

A WORLDWIDE PROBLEM

Groundwater is getting **contaminated with nitrates by agriculture** and livestock, affecting to the health of millions of people and even causing cancer.

Developed countries have established **control procedures by law** to reduce fertilizer use, **but this contamination** level's on ranches and farms **cannot be measured...**



HOW BIG IS THIS PROBLEM?

It's huge...

140 MILLION TONNES OF FERTILIZER
are used by farmers every year

...and based on
intuitive decisions!

USA is just an example.



	Nitrogen Input	Aquifer Vulnerability	 Increasing Risk
	High	High	
	High	Low	
	Low	High	
	Low	Low	
Source: water.usgs.gov			

OPPORTUNITY COST

WE PLANIFY (*fertilization plan*)

LACK OF DIAGNOSIS
INDICATORS

IN ALMERIA WE HAVE
3-4.000 €/HA YEAR

WE ARE TALKING ABOUT
ANUAL COST OF
70M €/HA YEAR

WE ARE GOING TO
SHOW SAVINGS OF
NUTRIENTS OVER

50%

THE SOLUTION

*The first soil nutrition management
tool*



NUTRISENS

A special sensor to measure
NITRATE & POTASSIUM
in the soil: a gelatine filter the nitrate
and potassium

POTASSIUM



NITRATE

THE SOLUTION

*The first soil nutrition management
tool*



NUTRISENS

A special sensor to measure
NITRATE & POTASSIUM
in the soil can detect:

IF PLANT IS UPTAKING NITRATE

IF NITRATE IS LEACHED OR NOT

OVER OR UNDER NITRATE
IRRIGATION CONCENTRATION

UNDERSTAND HOW WEATHER
CONDITIONS AFFECTS NUTRIENT
UPTAKE

WHAT IS THE PROBE MEASURING?

- Measures NO_3^- , not other nitrogenous forms
- The concentration of nutrients in the soluble fraction (PORE WATER)

+ Móvil + Bioaccesible	FRACCIONES DEL SUELO					- Móvil - Bioaccesible
SOLUBLE	INTERCAMBIABLE	ASOCIADA A CARBONATOS	ASOCIADA A ÓXIDOS DE HIERRO Y MANGANESO	ASOCIADA A MATERIA ORGÁNICA (M.O.) Y SULFUROS	RESIDUAL	
Potasio bioaccesible						
Potasio biodisponible						
Fácilmente accesible	Potasio bioextraíble					
	Potencialmente accesible					
CONCENTRACIÓN TOTAL						
Solubles en agua.	Movilizable por cambios de pH o de composición iónica.	Sensible a cambios de pH.	Movilizable bajo condiciones anóxicas.	Movilizable bajo condiciones oxidantes.	Solo movilizable bajo condiciones extremas.	

NEW PROPOSAL OF NUTRITION MANAGEMENT

1. WE HAVE THE **FERTILIZER SOLUTION** FOR EACH PHENOLOGY AND THE **STANDARD INJECTION RATIO**
2. THE **CONCENTRATION OF NITRATE AND POTASSIUM** IS MEASURED IN THE DRIPPER WITH HORIBA
3. **DIAGNOSIS**: THIS CONCENTRATION IS **COMPARED** WITH THE CONCENTRATION IN THE **NUTRISENS** PROBE IN ROOTS AND DRAINAGE
4. **ACTION**: **FERTILIZATION IS CHANGED FROM THIS DATA**

TO BE ABLE TO DO THIS, **NUTRISENS** MUST BE CALIBRATED FOR EACH TYPE OF SOIL:

WITH **SUCTION PROBE** + **HORIBA (Laquatwin)** METER

QUICK ANALYSIS OF NO₃⁻ IN DRIP AND RHIZON

HORIBA

LAQUAtwin

According to IFAPA studies, its values in aqueous solutions (suction probes) are as reliable as a laboratory



