERRAMIENTAS PARAV EL DESGRANE MANUAL



GRAFICA 9: HERRAMIENTAS UTILIZADAS PARA REALIZAR EL DESGRANE MANUAL DE MAZORCAS



GRAFICA 10: CANTIDAD DE PROBLEMAS PRESENTADOS AL REALIZAR EL DESGRANE MANUAL

Source: Compiled by the author

GRAFICA 11: TIPOS PROBLEMAS PRESENTADOS AL REALIZAR EL DESGRANE MANUAL

GRAFICA 12: ¿USARIA ALGUNA HERRAMIENTA PARA FACILITAR EL DESGRANE MANUAL?

GRAFICA 13: CARACTERISTICA PRINCIPAL QUE DEBE CONTENER LA HERRAMIENTA PARA REALIZAR EL DESGRANE MANUAL

GRAFICA 14: PRECIO QUE ESTARÍAN DISPUESTOS A PAGAR POR LA HERRAMIENTA QUE LES FACILITE EL DESGRANE DE MAZORCAS

Source: Prepared by the author

ANALYSIS OF RESULTS AND PROTOTYPE DESIGN

According to the survey results, 80% reported experiencing hand pain upon completing the de-kerneling process, and 100% reported experiencing pain or fatigue in their hands, wrists, and arms. Sixty percent stated that the most important feature a manual de-kerneling tool should have is efficient de-kerneling, followed by 27% who chose ease of use. 100% reported having problems with efficiency and shelling times, and 73% said they had used a tool for shelling, noting that they had improvised such a tool using a corn cob, a piece of wood with nails, or a piece of cardboard. To address this problem, the decision has been made to develop an ergonomic glove with inlays that facilitates the de-kerneling of corn cobs. This invention is designed for people who work in the fields—small-scale farmers who, due to the nature of their work, need effective and accessible tools that minimize physical effort and injuries. Therefore, the plan is to develop an innovative glove, emphasizing the importance of a design based on the ergonomic needs of users, tailored to the tasks they perform daily in the fields—specifically, the shelling of corn cobs.

For the glove's design, anthropometric measurements were taken from 15 small-scale farmers in northern Sinaloa (the same farmers who completed the questionnaire). The dimensions considered were:

- Hand length
- Palm length
- Palm width
- Inner grip diameter

These measurements, obtained from a representative sample of potential users, are crucial to ensuring that the glove fits properly and provides optimal performance during shelling.

Anthropometric Measurements

The following table shows the anthropometric measurements collected from 15 small-scale farmers in northern Sinaloa, which will be used for the design and manufacture of the first prototype of the corn-de-kerneling glove. The table lists the anthropometric measurements taken into account: hand length, palm length, palm width, grip diameter, weight, height, and age.

Development of the First Prototype of the Corn-Shelling Glove

Based on these measurements, it was determined that the glove must adapt to individual variations using the 0.5 and 0.9 percentiles, as these are ergonomically the most optimal measurements for the majority of farmers.

The design process for the de-cobber glove began with identifying the ergonomic needs of the users, who are small-scale farmers in Sinaloa. Without access to advanced agricultural machinery, these farmers must perform manual tasks such as de-cobbing corn, which can lead to long-term health problems due to repetitive strain. Therefore, the main objective was to create an accessible, effective, and safe tool to reduce fatigue and improve productivity.

For the glove's design, anthropometric data from a sample of farmers in northern Sinaloa were taken into account, allowing the glove to be tailored to their anthropometric dimensions. Key measurements included hand length, palm length, and grip diameter, and the 0.5 and 0.9 percentiles were used to ensure that the glove would fit most users (0.5 for women and 0.9 for men).

Table 2. *Results of the anthropometric assessment conducted on 15 farmers.*

NOMBRE	LONGITUD DE LA MANO (cm)	LONGITUD DE LA PALMA (cm)	ANCHO DE LA PALMA A LA MANO (cm)	DIAMETRO DE AGARRE INTERIOR (cm)	PESO (KG)	ESTATURA (CM)	EDAD
[illegible]	16	10	8	4	67	171	20
[illegible]	16	12	8	3	112	170	45
[illegible]	17	10	8	4	120	170	41
[illegible]	17	11	8	4	82	201	19
[illegible]	17	11	8	3	110	187	20
[illegible]	17	10	8	3	81	170	37
[illegible]	15	10	7	4	96	185	35
[illegible]	16	10	8	3	85	184	40
[illegible]	16	11	8	3	85	170	66
[illegible]	16	11	8	3	84	174	43
[illegible]	16	10	7	4	82	180	41
[illegible]	16	10	7	4	85	173	39
[illegible]	16	10	7	4	101	187	37
[illegible]	16	9	8	4	60	185	19
[illegible]	15	10	7	4	70	184	41
PERCENTIL							
0.05	15	9	8	4			
0.5	16	10	7	4			
0.9	16	11	8	3			
PUNTO MAS ALTO	21	14	11	7	120	201	66
PUNTO MAS BAJO	17	9	8	4	60	164	19
PROMEDIO	17	10	7.5	4.5	80	170	40

Source: *Prepared by the authors.*

Once the measurements were collected, the materials were selected. The glove was designed using high-strength materials such as chain links with rounded edges to ensure efficient de-cobbing without damaging the corn kernels; it was also reinforced with plastic-steel to improve its durability.

Design and Materials of the Prototype Glove

The anthropometric measurements of the target users were essential for determining the glove's size and fit. This allows the glove to adapt to a variety of hand sizes and shapes, ensuring an efficient grip during the shelling process.

The optimal glove size was size 9 based on the anthropometric results using the 0.9 percentile, but a design was also created in size 7 using the 0.5 percentile, as this percentile is tailored to the female population.

DESIGN AND MATERIALS OF THE PROTOTYPE GLOVE

The glove prototypes are presented below: Size 7 (M):

- Hand circumference: 178 mm
- Hand length: 182 mm
- Palm width: 80 mm

Figure 1. *Sample of size 7 gloves.*

Source: Author's *own work.*

Size 9 (G):

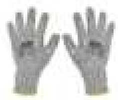
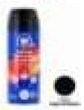
- Hand circumference: 218 mm
- Hand length: 200 mm
- Palm width: 90 mm

Image 2. *Sample of size 9 gloves.*

Source: *Prepared by the author.*

The materials used to make the gloves were as follows:

Table 2. *Materials used in the manufacture of the prototype glove.*

Guantes talla 7 y 0 	Eslabones de cadena 	Pinzas de corte 
Pegamento plasta-acero 	Hilo y Aguja 	Pintura en aerosol negra 

Source: *Compiled by the author.*

Taking into account the dimensions of the grains from northern Sinaloa—which on average are between 8 and 12 mm long, between 6 and 8 mm wide, and between 4 and 6 mm thick—we chose the following chain because it has small, rounded edges that gently push the grains one after another, ensuring they are not damaged during threshing.

Figure 3. *Shows the dimensions of the links*.

Source: *Prepared by the author*.

The goal is to weld them together and then reinforce them with a plastic-to-steel adhesive.

Prototype Development Procedure

1- Select the type of glove to be used, based on the 0.05 percentiles, which are more objective according to the anthropometric measurements taken for this redesign.

Figure 4. *Sample of the gloves used in the prototype.*

Source: Author's *own work.*

2- Select the type of links to attach to the glove, ensuring they have rounded edges so as not to damage the kernels when force is applied with the gloves during dehusking.

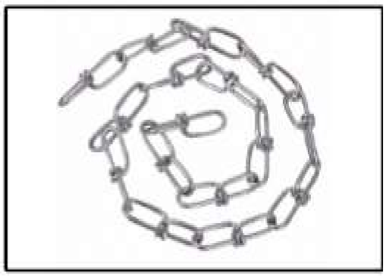


Figure 5. *Sample of the steel chain used in the prototype.*

Source: Author's *own work.*

3- Cut the chain to remove the links that will be used in the gloves.

Image 6. *Shows the cut links.*

Source: Author's *own work.*

4- Sew the links one by one until all the links for each glove are in place.

