Universidad Mayor de San Andrés

University of Missouri

Saberes Encontrados
CLIMAS MANEJADOS

Knowledge **F**ounded

Handled Climates

Timely and accurate climatic services for small farms in the Bolivian Highlands in view of climate change impact

THE McKNIGHT FOUNDATION

Magalí Garcia - Edwin Yucra - Jere Gilles – Katherine Rojas - Gavi Alavi

IUPWARE
ALUMNI EVENT 2018
Cuenca - Ecuador

Bolivian Andes

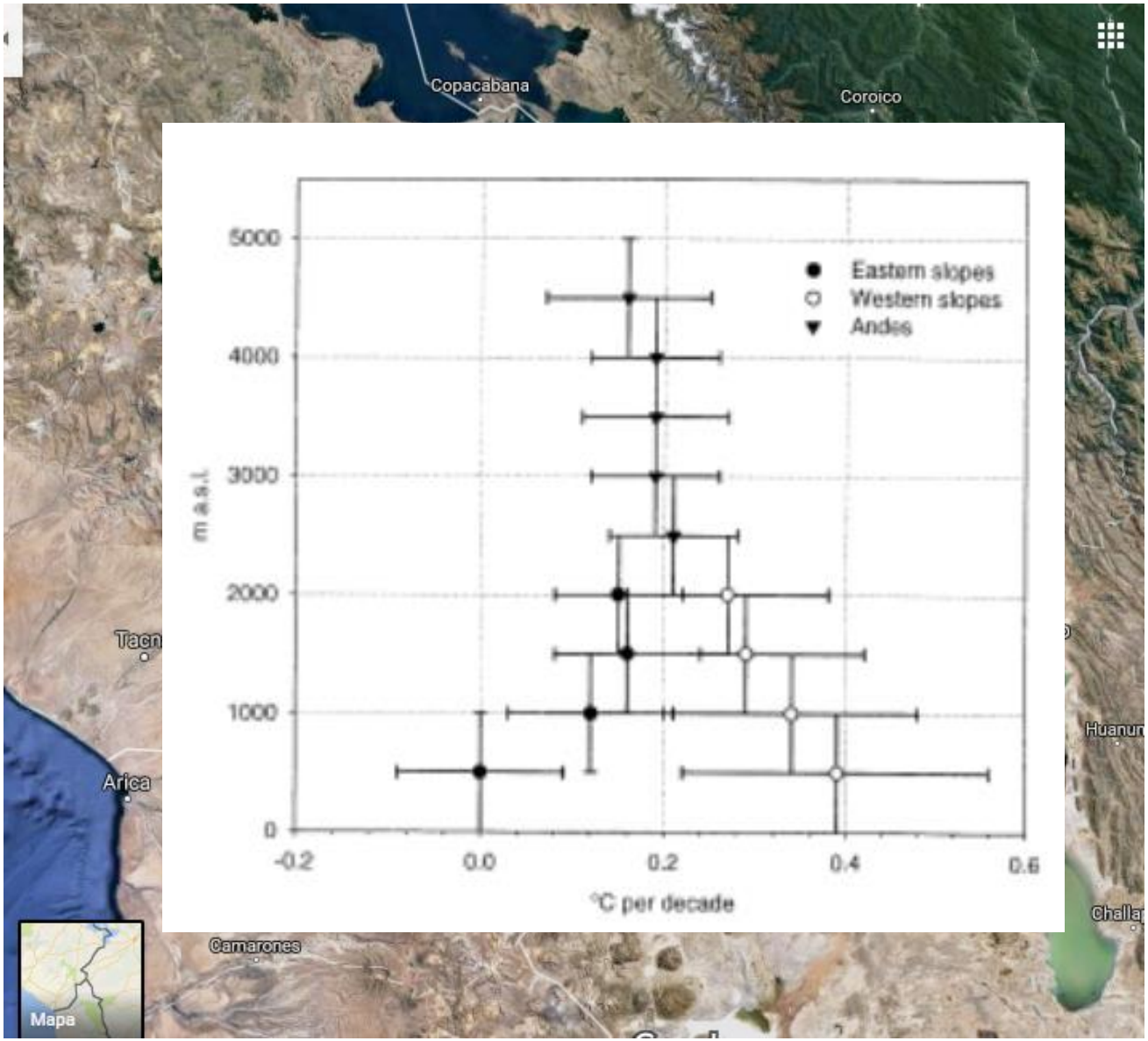
- Important productive zone

BOLIVIAN ANDES

IT IS A VERY COMPLEX AND LOCAL CLIMATIC SYSTEM

- **NO SIGNAL FOR ANNUAL RAINFALL**
- **TEMPERATURES CLEARLY RISING**

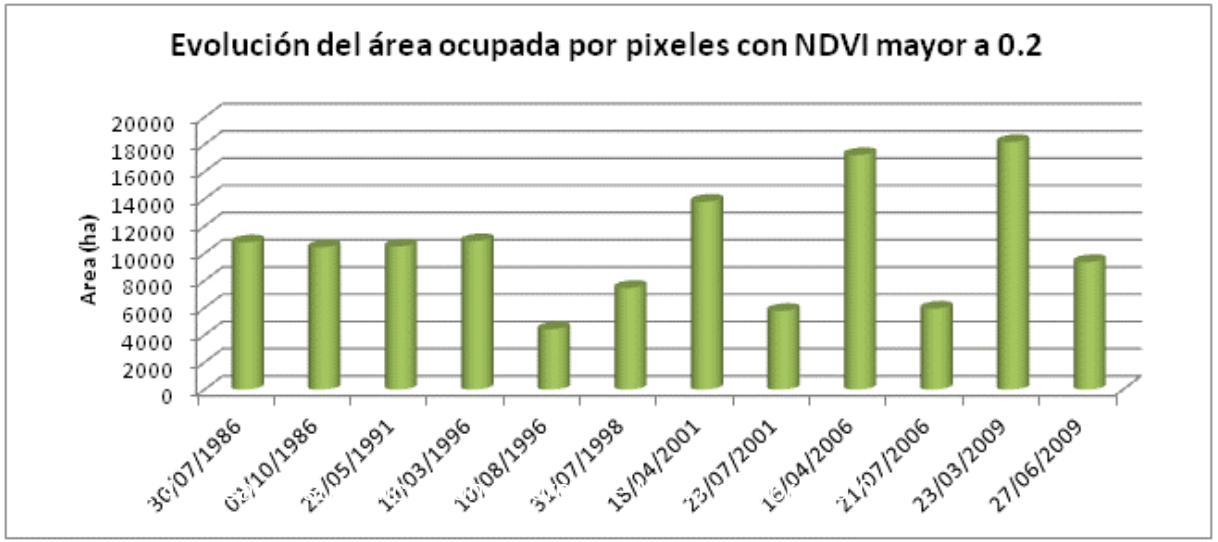
Figura No. 1 Perfil de La Paz, con indicación de Provincias Fisiográficas



THEN…..