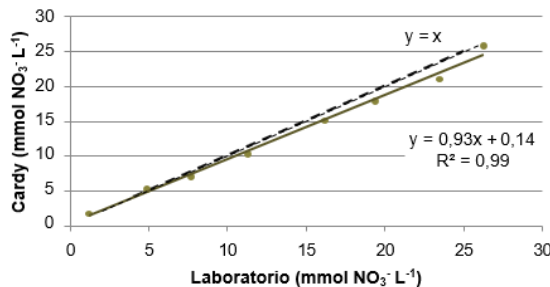
Sensors

Measure
button

Calibration
button

Reading screen

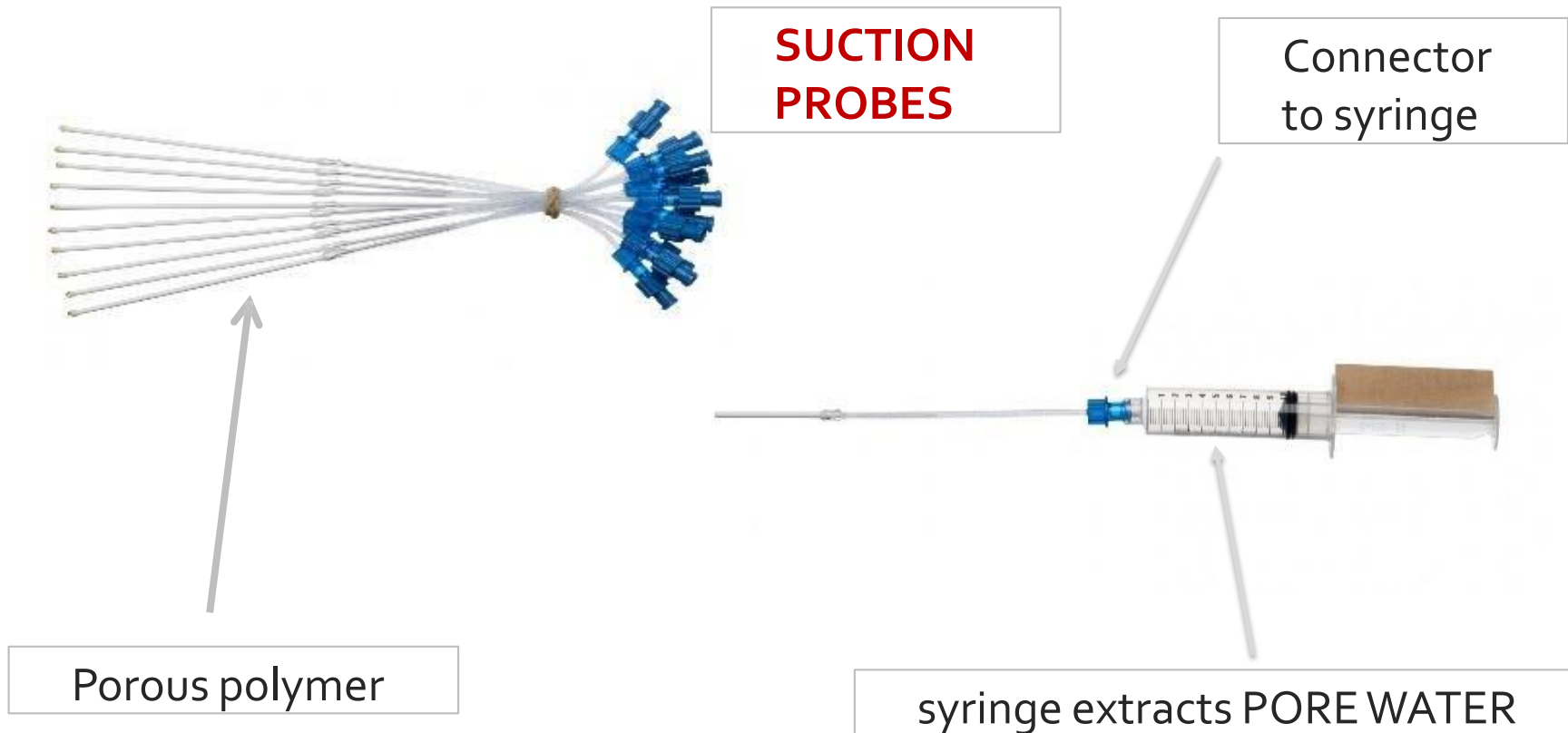
LAQUAtwin vs Laboratorio



CALIBRATION OF NUTRISENS IN EACH SOIL

At least **3 suction probes** should be used per Nutrisens probe.

Solution is extracted from the soil at least 2-3 times in 1 h of suction and this value is used to calibrate the probe



DIAGNOSIS FOR CALIBRATION AND OTHER EXTRA POINTS IN GREEN HOUSE

THE **CONCENTRATION OF NITRATE AND
POTASSIUM** IS MEASURED IN THE
DRIPPER WITH HORIBA



THIS CONCENTRATION IS COMPARED WITH **THE
CONCENTRATION IN THE NUTRISENS PROBE IN
ROOTS** AND DRAINAGE **WITH SUCTION PROBES**





