

AVANCES EN LA MEJORA GENÉTICA

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Bogotá, Colombia
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Con un monje y sus garbanzos...

Un comienzo simple

Una perspectiva robusta

La semejanza entre parientes



<u>Character</u>	<u>Traits</u>	
Seed shape	 Round	 Wrinkled
Seed color	 Yellow	 Green
Pod shape	 Inflated	 Constricted
Pod color	 Green	 Yellow



Objetivo de la Mejora Genética en la Producción de Carne de Cerdo



Incrementar la frecuencia de genes favorables en una población lo que conduce a cambios deseables en características importantes para una producción rentable, sustentable y con atributos que satisfagan al consumidor

El Cerdo Ideal (2007)



•Cerde

- Resistente a PRRS y mayor robusticidad en general
- Temperamento no agresivo
- Buena calidad de aplomos, menos frágil
- Larga vida productiva (7+ camadas)
- Camadas grandes y lechones uniformes; baja mortalidad pre y post-destete; progenie de alto crecimiento y cerdas blancas

El Cerdo Ideal (2007)



•Cerdo a Mercado

- Resistente a PRRS
- Robusto con requerimiento menor / nulo de antibióticos, vacunas.
- Excelente eficiencia de conversión, reducir costo así como excretas de P y N
- Cantidad alta de carne magra y de buena calidad para venta
 - Características superiores de cocinar y sabor exquisito
- Crecimiento rápido pero consistente

Mejoramiento Genético



1972



379 kg



100 kg

CA: 3.80



60%

2017



273 kg



128 kg

CA: 2.23

**190kg de alimento x 1,000 cerdos vendidos =
iiiiii 190 ton. de alimento ahorrado!!!!**



Mejoramiento Genético

Selección para el crecimiento magro



1980

2005



NC STATE UNIVERSITY

Mejora en Prolificidad



- De 1995 a 2010 (**15 años**) Cerdos/Hembra/Año aumentó **6.6 cerdos**
- En los últimos **7 años** los Cerdos/Hembra/Año aumentó **5 cerdos**

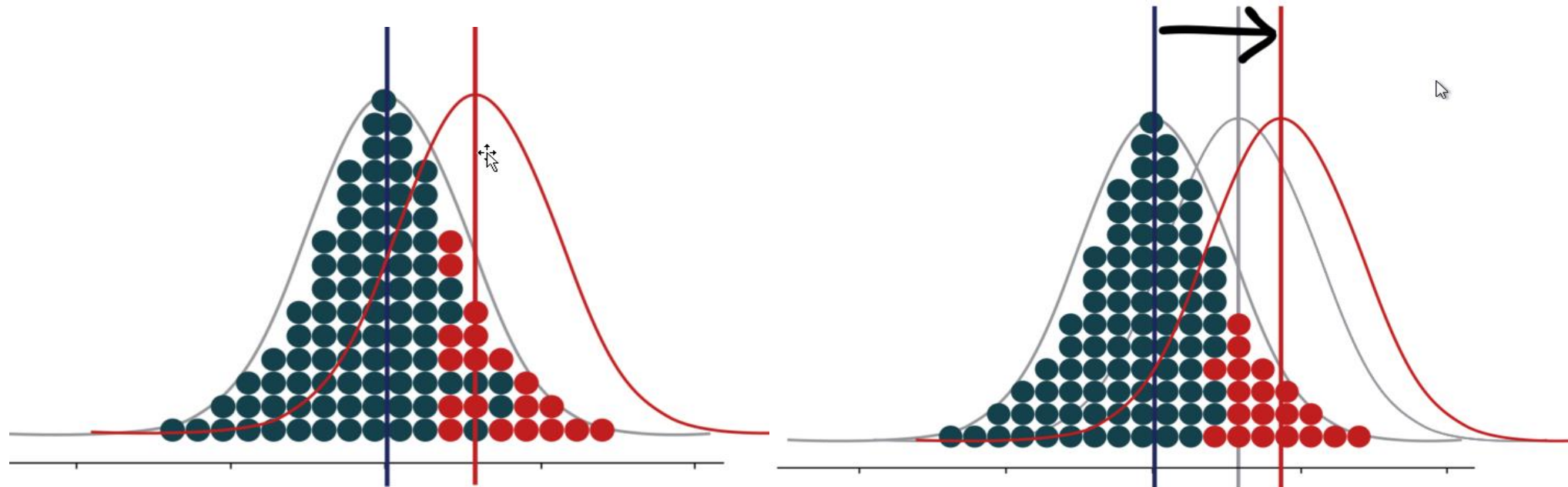


¿Cómo acelerar el Mejoramiento Genético?



$$\Delta G = \frac{\text{Precisión} * \text{Intensidad} * \text{Index STD}}{\text{Generation Interval}}$$

Mayor Precisión a la selección significa mayor ganancia para la próxima generación.