Image 7. *Shows the links being sewn onto the gloves.*

Source: *Created by the author.*

5- Apply Plasti-Steel adhesive to reinforce the links on the shelling gloves.

Image 8. *Shows the application of Plasti-Acero to the gloves.*

Source: *Created by the author*.

6- Paint the palm of the hand with non-toxic paint to prioritize user health.

Image 9. *Sample of size 9 gloves*.

Source: Author's *own work*.

7- The glove is ready for use by workers at small agricultural businesses.

How the Glove Works

The ergonomic corn-de-cobber glove allows the user to place the cob on the indentations and, with a simple downward motion, remove the kernels without having to apply much force. This design not only improves shelling speed but also reduces the risk of repetitive strain injuries, significantly decreasing strain on the hands and wrists and making work easier for people working in small agricultural businesses.

Preliminary Performance Tests

The first operational test of the first prototype of the de-cobber glove was conducted. The results were positive, as the cob was efficiently de-cobbed through a series of simple and effective movements on the cob that push the corn kernels in various directions. Since there is currently no ergonomic technique to reduce the injury rate during this task, however, the kernels embedded in the cob are successfully dislodged by the links, and this procedure is repeated with both hands, one at a time, since while one hand holds the cob, the other performs the shelling motion, with each hand handling its respective part of the cob.

Image 10. *Shows the preliminary operational test.*

Source: Author's *own work.*

Comprehensive Efficiency Tests

Comprehensive efficiency tests were conducted with various operators who work in different agricultural fields in the region where the surveys shown above were carried out. Their primary job is generally the manual shelling of corn cobs (as shellers), and they have a high level of experience in the studied work environment. On this occasion, the tests were performed by shelling a white corn cob.

However, it can be observed that the operator performs repetitive movements without following ergonomic principles because he is accustomed to working in this manner; nevertheless, he reported feeling significantly less fatigue and pain in his hands when using the shelling glove, as it prevents direct injury to his hands and exponentially improves efficiency during the shelling process.

Image 11. *Shows the comprehensive efficiency test.*

Source: Author's *own work.*

Explanation of the ergonomic de-kerneling technique

This section demonstrates the correct ergonomic technique for manually shelling corn on the cob more quickly and efficiently, with the primary goal of reducing shelling time and the risk of injury caused by repetitive, incorrect, or hazardous movements during manual corn shelling. This technique involves performing a series of downward movements, pushing the kernels off the corn cob so that they come into contact with the links embedded in the de-cobber glove, which help dislodge the kernels without damaging them thanks to the glove's rounded edges. the movements are performed with one hand at a time; while one hand holds the cob, the other hand pushes to detach the kernels, with each hand performing its task (detaching kernels) in its designated area.

Image 12. *Illustration of the ergonomic technique.*

Source: *Prepared by the author.*

Exhaustive performance tests using the ergonomic technique

The figure shows an agricultural worker performing manual corn cob shelling using a proposed ergonomic technique designed to prevent injuries. During the test, a very noticeable resistance to change was observed in the workers' shelling method, as some became frustrated or tried to twist their wrists at first—as they were accustomed to doing when shelling in the usual way—thus giving rise to these adaptability issues. However, after performing the task repeatedly, it was noted that their safety and personal satisfaction improved as they began to adapt to the new ergonomic technique for manual shelling, stating that it was incredibly easy to perform manual de-kerneling that way and, as a result, achieving much better results than expected—exceeding our expectations regarding how they would react when they began using the corn cob de-kerneling glove.

Image 13. *Sample of the comprehensive efficiency tests using the ergonomic technique.*

Source: *Prepared by the author*.

To monitor the effects of using the prototype corn-de-cob glove, a preliminary performance test was conducted with 15 users from northern Sinaloa; the survey administered to them is shown below.