TOMATO EXPERIENCE WITH PARQUENAT 16-17

FRANCISCA FERRER GROWER

INCREASE NITRATE NOV-DIC

NOVEMBER 17

DECEMBER 17

NITRATE EN 15 CM

Eliminar zoom

11,1 MEQ/Litro NITRATE IN DRIPPER

9,6 MEQ/Litro

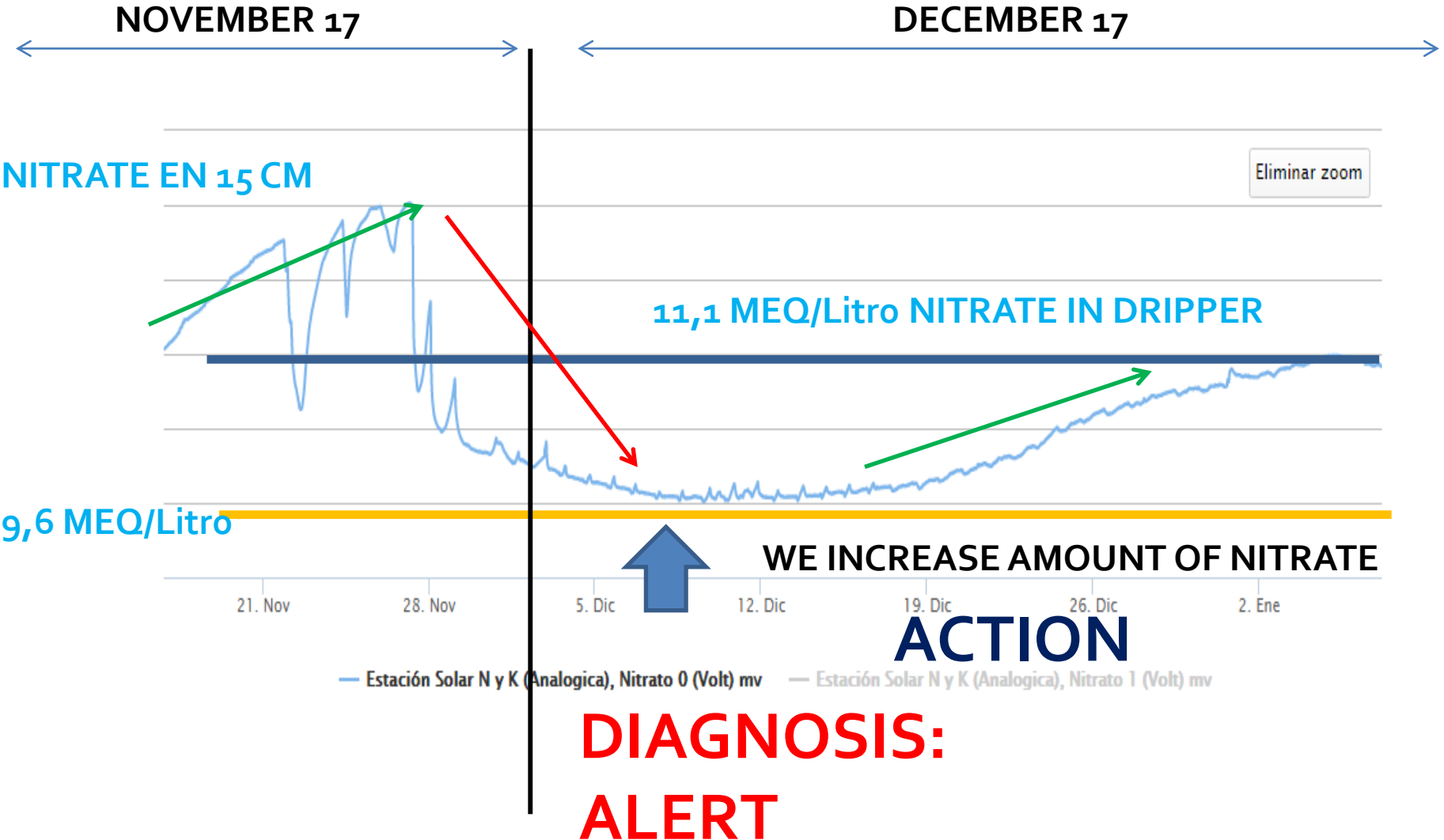
WE INCREASE AMOUNT OF NITRATE

ACTION

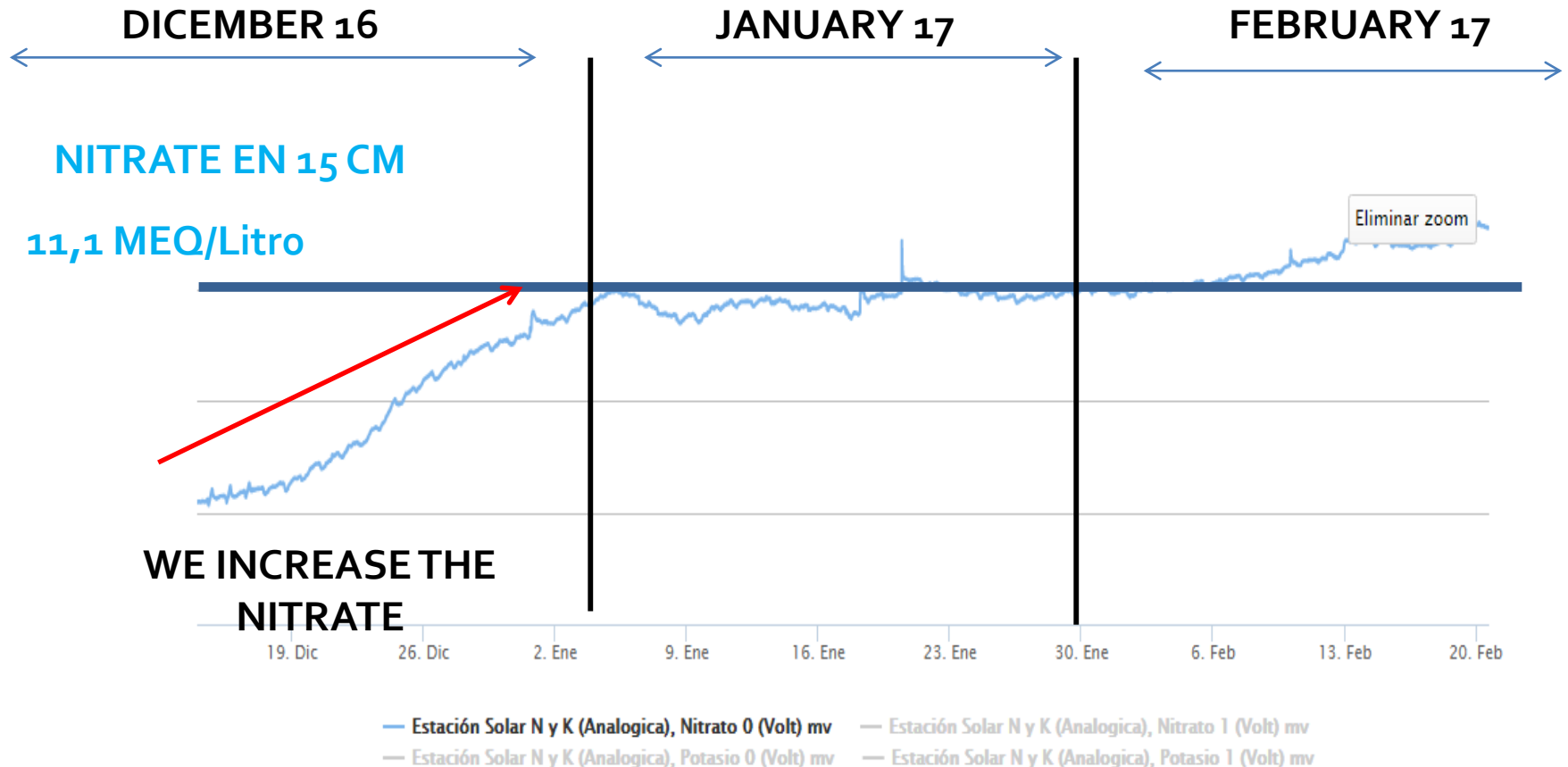
— Estación Solar N y K (Analogica), Nitrato 0 (Volt) mv