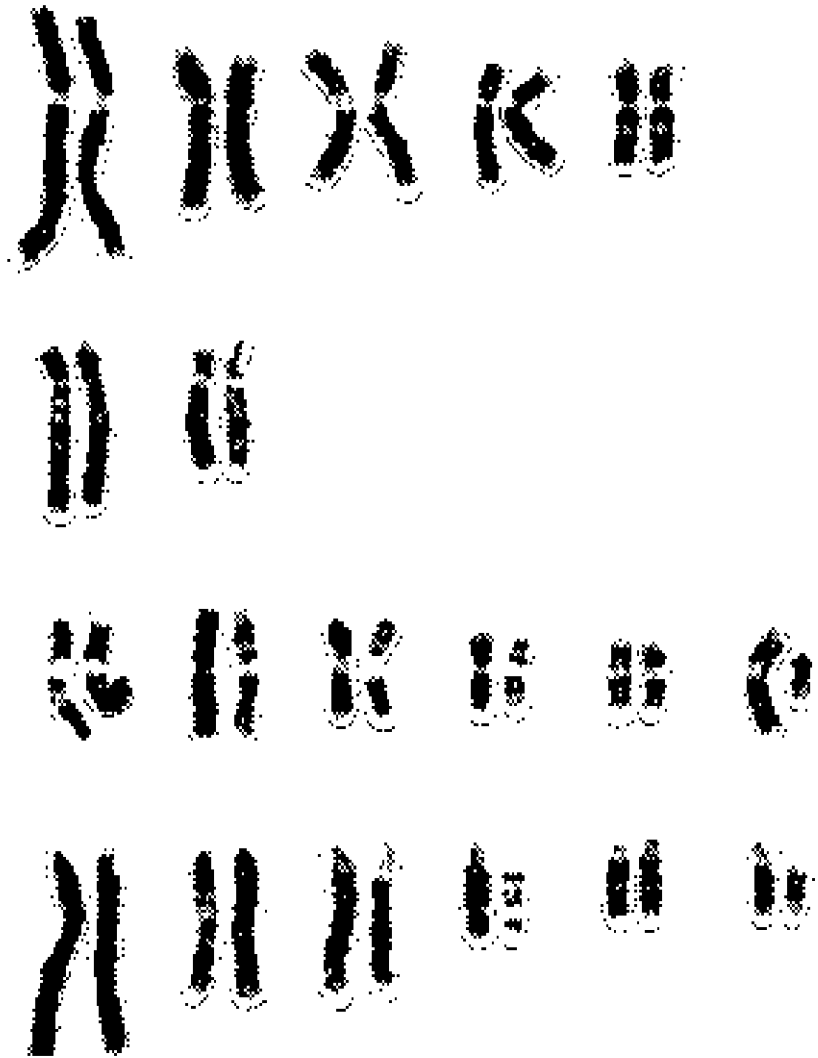


Genética Molecular y Cría de Cerdos



El Genoma del Cerdo

- De 2 a 3 mil millones de pares de base
- De 25 a 30 mil genes



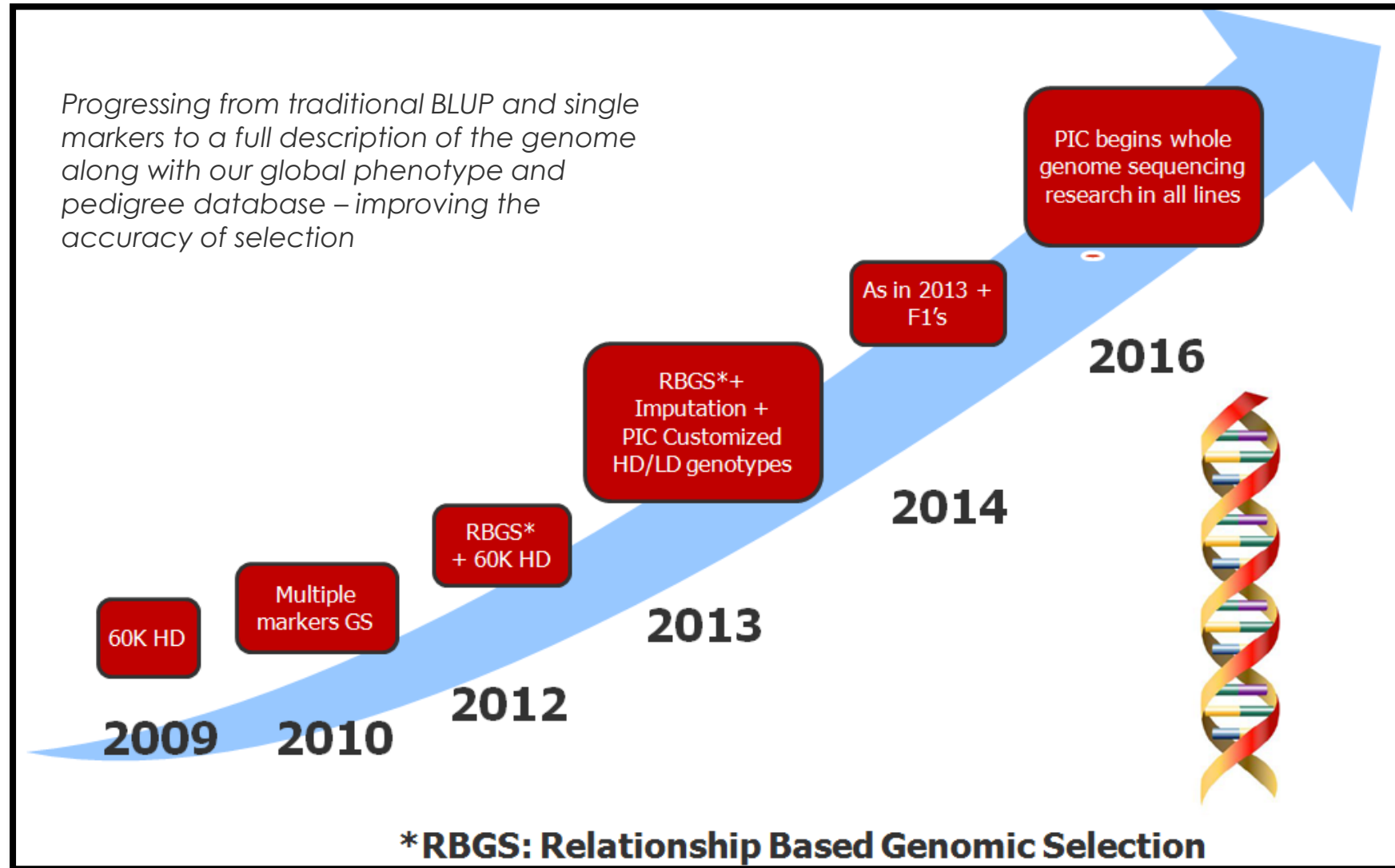
Genómica- Información del ADN



