Precision crossbreeding for smallholder dairies: an investment in our future

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Today's Agenda

01 **ABOUT US**

02 **OPPORTUNITIES**
Challenges & Solutions for smallholder dairies

03 **VISION**
How can we impact lives of all producers

04 **COMMERCIALIZATION**
Getting animals into working position

01

About Us

Our History

Recombinetics HQ in Eagan, MN

- Parent company founded in Minnesota in 2008
- Now has 35 employees
- The main platform is developing applications for gene edited livestock cells
- Primary focus is on human longevity using edited animal cells for xenotransplantation and and developing models of human disease
- Acceligen is a subsidiary of RCI formed in 2013
- Applications focused on genetic improvement of food animals
- Actively working on 12 traits in cattle, swine, and fish

OUR TIMELINE

PROOF OF CONCEPT ANIMALS

Many 1st's
For Naturally Occurring Traits

6

5

4

3

2

1

2013

Enhanced Muscle

2014

Allergen Free cattle NZ
Genetic Castration in pigs

2015

Polled calves

2017

Polled Progeny
FMDV Resistant Swine

2018

Slick Angus
Brazil

2019

AUS Polled Progeny
Castration Free Swine

Company Mission

At Acceligen, we care about the animal health and well-being during production to provide sustenance to the world. Healthier livestock means healthier people and a healthier planet. We strive to improve animal genetics to better all livelihoods.

Our team of experts is pursuing solutions to global food security, an urgent issue as populations rise, cropland shrinks, and the climate changes.

Better Animals for a Better Planet

02

Opportunities

nature

To end hunger, science must change its focus

Policymakers need research on ways to end hunger. But a global literature review finds most research has had the wrong priorities.

How can research help to end hunger? One way to answer this question is to assess published research on hunger, and determine which interventions can make a difference to the lives of the 690 million people who go hungry every day.

That's what an international research consortium called Ceres2030 has been doing[1]. And the results of its 3-year effort to review more than 100,000 articles are published this week across the Nature Research journals[2] (see go.nature.com/3djmppq). The consortium's findings – coming just days after this year's Nobel Peace Prize was awarded to the World Food Programme – are both revealing and concerning.

The team was able to identify ten practical interventions that can help donors to tackle hunger, but these were drawn from only a tiny fraction of the literature. The Ceres2030 team members found that the overwhelming majority of agricultural-research publications they assessed were unable to provide solutions, particularly to the challenges

> "Of some 570 million farms in the world, more than 475 million are smaller than 2 hectares."

from the Ceres2030 team's findings includes the striking statement that "most of the included studies only involved researchers without any participation from farmers"[5].

So why aren't more researchers answering more practical questions about ending hunger that are relevant to smallholder farmers? Many of the reasons can be traced to the changing priorities of agricultural-research funding.

During the past four decades, funding provision for this type of research has been shifting towards the private sector, with more than half of funding now coming from agribusinesses, according to the work of Philip Pardey, who researches science and technology policy at the University of Minnesota in Saint Paul, and his colleagues[6].

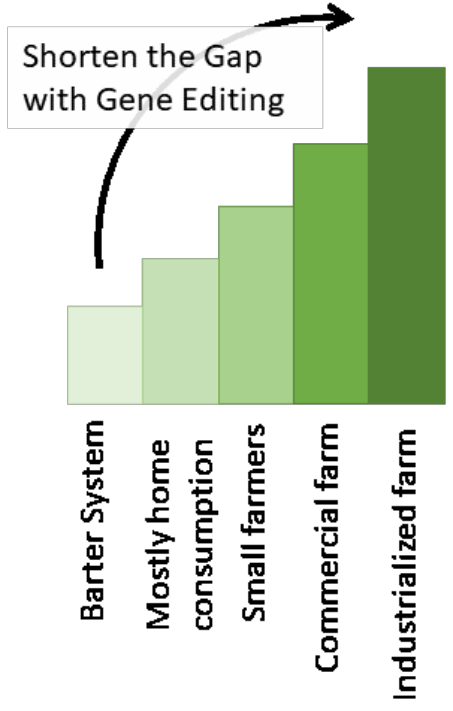
Small is less desirable

At the same time, applied research involving working with smallholder farmers and their families doesn't immediately boost an academic career. Many researchers – most notably those attached to the CGIAR network of agricultural research centres around the world – do work with smallholders. But in larger, research-intensive universities, small is becoming less desirable. Increasingly, university research-strategy teams want their academics to bid for larger grants – especially if a national research-evaluation system rewards those who bring in more research income.

Publishers also bear some responsibility. Ceres2030's co-director, Jaron Porciello, a data scientist at Cornell University in Ithaca, New York, told *Nature* that smallholder-farming research might not be considered sufficiently original, globally relevant or world-leading for journal publication. This lack of a sympathetic landing point in journals is something that all publishers must consider in the light of the Ceres2030 team's findings.