— Estación Solar N y K (Analogica), Nitrato 1 (Volt) mv

**DIAGNOSIS:
ALERT**



WE KEEP NITRATE TARGET IN ROOT ZONE



IN JANUARY AND FEBRUARY WE HAVE MAINTAINED THE CONCENTRATION OF **12 MEQ** IN ROOTS AREA (IN 15 CM)

STRESS AND ITS INFLUENCE IN THE ABSORPTION OF NITRATE AND POTASSIUM FROM PLANT ROOTS

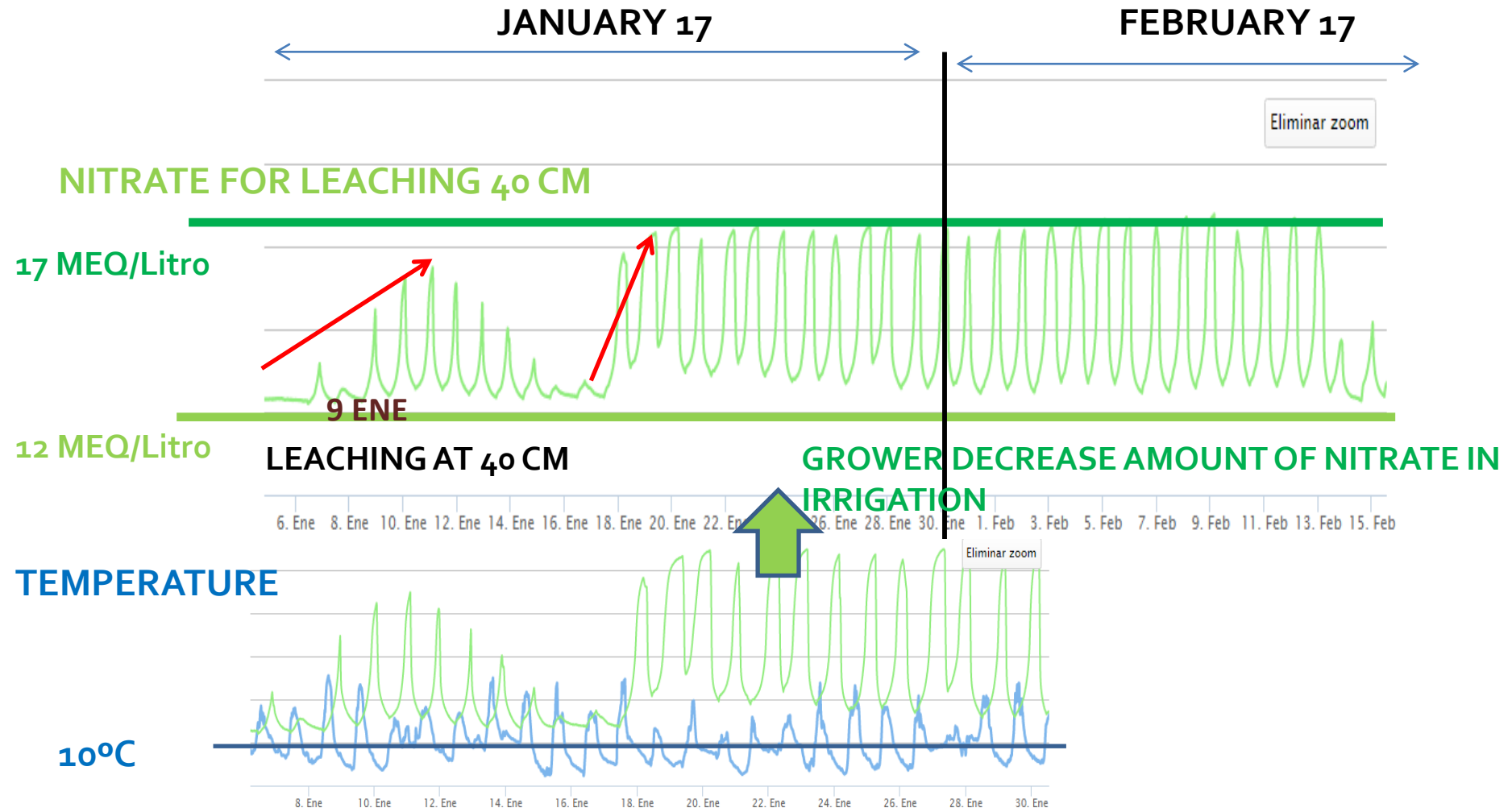
ANY TYPE OF **STRESS** PROMOTES A STOMATIC CLOSURE ON THE PLANT AND THIS PRODUCES:

- **LOWER NITRATE** CONSUMPTION
- **HIGHEST POTASSIUM** CONSUMPTION

STRESSES CAN BE BY **COLD**, BY **SALINITY**, **WATER STRESS** AND BY **HIGH VPD** (HIGH TEMPERATURE AND LOW RELATIVE HUMIDITY).