Existe información codificada en el ADN que puede ser utilizada para incrementar la precisión en la selección

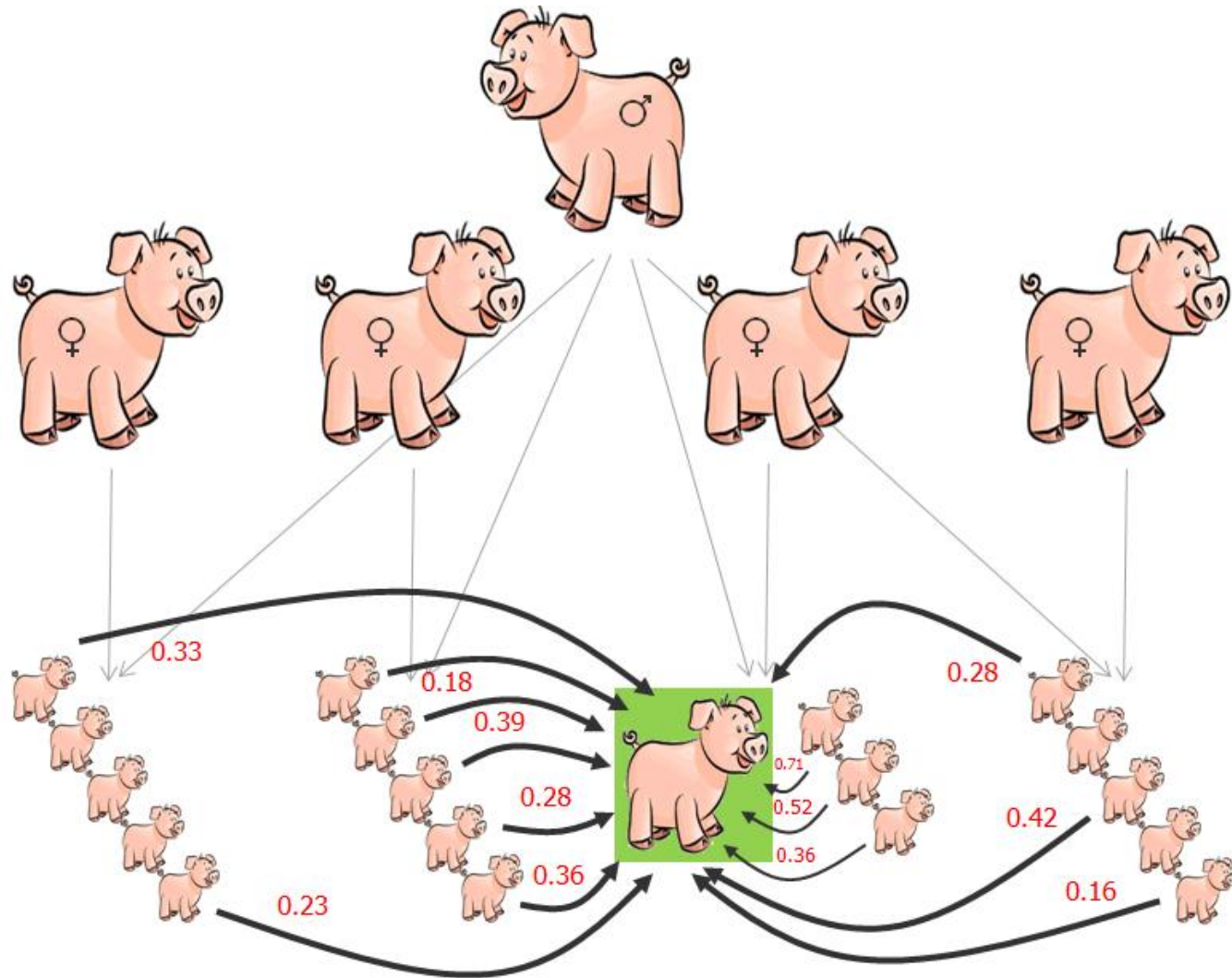


Nunca dejamos de mejorar



6 porkcalidad

Evaluación de la Genética



Utilizando la genómica para estimar con mayor precisión el grado de parentesco entre individuos!!