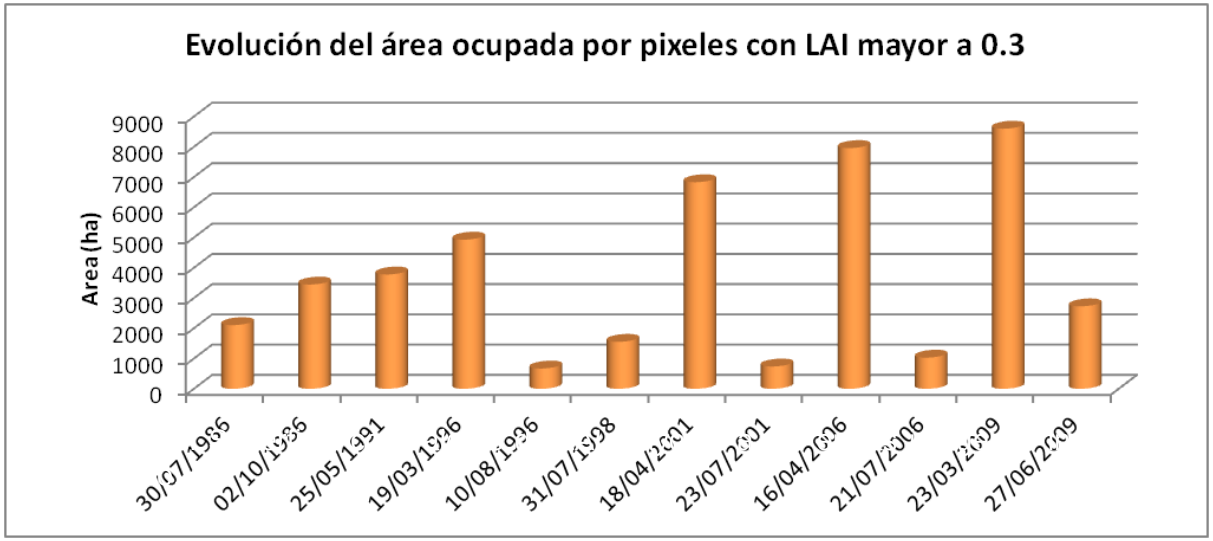
What are the SMALL farmers doing in this new conditions?

Native and cultivated plants are adapting to this new warmer environment. In many cases this makes the productive system more vulnerable to climate extremes



Sajama National Park.
Area with NDVI larger than 0.2
Dry and wet periods

Area with LAI larger than 0.3
Dry and wet periods



Cultivated systems have more intensification, more commercial species with less agrobiodiversity

STRATEGIES USED BY FARMERS

Farmers have their own forecast system

NATURAL INDICATORS

- This indicators are plants and animals behavior, and atmospherical and astronomical events.
- Farmers used to decide the date to plant their crops acording how this indicators behaves.