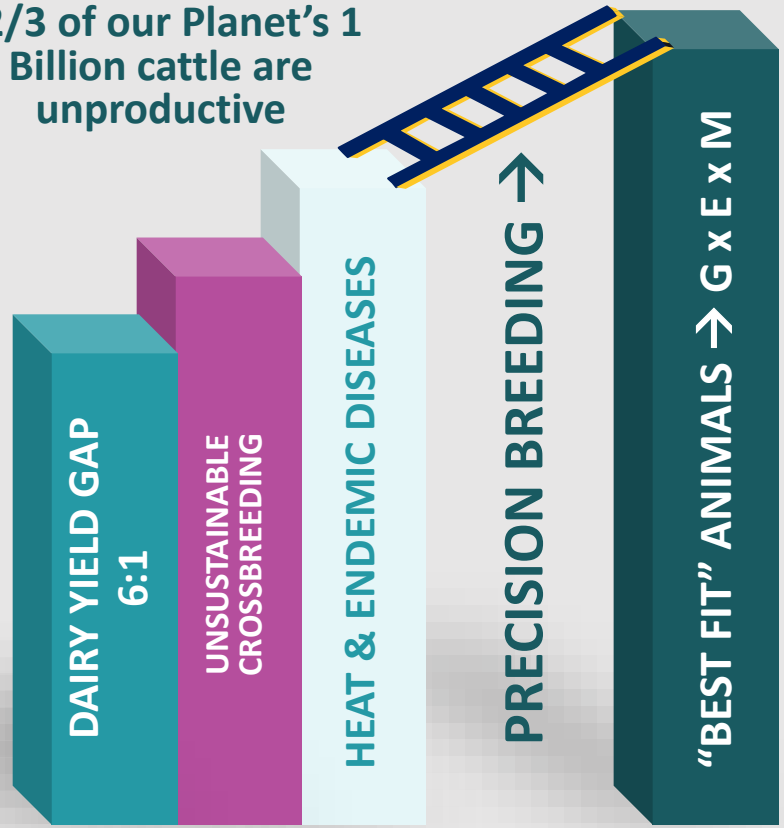
The Ceres2030 collaboration is to be congratulated for

2/3 of the global cattle population are in this zone
800 million "non-productive" cattle
Held by 300 million small holders