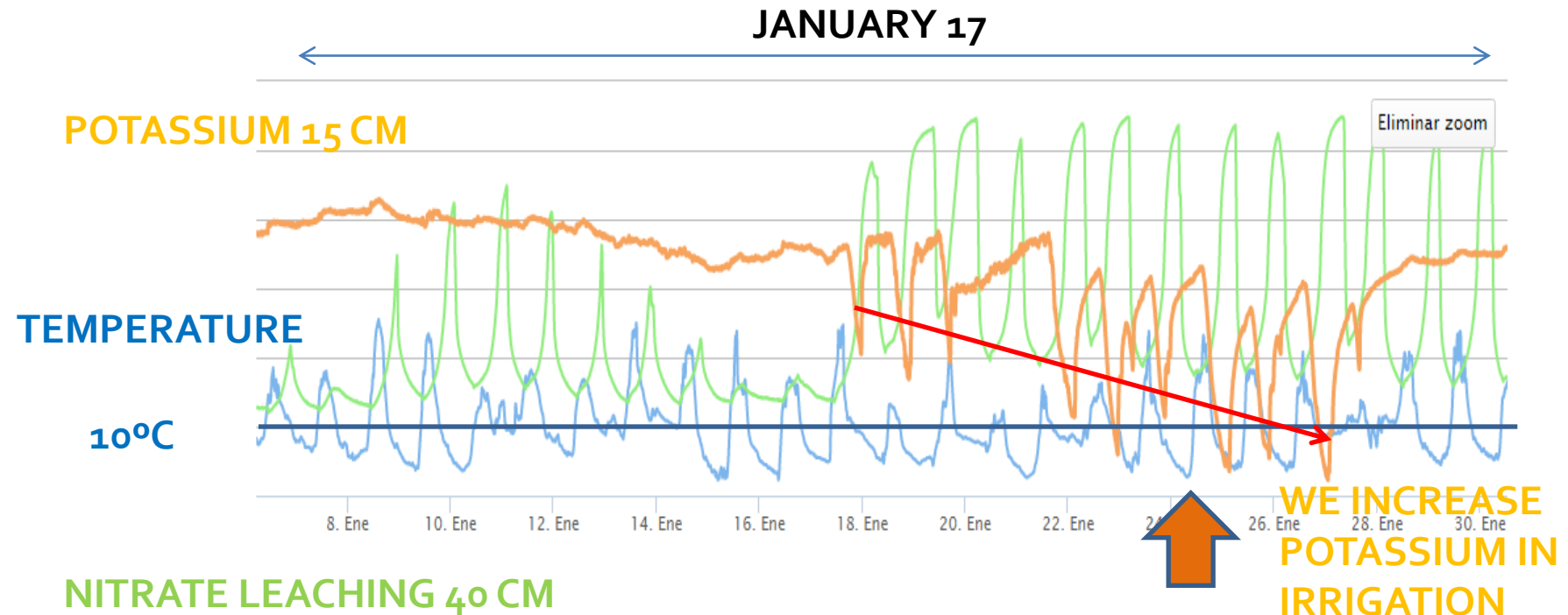
WE **WILL BE ABLE TO UNDERSTAND** THE INFLUENCE OF STRESS IN NUTRITION WITH THE DAILY TRENDS OF THE PROBES

COLD STRESS IN TOMATO: DECIDES TO PROVIDE LESS NITRATE WHEN DETECTING LEACHING



WITH THE COLD OF JANUARY NITRATE LEACHING WAS DETECTED, WITH HIGH VALUES OF 17 MEQ / L, WHICH MEANS THAT THE PLANT DOES NOT TAKE NITRATE

COLD STRESS TOMATO: DECISION TO INCREASE POTASSIUM CONTRIBUTION BY DETECTING THE INCREASE OF ITS CONSUMPTION IN SOIL



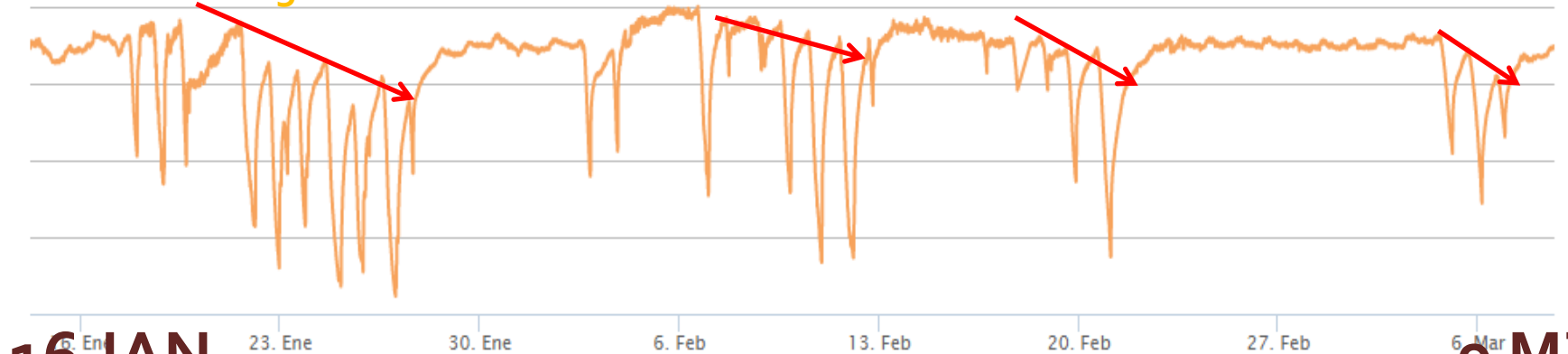
THE PLANT INCREASE POTASSIUM CONSUMPTION WITH THE COLD, MATCHING WITH THE STRONG NITRATE WASH

