# *Situational report of pickle production (Bernstein variety) in Color Dry Fruit Company, Mexico*

MARCATUS -QED

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***Situational report of pickle production (Bernstein variety) in Color Dry Fruit Company, Mexico***

This document reports field visits to two of the three pickle production areas administered by Dry Color Food Company based in Hermosillo-Sonora and Los Mochis-Sinaloa, Mexico. Field visits occurred from 1st to 11th November 2022.

## Hermosillo-Sonora District

Hermosillo is part of the desert of Sonora in Mexico, one of the rapidly industrializing cities with a semi-arid climate . The annual precipitation in Sonora is around 420 mm, but it varies from 200 mm to 600 mm from lower to higher altitudes (Figure 1) (Eakin et al., 2007)

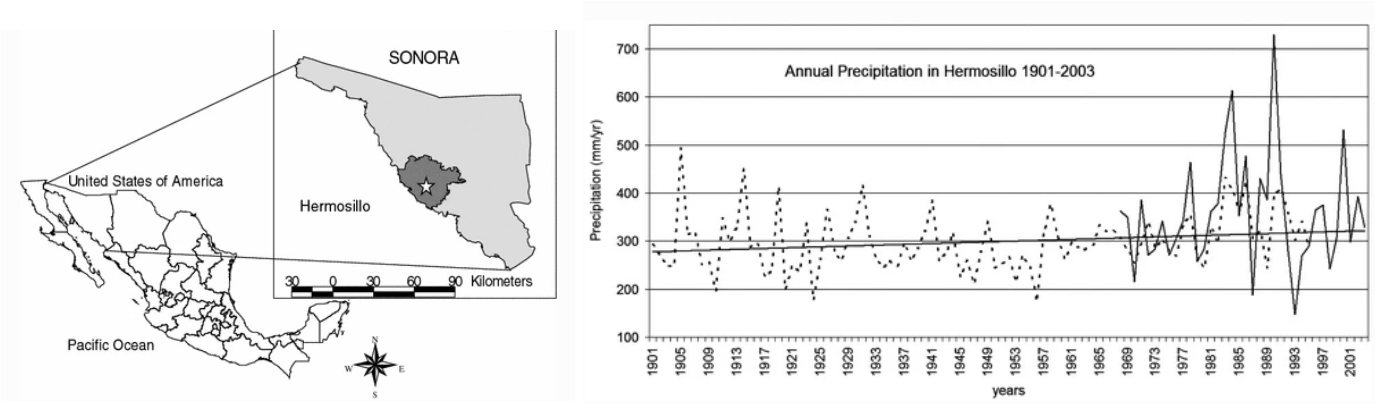



*Figure 1. Left - Hermosillo-Sonora district, México. Sources: (Eakin et al., 2007). Right - Long-term Trends in annual precipitation in Hermosillo, Sonora, 1991-2003. Interpolated values (dazed line) from IPCC (2004) and observed values in Hermosillo (solid line) from Mexico National Water Commission (2004) Source: (Eakin et al., 2007).*

The Mexican monsoon is associated with short periods of rain and severe storms from July to September. Annual mean temperature varies between 15°C to 25°C, with a maximum temperature of above 30°C year-round, reaching up to 45°C in summer, with low moisture during the years (Figure1-right). On July 27th, the forecast predicted 140 mm /month (WeatherBELL Analytics, 2022) hoping for an average month (Figure 2-left).

However, on August 6th, 2022, Colour Dry Food Company started to sow cucumber (Bernstein variety) under unexpected weather conditions. During that week, a weather report indicated that by Wednesday, 10th, 2022, Hermosillo had received twice the amount of rainfall compared to last year (Table 1, Figure 2-right, 2, 3 and 4) (Weather BELL Analytics, 2022). As a result, seeding planning activities were challenging due to the amount of water in the soil, causing a delay in the unexpected planning of sowing depending on the soil conditions. Sowing started from August 6th to September 25th, 2022, with a rate of 4 ha/day, covering 125 ha.

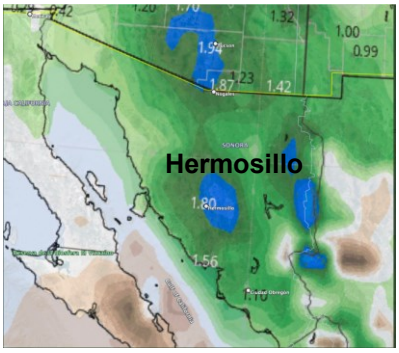




*Figure 2. Left- Precipitation forecast for August Hermosillo-Sonora for August 2022. Source (July 27th, 2022, Weather BELL Analytics, 2022). Right - Flooding events in Hermosillo city (Local news-Hermosillo)*

*Table 1. Precipitation days for San Pedro de Saucito*

| Day | mm/ Day | Winds km/h |
|---|---|---|
| July 28th | 58 | Nr |
| August 2nd | 11 | Nr |
| August 6th | 43 | 75 |
| August 8th | nr | 77 km/h |
| August 15th | 75-100 | |
| August 18th | 11 | Nr |