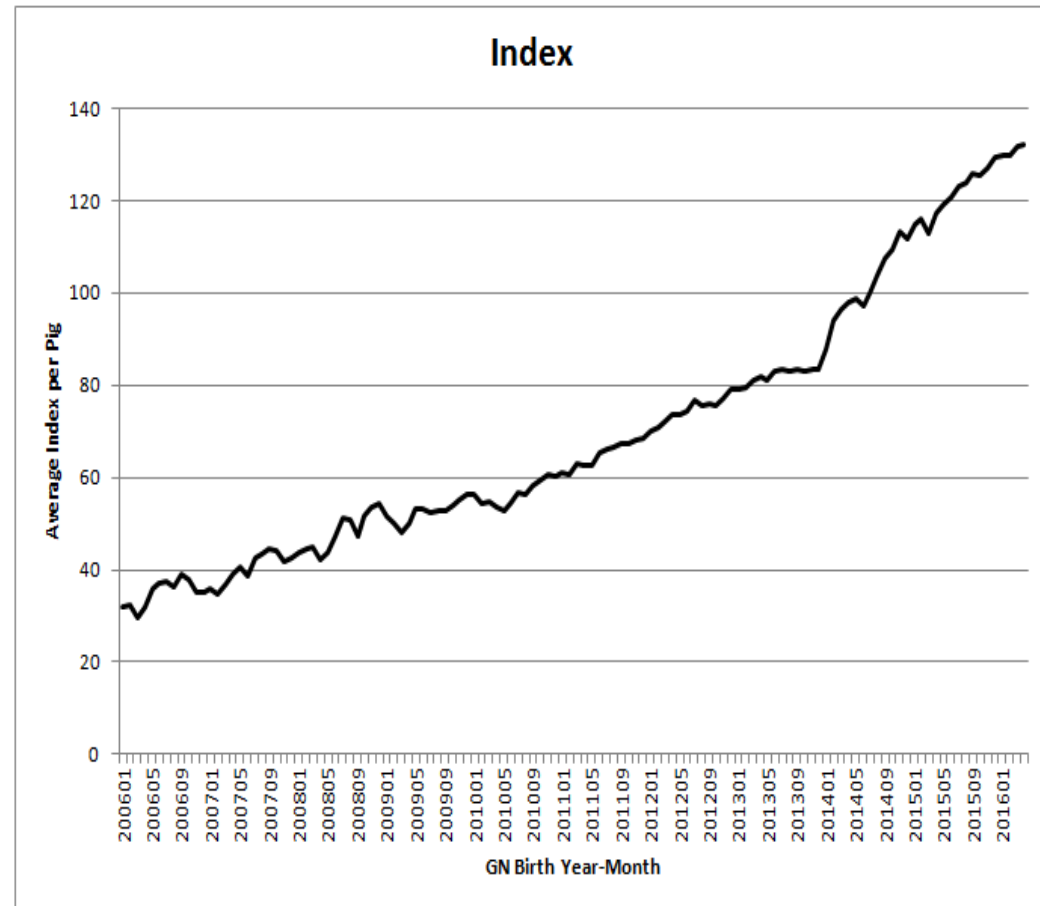
Algo revolucionario en la industria de mejora genética animal!

Acelerando la mejora...

Medir lo que se quiere mejorar



- Grandes poblaciones
- Mejor ciencia
- Medición enfocada en el éxito comercial
- Selección basada en el éxito a nivel comercial