1. Based on your experience using the prototype glove, do you consider it to be the ideal tool you needed for shelling corn cobs?
   a) Yes b) No
2. Do you feel that your productivity improved after using the shelling glove?
   a) Yes b) No
3. Did your safety and comfort improve while de-hulling corn cobs?
   a) Yes b) No

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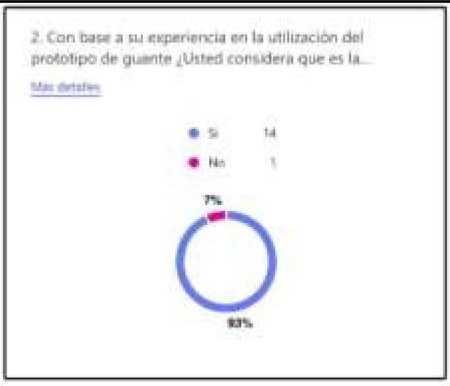
4. Do you feel that using the prototype glove reduced discomfort in your hands, wrists, and arms?
   a) Yes b) No

The following shows the results of the survey administered to the users involved in the prototype

Table 2. *Graphs showing the results of the questionnaires administered to farmers.*



GRAFICA 1: MUESTRA EL INDICE DE CONSIDERACION QUE ES LA HERRAMIENTA IDEAL QUE NECESITABA PARA REALIZAR EL DESGRANE

GRAFICA 2: MUESTRA EL ÍNDICE DE MEJORA DE LA PRODUCTIVIDAD DESPUÉS DE UTILIZAR EL GUANTE

GRAFICA 3: MUESTRA EL ÍNDICE DE INCREMENTÓ DE SEGURIDAD Y COMODIDAD AL UTILIZAR EL GUANTE

GRAFICA 4: MUESTRA LA DISMINUCIÓN DE MOLESTIAS EN MANOS, MUÑECAS Y BRAZOS

Source: *Prepared by the author.*

DISCUSSION AND ANALYSIS OF RESULTS

The results obtained from using the shelling glove were positive, as, based on the opinions of the operators (shellers) in the survey conducted with them, they reported experiencing a significant reduction (93%) in the effort required, since they no longer felt fatigue, pain, chafing, or discomfort in their hands thanks to the gloves they used; and the embedded chain links facilitated and improved manual shelling without damaging the product (grains), which gave them greater confidence in working quickly and efficiently without injuring their hands (100%). In addition, the implementation of the new technique was very helpful to them, since they previously used a technique that involved a lot of wrist rotation, whereas now they use a technique involving vertical movements, which reduces physical strain and improves the effectiveness of their work when manually shelling corn cobs.

CONCLUSIONS

The development of the de-kerneling glove represents an innovative solution for small-scale farmers who face the limitations of manual labor in the field. This design not only addresses users' ergonomic needs but also provides an affordable tool that facilitates the shelling of corn cobs. Adapting the glove to users' anthropometric measurements was a crucial step in ensuring its effectiveness and comfort, which translates into a significant reduction in the physical effort required and a lower incidence of injuries.

The use of durable materials and a modular design ensure the glove's longevity, making it an efficient tool for small-scale agricultural work. Field tests demonstrate that this glove can improve the productivity of small-scale farmers by reducing the time and energy required to shell corn cobs. Furthermore, by focusing on the real needs of agricultural workers, this project underscores the importance of ergonomics in the design of agricultural tools.

Furthermore, 100% of the workers reported feeling less fatigue and pain in their hands when using the de-cobber glove; de-cobbing efficiency was also improved thanks to the implementation of the recommended technique for proper de-cobbing, eliminating the need for risky movements that could harm the worker performing manual de-cobbing.

In short, this project offers an accessible and effective alternative for small-scale producers who need to optimize their production processes without resorting to expensive machinery. The shelling glove not only makes daily work easier but also has the potential to improve working conditions in the field, making agricultural tasks more sustainable and less strenuous.

Excellent results have been obtained following various tests conducted with farm workers.

PROPOSALS FOR FUTURE WORK

The glove's objective was met; however, some observations arose that are of utmost importance to consider for improving the prototype. For example:

- An illustrated manual on the correct use of the glove using ergonomic techniques.
- Verify the glove's functionality.
- Conduct exhaustive efficiency tests.
- Implement measurement techniques (force, resistance, durability).
- Improve the design of the prototype glove based on national and international standards and regulations.

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