OPTIMIZATION OF INPUTS

+ 33% POTASSIUM

POTASSIUM 15 CM

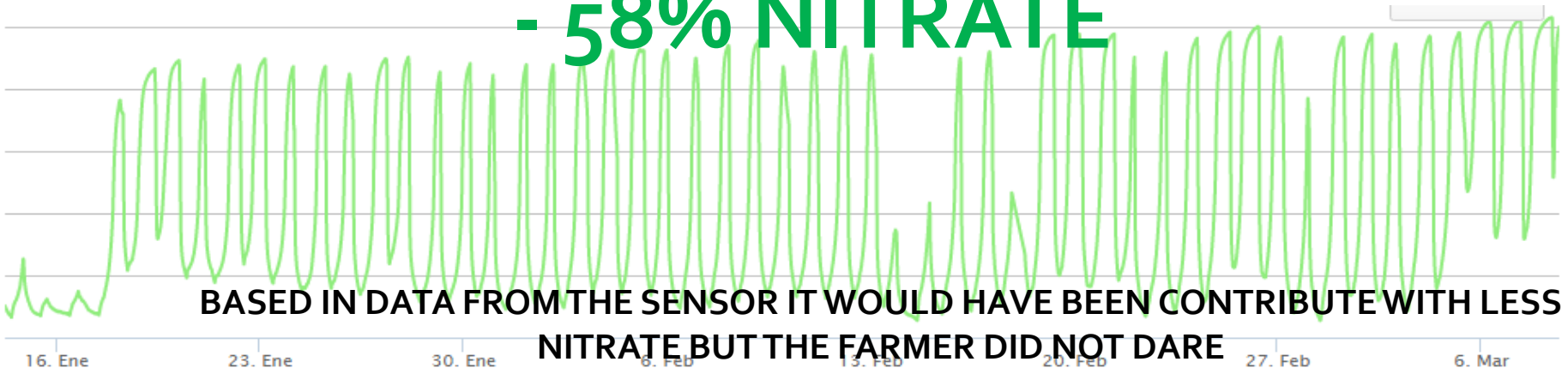
Entire 200m



THE POTASSIUM CONTRIBUTION HAS BEEN INCREASED IN RESPECT OF 2016

- 58% NITRATE

BASED IN DATA FROM THE SENSOR IT WOULD HAVE BEEN CONTRIBUTED WITH LESS NITRATE BUT THE FARMER DID NOT DARE



11% OF BETTER OF FRUIT SIZE I-G COMPARED WITH 2016



WE HAVE INCREASE THE NUMBER OF HOURS OF THE PLANT "WORKING" WITH THE STOMATA OPEN IN THE STRESS CONDITIONS AND LET THE PLANT TO TAKE MORE WATER TO PRODUCE MORE FRUIT SIZE. WATER WAS IN FULL CAPACITY, THIS IS FIX FACTOR, BUT WE MUST HELP THE PLANT TO UPTAKE THIS AVAILABLE WATER