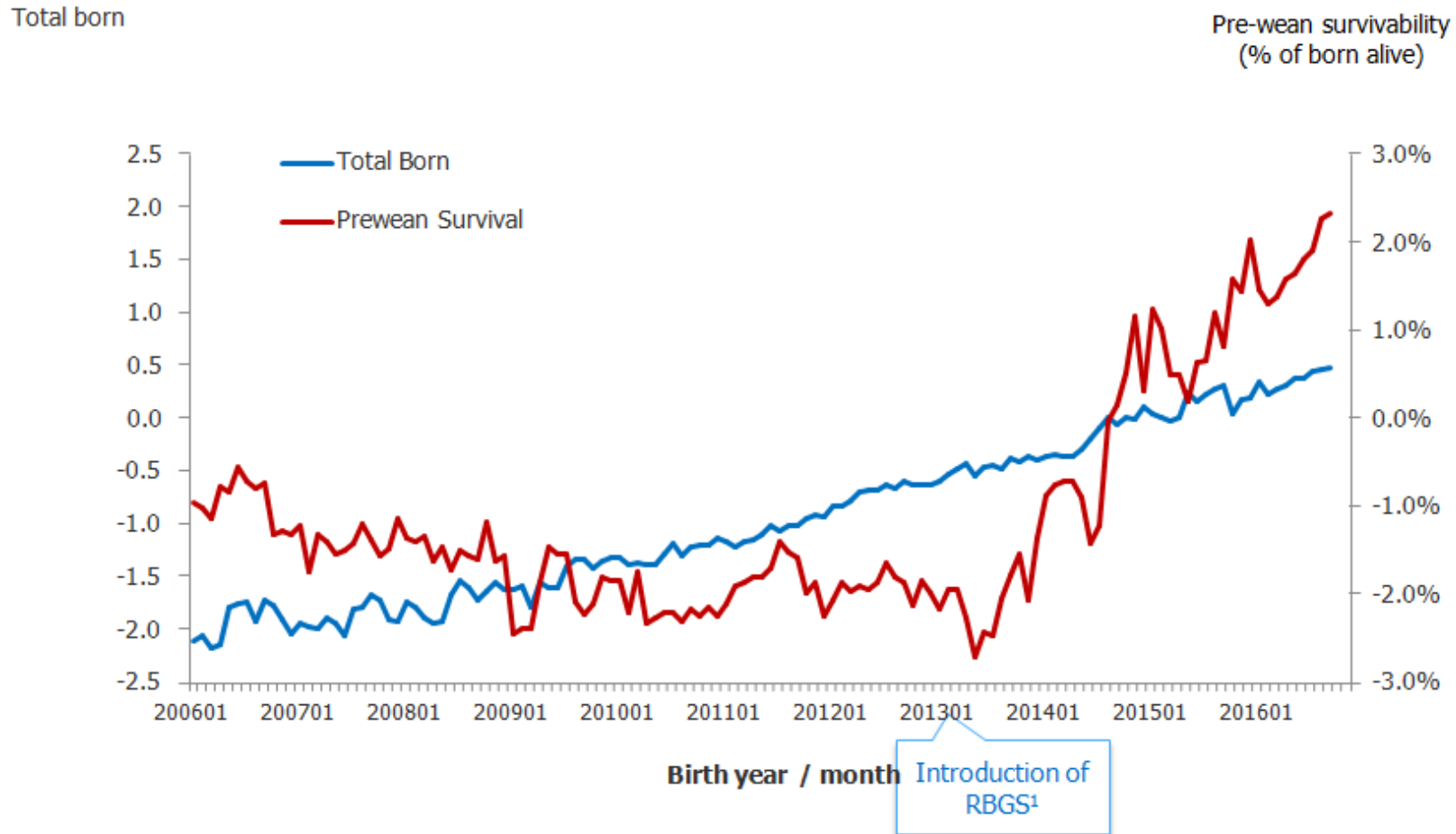


Acelerando la mejora...

Nacidos Totales y % MPD



Genetic improvement in pre-wean survivability and total born
(PIC Genetic Nucleus)



1. Relationship based genomic selection
Source: PIC L02, L03 pure lines (Camborough)



LA SIGUIENTE OLEADA DE INNOVACIÓN

¿Qué sigue?

Secuenciación completa del Genoma



•Impacto

- Mayor precisión en la selección
- Variantes causales
- Captura de mutaciones “de-novo”
- Objetivos de la Biología Molecular



¿Qué sigue?

Edición de Genes



¿Qué sigue?



This Gene-Editing Tool Could Destroy Zika Virus

CRISPR may help us edit dangerous female mosquitoes out of the population, preventing the spread of Zika

[Share this](#) [Tweet this](#)

By Joshua A. Krisch on Feb 17, 2016 at 3:45 PM



Aedes aegypti mosquito perches on a leaf in Costa Rica (REUTERS)

DAILY NEWS 5 November 2015

Gene editing saves girl dying from leukaemia in world first



Ad

Layla is doing well so far
Sharon Lees/GOSH

For the first time ever, a person's life has been saved by gene editing.

One-year-old Layla was dying from leukaemia after all conventional treatments failed. "We didn't want to give up on our daughter, though, so we asked the doctors to try anything," her mother Lisa said in a statement released by Great Ormond Street Hospital in London, where Layla (pictured above) was treated.

¿Qué sigue?

Entrega de un valor único

CORRESPONDENCE



Gene-edited pigs are protected from porcine reproductive and respiratory syndrome virus

To the Editor:

Porcine reproductive and respiratory syndrome (PRRS) is the most economically important disease of swine in North America, Europe and Asia, costing producers in North America more than \$600 million annually¹. The disease syndrome was first recognized in the United States in 1987 and described in 1989 (ref. 2). The causative agent, porcine reproductive and respiratory syndrome virus (PRRSV), was subsequently isolated and characterized in Europe in 1991 (ref. 3). Vaccines have been unable to control the disease. It has been suggested that

disease syndrome and porcine circovirus-associated disease, and can establish a lifelong subclinical infection⁶. In 2006, a more severe form of the disease, called highly pathogenic PRRS, decimated pig populations throughout China⁷. Although genetic selection for natural resistance is an option, success to date has been limited, possibly due to the genetic diversity of the virus⁸.

It had been proposed that PRRSV infects alveolar macrophages using the surface protein SIGLEC1 (CD169) as the primary viral receptor⁴. In this proposed model, after binding to CD169 and being taken

homologous recombination and somatic cell nuclear transfer) were infected with PRRSV and compared with infected wild-type pigs, no difference in virus replication was found⁹. To test the role of CD163 in infection, we previously created 45 live-born piglets with insertions ranging from 1 bp to 2 kb, deletions from 11 bp to 1.7 kb, as well as a partial domain swap in *CD163* using CRISPR-Cas9 technology⁵.