Very valid and well organized, but do not have many short term indicators

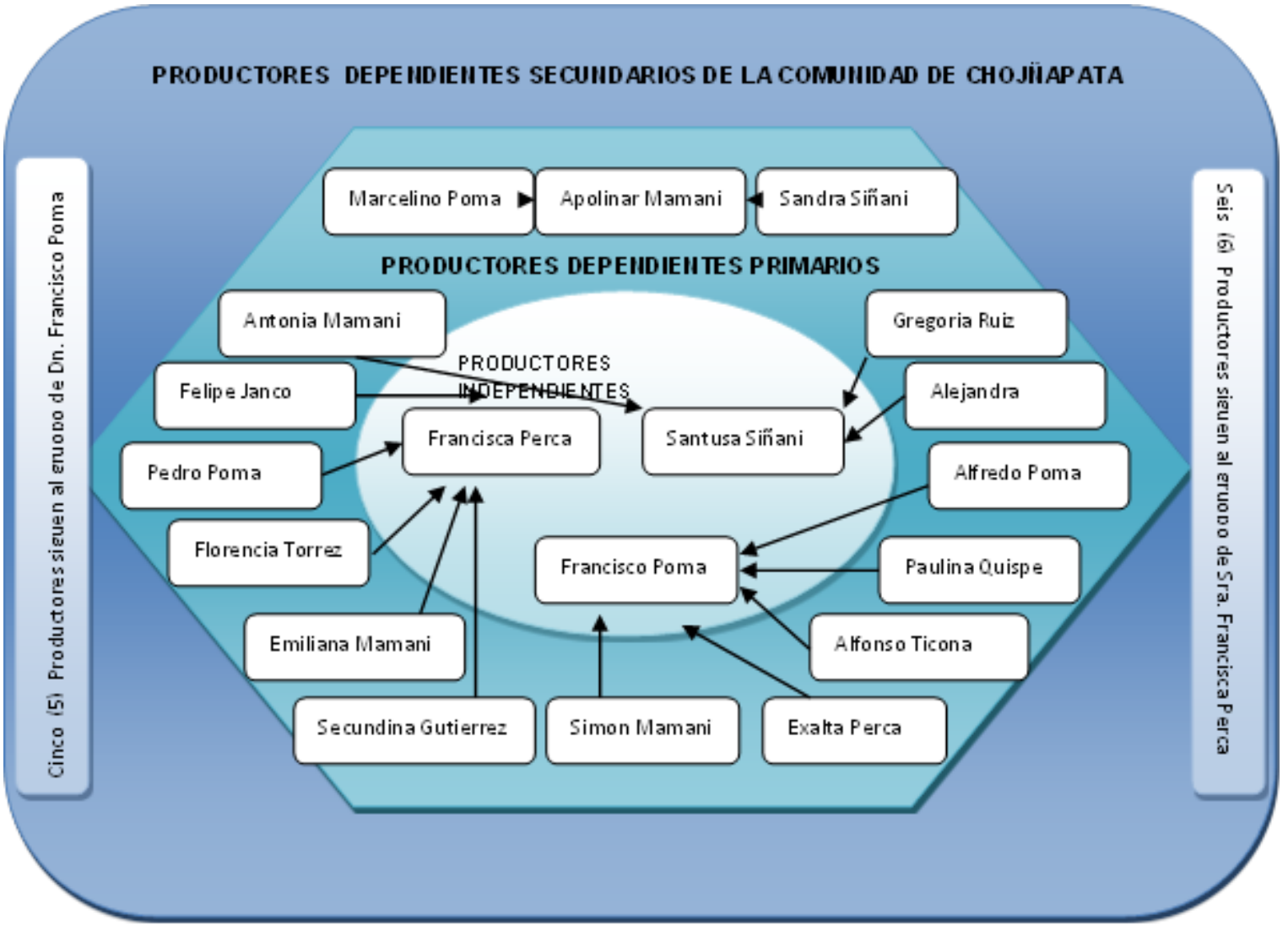
C-I. Calendario de indicadores naturales climáticos de
(Comunidades: Iñacamaya, San José e In

	Indicadores naturales	Jul	Ago	Sep	Oct	Nov	Dic	En
Fitoindicadores (Plantas)	Thola (1)		■	■	■			
	Phuscalla (2)		■	■	■	■		
	Q'uta (3)				■	■	■	
	Amañoke (2)						■	■
Zooindicadores (Animales)	Zorro (1)		■	■	■			
	Liki liki (2)				■	■	■	
	Tuju (3)		■	■	■			
	Ch'ijta (3)		■	■	■			
	Tiki tiki o Phiskillo (3)	■	■	■	■	■		
	Suerte María (3)			■	■	■		
Clima	Vientos (1)	■	■	■	■			
	Escarcha (2)		■					
Astros	Cruz del Sur (2)							
	Q'ana (1)			■	■	■	■	
	Luna (2)	■			■	■		
Costumbres	San Andrés (2)					■		
	Almanaque Bristol (2)			■	■	■		

C-2. Calendario de indicadores naturales climáticos del Municipio de Ancoraimes
(Comunidades: Chojñapata, Cohani y Calahuancane)

	Indicadores naturales	Jul	Ago	Sep	Oct	Nov	Dic	Ene	Feb	Mar	Abr	May	Jun
Fitoindicadores (Plantas)	Sank'ayo (1)		■	■	■	■	■						
	Phuscalla (2)		■	■	■	■							
	Q'uta (2)			■	■	■	■						
	K'ua (3)		■	■	■	■							
	Qariwa o waycha (2)		■	■	■	■							
	Laq'u (3)			■	■	■							
	Thola (3)			■	■	■							
Zooindicadores (Animales)	Zorro (1)			■	■	■							
	Wallata (2)			■	■	■	■						
	Tiki tiki o Phisquillo (2)		■	■	■	■							
	Cusi cusi (3)	■										■	■
	Sapo (3)			■	■	■	■	■	■				
	Ratón (2)			■	■								
	Hormiga (2)							■	■	■	■		
	Liki liki (3)			■	■	■							
Clima	Vientos (1)		■	■	■	■				■	■	■	■
	Nubes (2)					■	■	■	■	■	■	■	■
	Escarcha (2)												■
Astros	Cruz del Sur (1)					■	■					■	
	Q'otu (2)	■	■	■	■	■							
	Luna (3)			■	■	■							
	Arado (3)					■	■						
Costumbres	Año Nuevo Aymara (2)												■

Tranmission of information works through networks and observations (mainly very local)



- 3 Observers farmers
- 13 Followers farmers that wait for observers recommendation

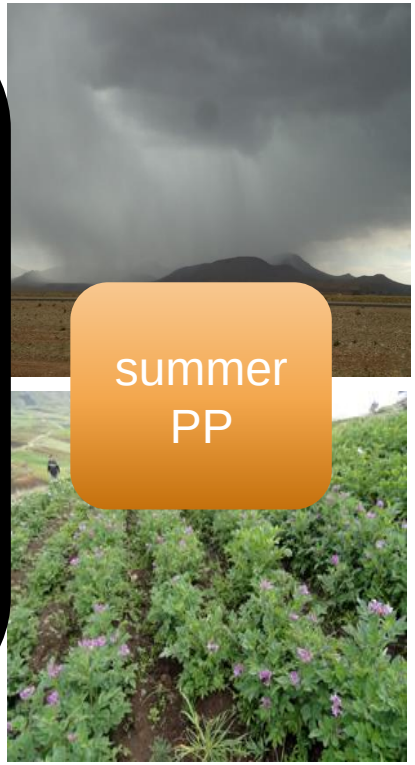
For all the natural indicators, some are very important and trustable for them. Example: Frost during the winter solstice week