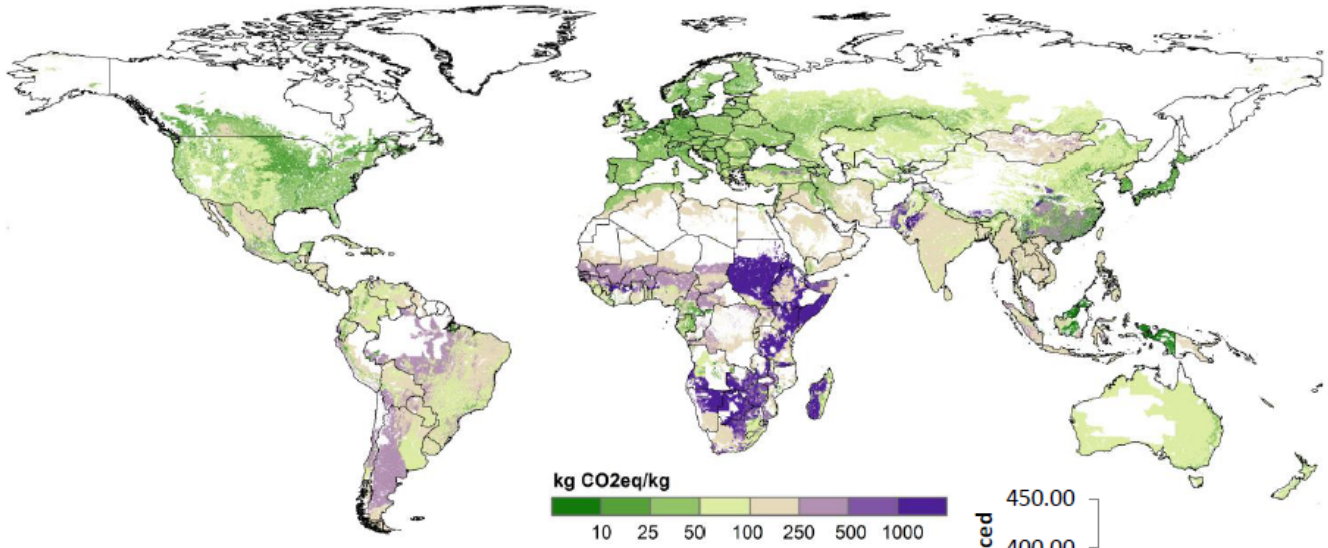


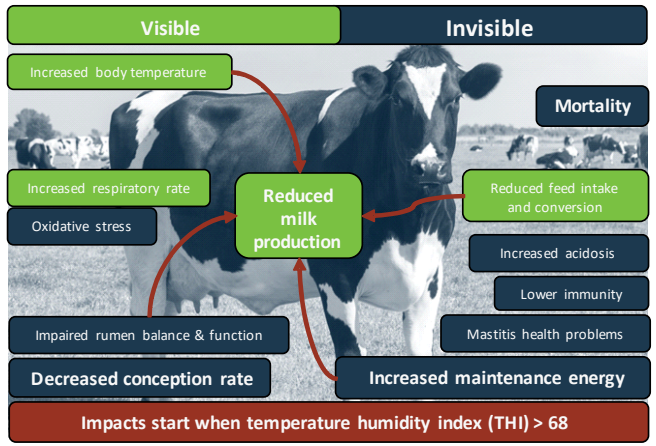
Bridge The GAP With Gene-Editing

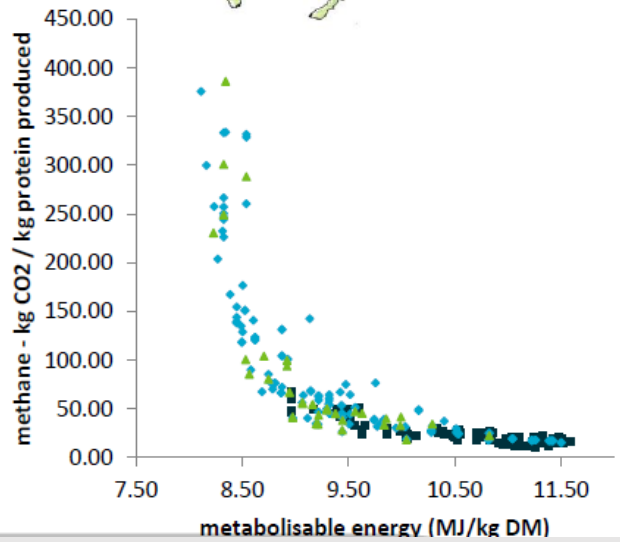
~2/3 of our Planet's 1 Billion cattle are unproductive



Global greenhouse gas efficiency per kilogram of animal protein produced







Time for history to repeat itself

- The birth of traditional animal selection
- 18th Century pressures of industrial revolution
- New methods of line breeding and selection to double animal size from 350 to 700 lbs

- The emergence of modern animal breeding
- 21st Century pressures of the information age
- New methods to complement the old that remove inefficiencies of crossbreeding

Robert Bakewell

ROBERT BAKEWELL was born in 1725 at Dishley, Leicestershire, England. He died October 1, 1795, at Dishley. Bakewell was an agriculturist who revolutionized sheep and cattle breeding in England by methodical selection and inbreeding. He was the first to improve animals for meat production and carcass quality.

Bakewell's father was a farm manager, with a farm of 440 acres (178 hectares) at Dishley. As a young man, Bakewell traveled about the country learning agricultural techniques and studying the anatomy of animals when it was a relatively unknown subject. He returned to the farm of his ailing father, who died in 1760. The younger Bakewell, as the first son with the hereditary right from his father, then assumed the management of the Dishley estate as a country gentlemen. He gathered useful stock from extensive horseback trips, welded them into a breed by deliberate and intensive inbreeding to fix type. There Bakewell became one of the first to breed both sheep and cattle for meat; previously the animals were bred primarily for wool or work. He developed the Leicestershire sheep and Longhorn cattle into good meat producers, but they were poor suppliers of milk and the cattle were later supplanted by the Shorthorns bred by the Colling Brothers. He also bred Shire horses and the Small White pig. Bakewell was very secretive about his work.

03

Vision

PROJECT OVERVIEW

- Primary outcome

Generate dairy animals that will bring about significant and sustainable production gains for African dairy production systems.