One founder male and one founder female, both of whom had mutations in exon 7 of *CD163*, were bred to produce offspring (Supplementary Methods). The founder

Resistencia al virus PRRS

Visión de alto nivel

- Los cerdos fueron creados con menor edición de nucleótidos en su ADN existente
- No se insertó ningún ADN nuevo o extraño en los cerdos

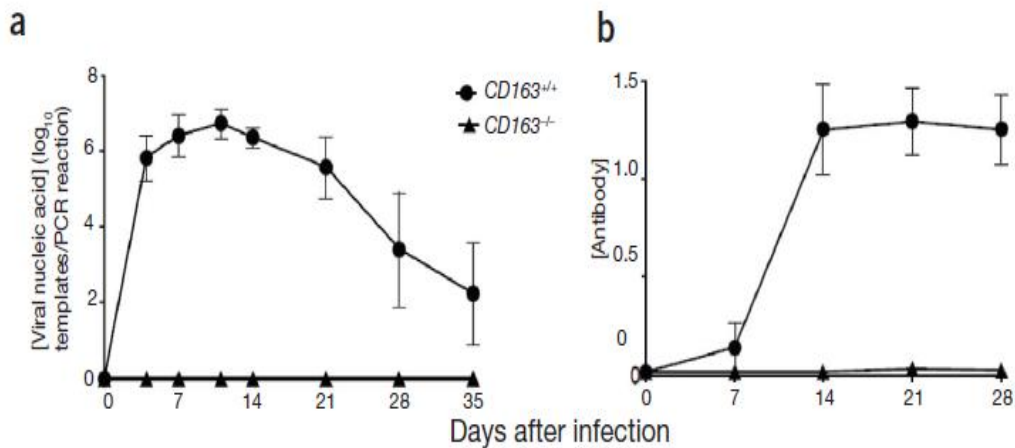


Figure 3 PRRSV-specific nucleic acid and antibody. (a,b) Mean and s.d. of PRRSV nucleic concentrations (a) and antibody (b) in serum from *CD163^{+/+}* ($n = 7$) and *CD163^{-/-}* ($n = 3$) pigs (one replication) are shown. Sample to positive ratio = the median fluorescent intensity (MFI) of the sample divided by the MFI of the positive control.

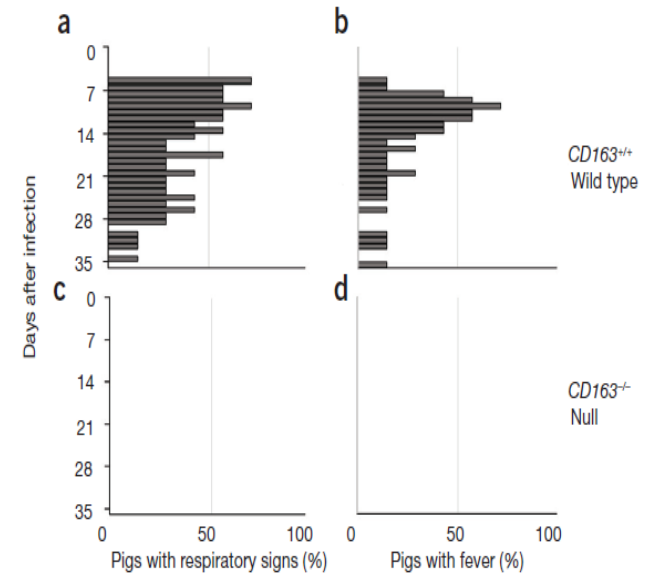


Figure 1 Clinical signs during acute PRRSV infection. (a-d) Results shown are compiled daily assessments for the presence of respiratory signs and fever for *CD163^{+/+}* ($n = 7$) and *CD163^{-/-}* ($n = 3$) pigs. The percentage of pigs with respiratory signs (a,c). The percentage of pigs with a fever (b,d). Fever was considered positive if it was ≥ 104 °F (normal body temperature, 101.6–103.6 °F). Respiratory scores ranged from 0: normal, to 1: mild dyspnea and/or tachypnea when stressed (when handled), 2: mild dyspnea and/or tachypnea when at rest, 3: moderate dyspnea and/or tachypnea when stressed (when handled), 4: moderate dyspnea and/or tachypnea when at rest, 5: severe dyspnea and/or tachypnea when stressed (when handled), 6: severe dyspnea and/or tachypnea when at rest. The percentage of piglets that had a fever or any sign of respiratory stress (a score of ≥ 1) at the various days of the challenge are shown. Note that the *CD163^{-/-}* piglets displayed no signs of either respiratory stress or fever.



Sin virus PRRS...

- Mejora el rendimiento de la granja
- Camadas de lechones más saludables y robustas.
- Mejora la mortalidad pre-destete
- Mejor rendimiento del cerdo en crecimiento y eficiencia en la alimentación
- Se reduce la interacción de la enfermedad



Alimentar al mundo...



Producir más con menos....