They observe water and ice in stones, to predict rainfall for next summer

Tmin
en junio

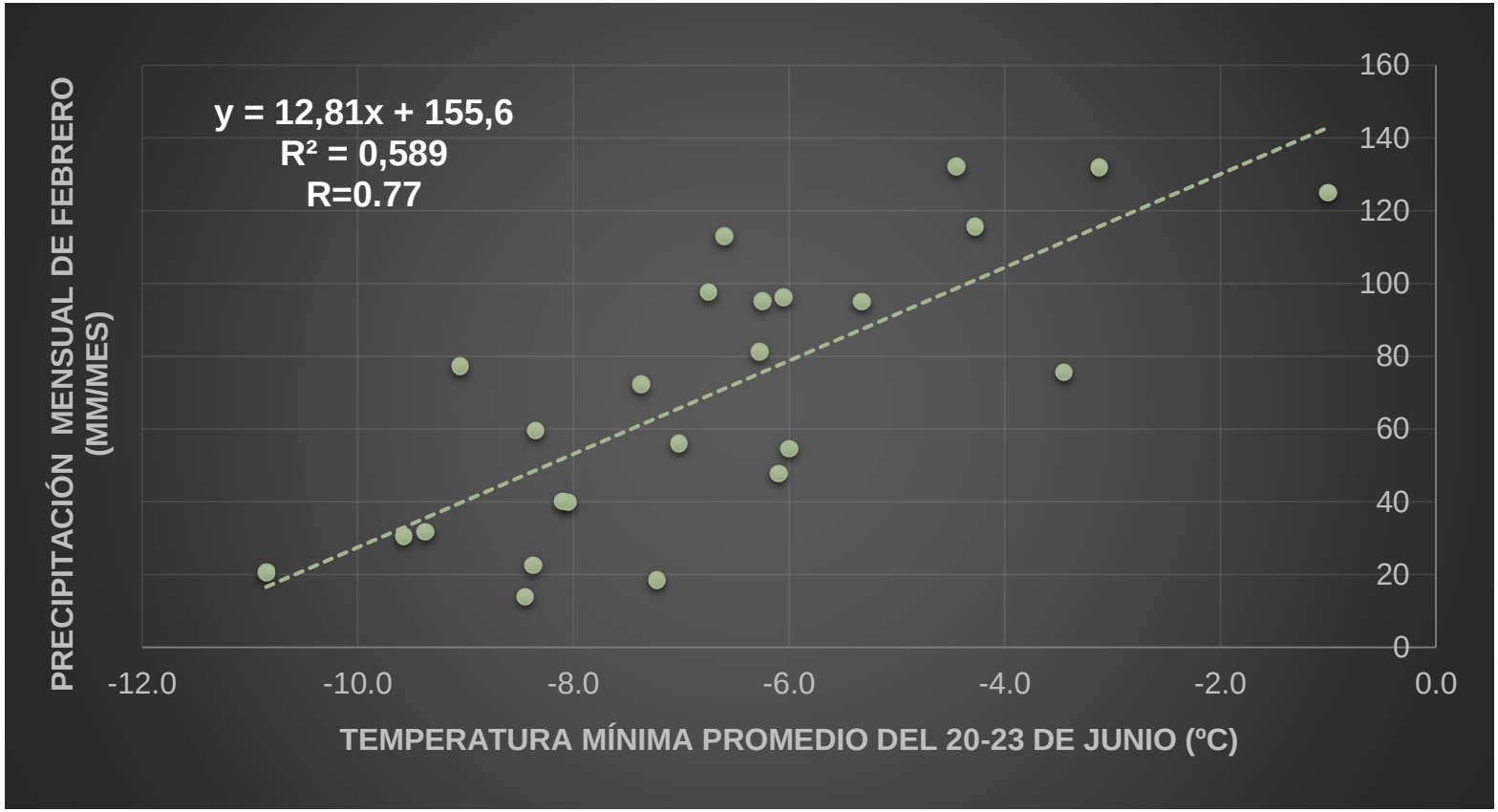
We analized it from the physical point of view, establishing proxy measuring from Tmin.

Lower Tmin, suggests less water vapour and more Terrestrial Radiation leaving the surface.