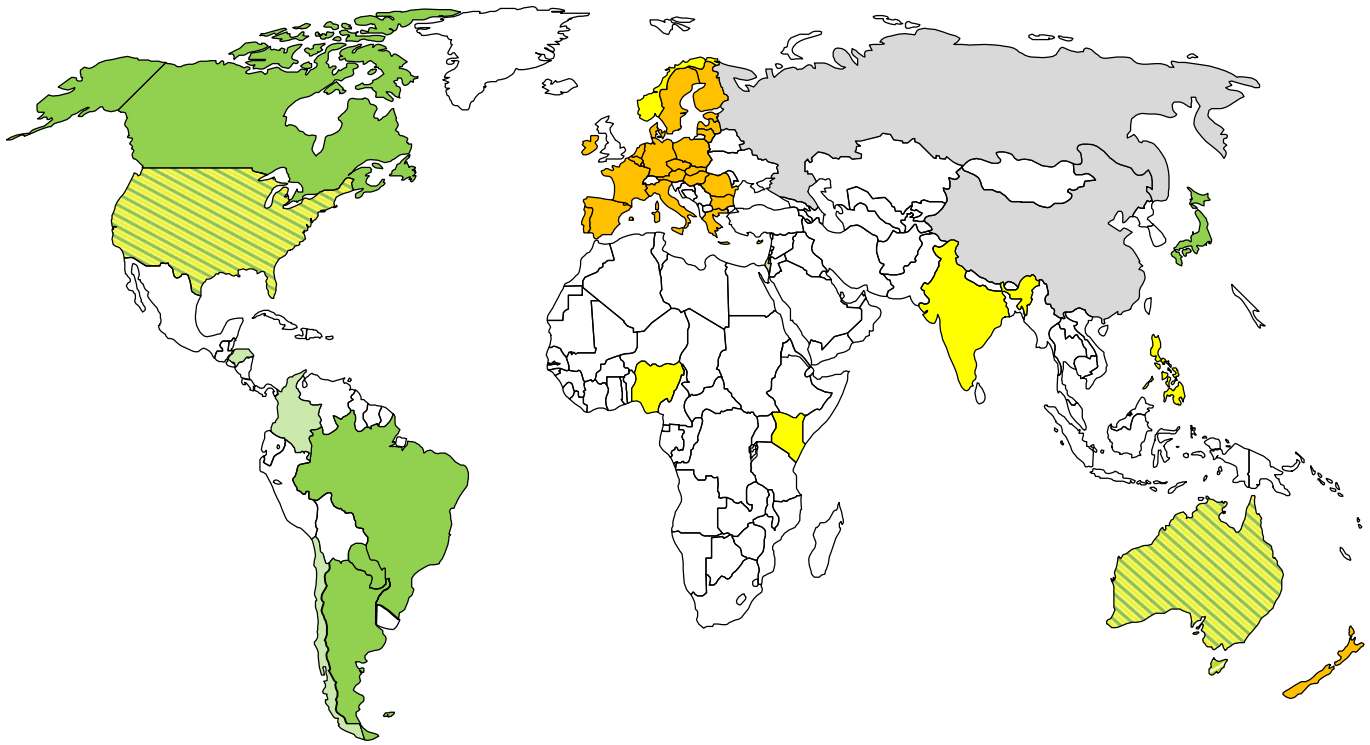
- These animals will have novel sequence variants delivered through a multiplex gene editing platform.

04

COMMERCIALIZATION

PIPELINE to REVENUE

Markets Open to Acceligen



- Countries with regulatory policy with exclusions
- Countries with **pending** policies, regulations, or legal rulings
- Countries with GMO only policy with no exclusions
- Countries with regulatory policy with exclusions (plants only)

República Argentina - Poder Ejecutivo Nacional
2020 - Año del General Manuel Belgrano

Nota

Número: NO-2020-38379730-APN-SABYDR#MAGYP

CIUDAD DE BUENOS AIRES
Martes 16 de Junio de 2020

Referencia: EX-2020-08019518- -APN-DGDMA#MPYT. Animal vacuno con tolerancia térmica mejorada, obtenido utilizando TALEN.

A: Dr. Daniel Sammartino (KHEIRON S.A.),

Con Copia A: Agustina Ines Whelan (DB#MPYT),

República Argentina - Poder Ejecutivo Nacional
2020 - Año del General Manuel Belgrano

Nota

Número: NO-2020-38379874-APN-SABYDR#MAGYP

CIUDAD DE BUENOS AIRES
Martes 16 de Junio de 2020

Referencia: EX-2020-08018836- -APN-DGDMA#MPYT. Animal vacuno con tolerancia térmica mejorada y mocho utilizando TALEN.

A: Dr. Daniel Sammartino (Kheiron S.A.),

Con Copia A: Agustina Ines Whelan (DB#MPYT),

Commercial activities – Fertility characterization & African Deployment

TRANS OVA genetics


Bull HA1


Bull HB2


Bull HC1


Bull HD1


Bull G1+


Heifer HA3


Heifer HB3


Heifer HC4


Heifer HD4


Heifer GA+

KHEIRON


Bull G1+


Bull G2+


Bull G3+


Heifer GA+


Heifer GB+


Heifer GC+

Semen collection & OPU and IVF mating for all combinations breed & export semen and frozen embryos

Our Role is in facilitating translation of the science to delivery on the ground

Centre for Tropical Livestock Genetics and Health

Acceligen

KHEIRON

TRANS OVA genetics

ADGG African Dairy Genetic Gains
More productive and profitable dairy cows

The goal is changing producer livelihoods through immediate access to improved lines of dairy cattle

Thank You