1960

1,5 Ha. arables/persona

Hoy

0,8 Ha. arables/persona

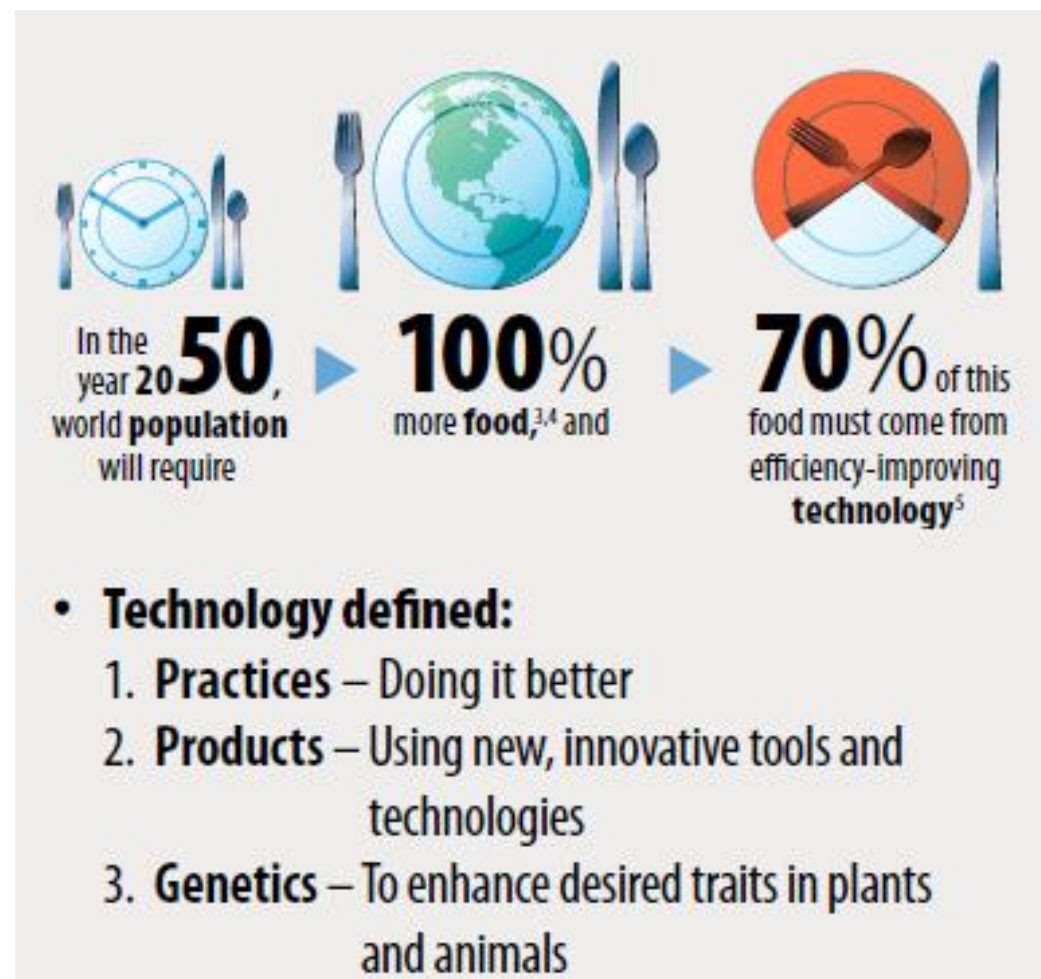
La tierra arable disminuye 1% cada año, producto de la erosión y urbanización

Para alimentar al mundo...

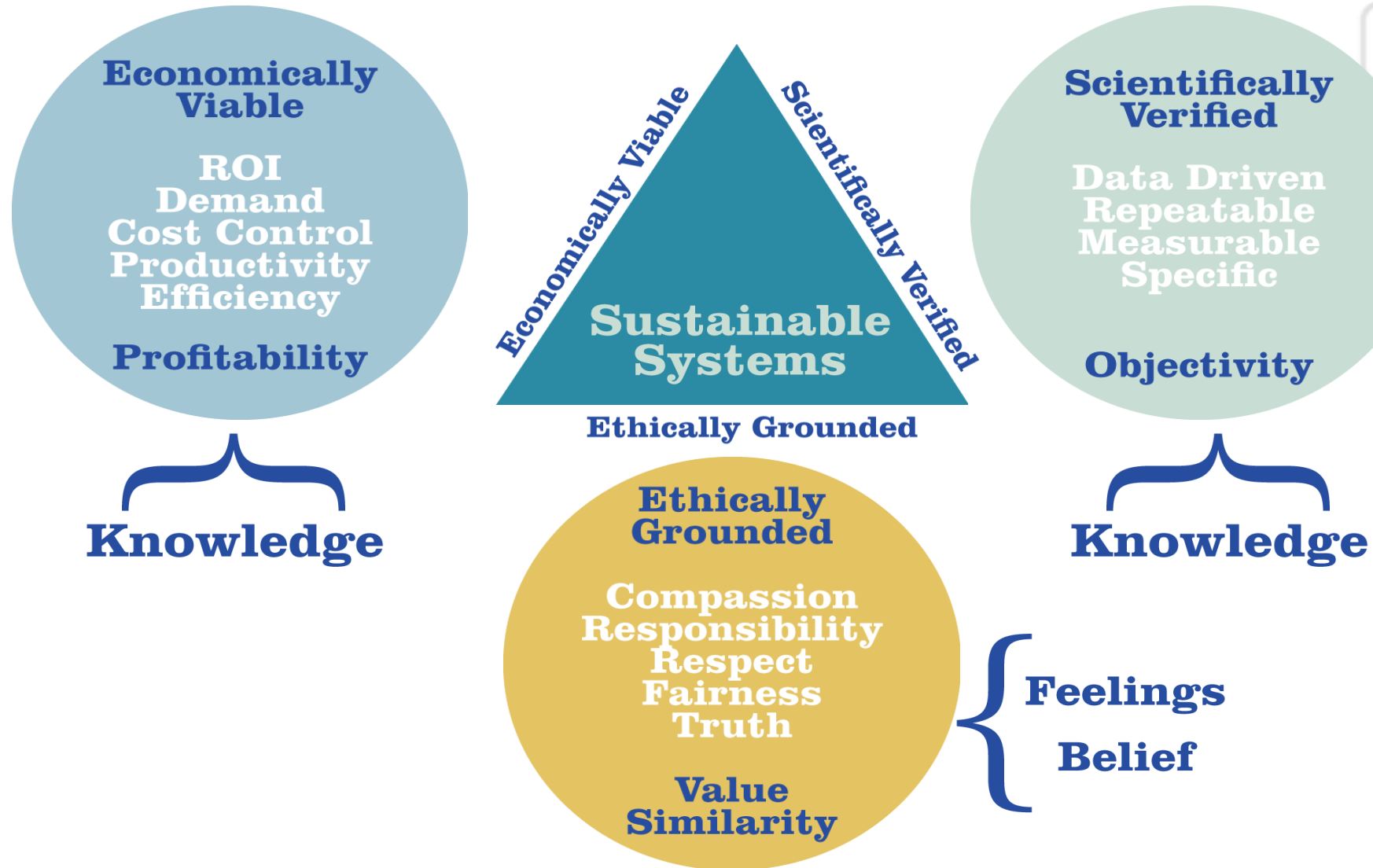
Para el año 2050, necesitaremos un 100% más de alimentos.