summer
PP

We analyzed Solstice Tmin vs rainfall in next rainy season and then in February



Data from Patacamaya.Correlation = 0.77

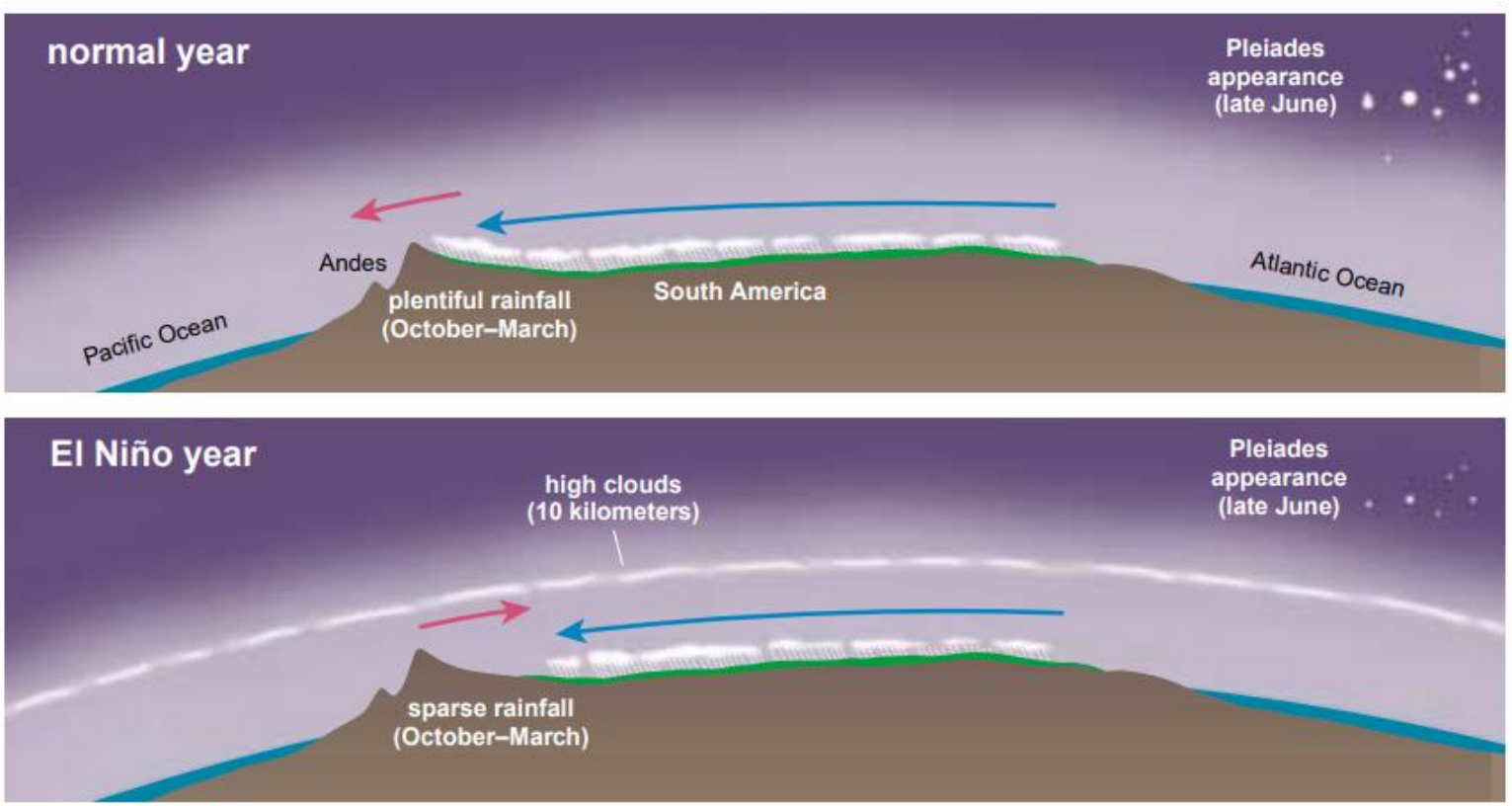
Ethnoclimatology in the Andes (American Scientist, 2002)

Benjamin Orlove, John C. H. Chiang and Mark A. Cane A

Pleiades are a star group in Taurus constellation

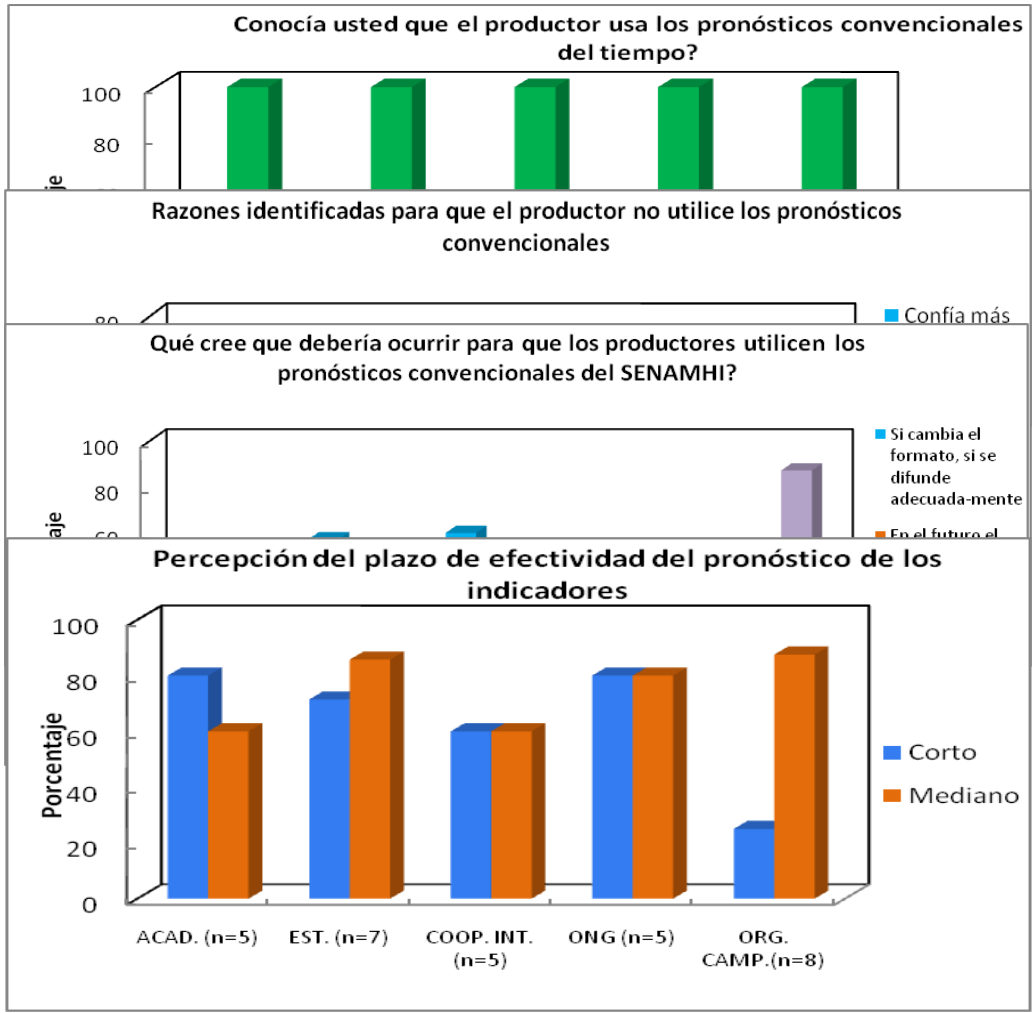
Farmers observe the brightness of these stars to predict rainfall during next summer – late June

Pleiades are seen: Good year for rain
Pleides are nos seen clearly: Low Rain



And what happen with the conventional forecast given by SENAMHI (National Service of Meteorology and Hidrology)?

the problem in many cases is the concept of what farmer actually needs



Farmers do not know the conventional forecast system

They trust more on their own forecast

They can use the conventional forecast if:

The info is given directly to them

Farmers have graeter access to technology

The important forecast terms for them are: Small and medium

SENAMHI gives conventional short term forecast which is not adapted to farmers´needs: just Regional forecasts

LA PAZ

Pronóstico general para hoy, Martes 17 Octubre 2017

Altiplano

Presentará bancos nieblas matinales, cielos poco nubosos por la mañana, nubosos con chubascos aislados y probables tormentas eléctricas por la tarde y noche, la humedad relativa variará entre 55% y 75%, vientos CALMOS por la mañana, débiles de dirección NORESTE, con intensidad entre 10 y 20Km/h, leve ascenso de temperaturas máximas.

Norte

Presentará cielos poco nubosos durante el día, nubosos con chubascos aislados por la noche, la humedad relativa variará entre 50% y 65%, vientos CALMOS por la mañana, débiles de dirección NOROESTE, con intensidad entre 10 y 20Km/h, poco cambio de temperaturas.

Valles

Presentará cielos poco nubosos por la mañana, nubosos por la tarde y noche, la humedad relativa variará entre 55% y 70%, vientos CALMOS por la mañana, débiles de dirección NOROESTE, con intensidad entre 10 y 20Km/h, poco cambio de temperaturas.

Yungas

Presentará bancos de niebla matinales, cielos poco nubosos por la mañana, nubosos con chubascos aislados y probables tormentas eléctricas por la tarde y noche, la humedad relativa variará entre 75% y 90%, vientos CALMOS por la mañana, débiles de dirección NOROESTE, con intensidad entre 10 y 20Km/h, poco cambio de temperaturas.

Pronóstico general para el Miércoles 18 Octubre 2017

Altiplano

Presentará bancos nieblas matinales, cielos poco nubosos por la mañana, nubosos con chubascos aislados por la tarde y noche, la humedad relativa variará entre 35% y 60%, vientos CALMOS por la mañana, débiles de dirección NORESTE, con intensidad entre 10 y 20Km/h, poco cambio de temperaturas.

Norte

Presentará cielos poco nubosos por la mañana, nubosos con chubascos aislados por la tarde, la humedad relativa variará entre 45% y 65%, vientos CALMOS por la mañana, débiles de dirección NOROESTE, con intensidad entre 10 y 20Km/h, poco cambio de temperaturas.

Valles

Presentará cielos poco nubosos por la mañana, nubosos por la tarde y noche, la humedad relativa variará entre 40% y 60%, vientos CALMOS por la mañana, débiles de dirección NOROESTE, con intensidad entre 10 y 20Km/h, poco cambio de temperaturas.

Yungas

Presentará bancos de niebla matinales, cielos poco nubosos por la mañana, nubosos con chubascos aislados por la tarde, la humedad relativa variará entre 50% y 65%, vientos CALMOS por la mañana, débiles de dirección NOROESTE, con intensidad entre 10 y 20Km/h, poco cambio de temperaturas.

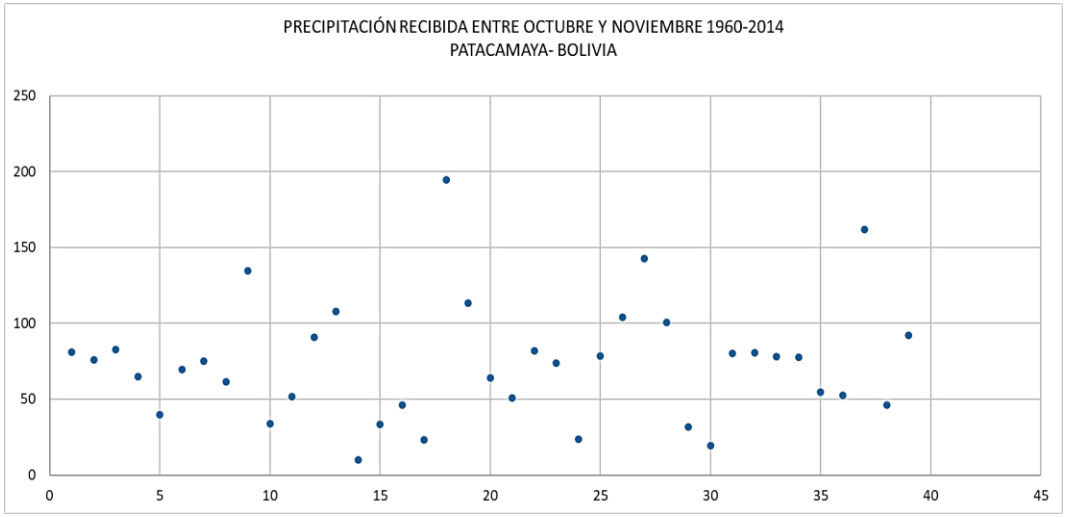
Pronóstico general para el Jueves 19 Octubre 2017