De acuerdo a la **FAO**, un 70% de este incremento provendrá de **tecnologías** que aumenten la eficiencia

Fuente: *The Three Rights: Food, Choice, Sustainability*



Balance sustentable



Principales preocupaciones del consumidor por segmento



Moms

- Rising Cost of Food (8.71)
- Keeping Healthy Food Affordable (8.65)
- Rising Healthcare Costs (8.51)
- Rising Energy Costs (8.35)
- Food Safety (8.29)
- U.S. Economy (8.28)

Millennials

- Keeping Healthy Food Affordable (8.18)
- Rising Cost of Food (8.13)
- Rising Healthcare Costs (8.09)
- U.S. Economy (8.01)

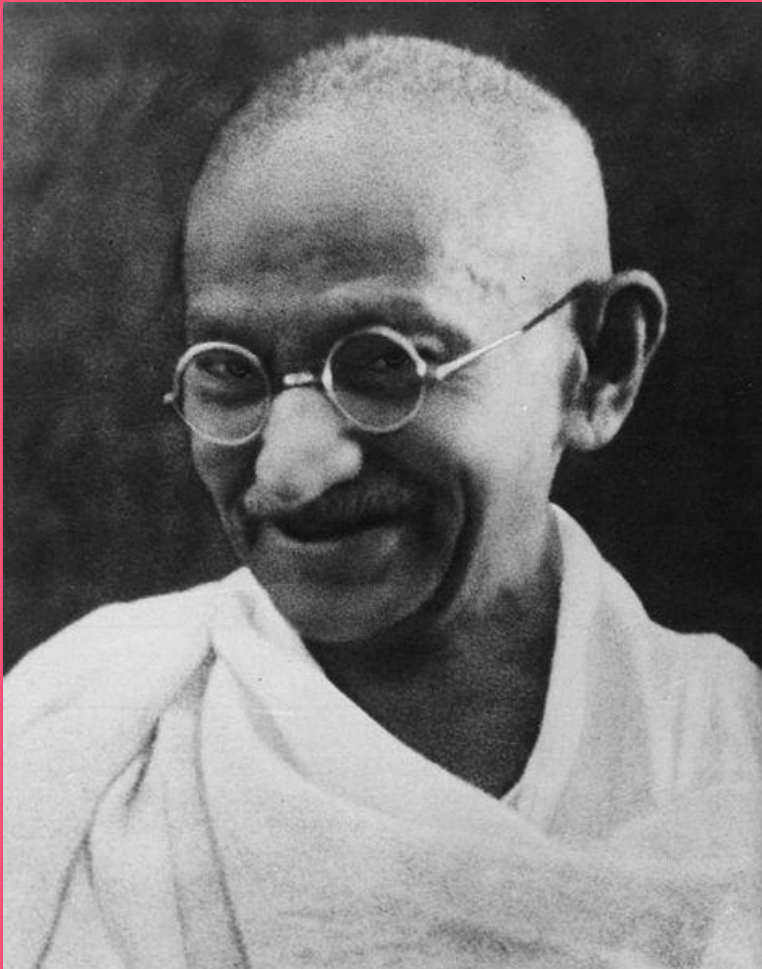
Early Adopter

- Keeping Healthy Food Affordable (8.55)
- Rising Healthcare Costs (8.50)
- Rising Cost of Food (8.47)
- The U.S. Economy (8.44)
- Rising Energy Costs (8.29)

Foodies

- Keeping Healthy Food Affordable (9.27)
- Food Safety (9.18)
- Rising Cost of Food (9.10)
- Rising Healthcare Costs (9.08)
- U.S. Economy (9.08)

¡GRACIAS POR SU ATENCIÓN!



“El futuro depende de lo que hacemos en el presente”

Mahatma Gandhi (1869 – 1948)