Altiplano

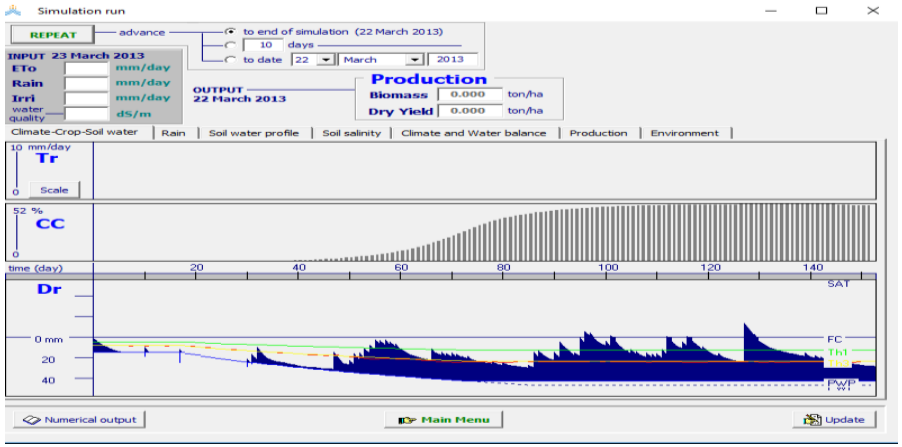
Presentará bancos nieblas matinales, cielos poco nubosos por la mañana, nubosos con chubascos y tormentas eléctricas aisladas por la tarde y noche, la humedad relativa variará entre 55% y 75%, vientos CALMOS por la mañana, débiles de dirección NORESTE, con intensidad entre 10 y 20Km/h, poco cambio de temperaturas.

How is the appropriate way to deliver this information to farmers?

- If the amount of water will be enough for their crop developing

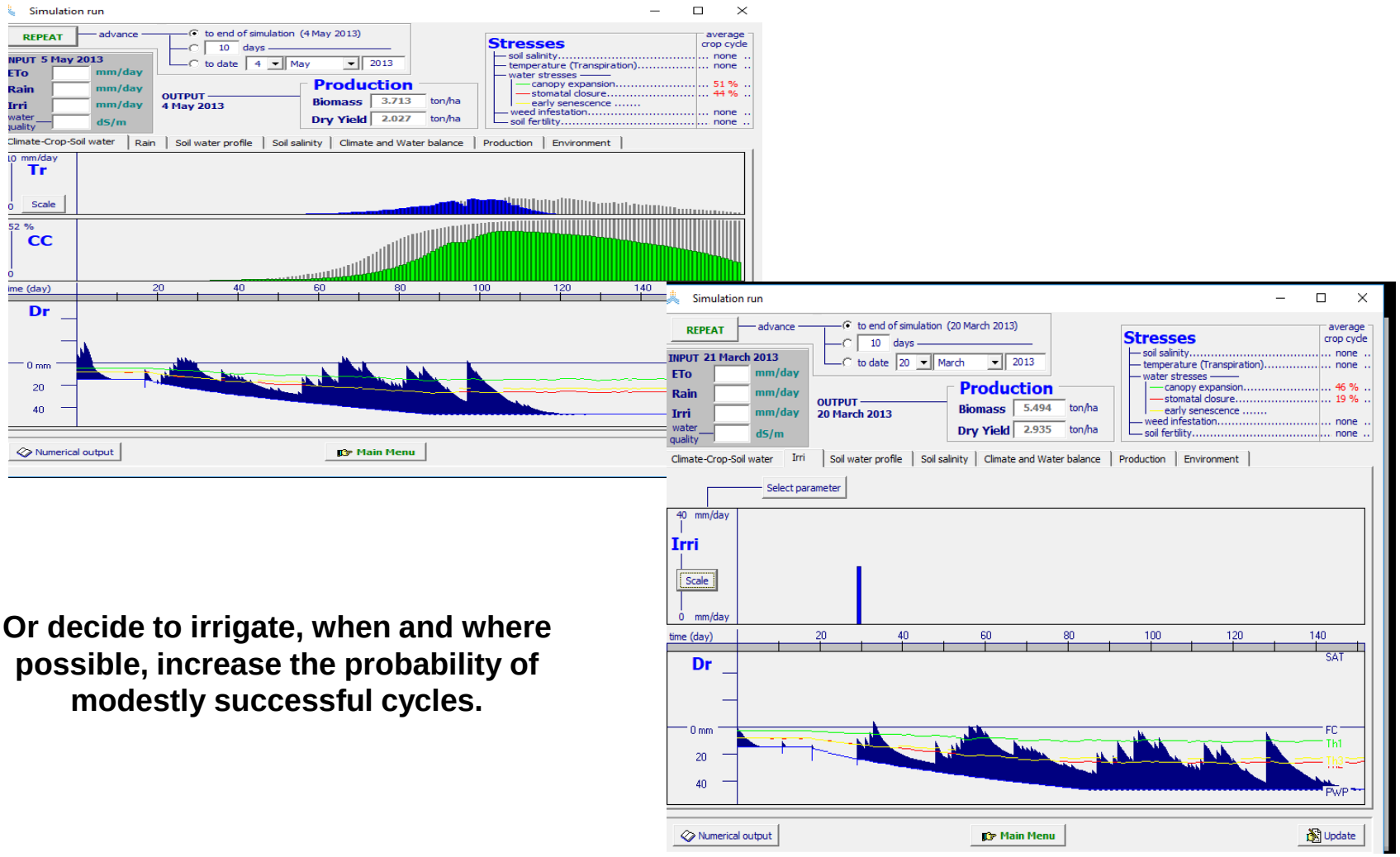


Exampe: It can be seen that the Pp that is received during the sowing months (Oct-Nov), is less than 100 mm, in an area where the ETo at that time is on average 4.5 mm / day. So the farmer has few success options, for annual crops. Scenarios are produced as follows:



How is the appropriate way to deliver this information to farmers?

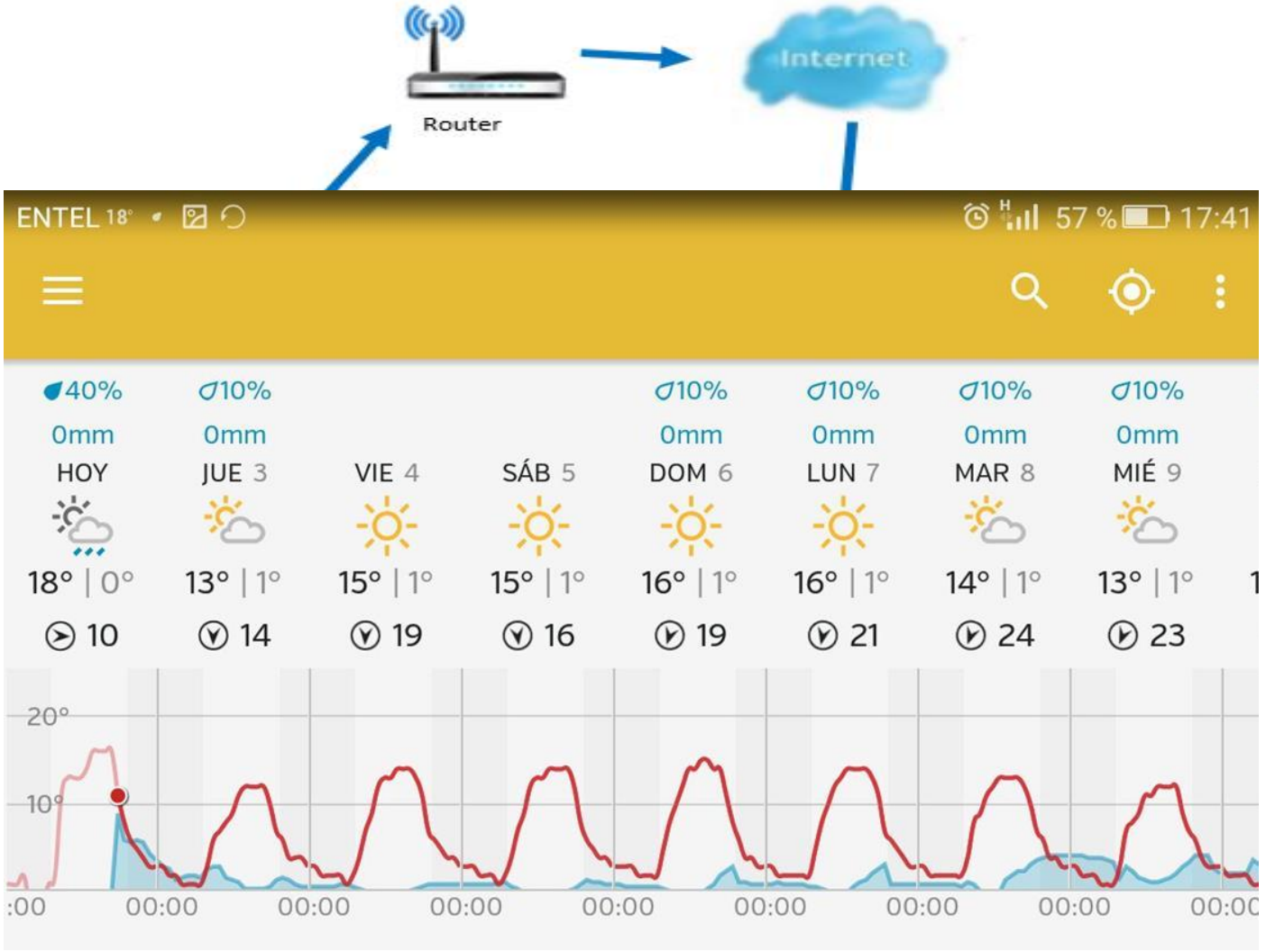
With timely information, scenarios could be given in which the farmer changes the sowing date:



Or decide to irrigate, when and where possible, increase the probability of modestly successful cycles.

With appropriate intervention, it is possible to exchange forecasts with farmers.

VIA WHATSAPP:
Farmers deliver medium-term forecasts (observation of Natural Indicators)
We return short-term forecasts (Accurate weather or weather underground)



CONCLUSIONS

- Increasing temperatures might improve the income from production system, but could also increase the vulnerability to sudden climatic shocks. Therefore, farmers need accurate climatic information more than ever.
- The utilization of climatic information for better and more efficient use of resources by farmers, strongly depends on the format and on the trustability of the information.
- Local conditions are very variating in tropical arid regions, then regional forecast might not be good enough for local extreme events forecast.
- Local knowledge is of extreme importance and we need to consider it as input for our knowledge.

THANK YOU