Source: Weather BELL Analytics, 2022

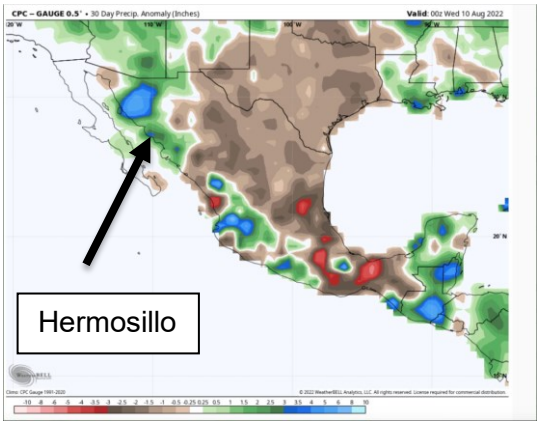
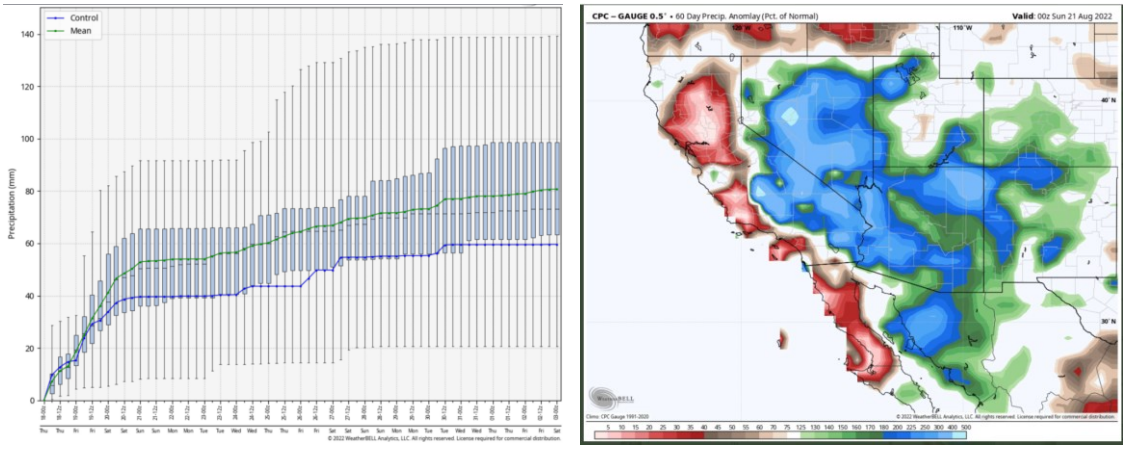



*Figure 3. Mean monthly precipitation Anomaly (inches) reported in Hermosillo (Weather BELL Analytics, 2022).*

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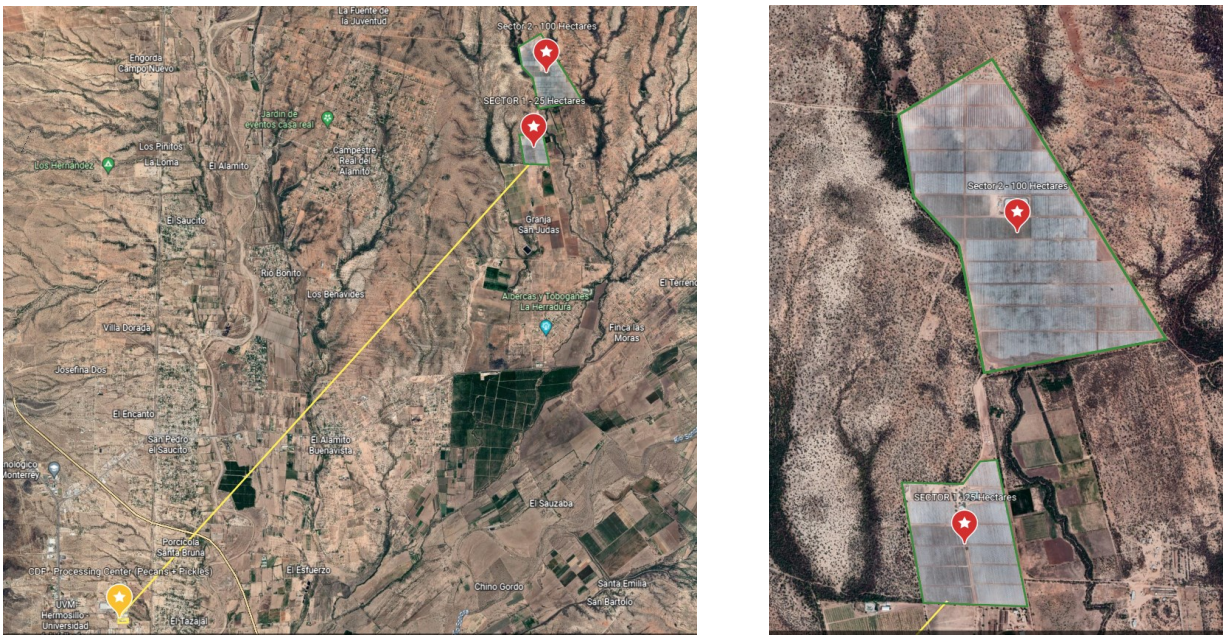
## Harvest period

In Hermosillo, the harvest period started after 18-20 days of seeding (Medina, 2022-Oral communication) with a growing cycle of 45-52 days under optimal conditions (temperature= 18-24 °C, minimum 16 °C, and maximum 32°C (Maynard & Hochmuth, 2022) in the areas (Figure 5). However, during the field visit (November 1st to 11th, 2022) and the previous month (October 2022), low temperatures below 16 °C caused a yield reduction of more than 60% (Medina Lopez, 2022; Medina Muñoz & Altamirano Flores, 2022). As a result, the growing season has extended up to 10-12 weeks, expected to end on December 15th, 2022.

Problems associated with low temperatures are a). stunted plant growth, b). flower abortions, c). crooked fruit, and d). stunted fruit. See video.

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In addition, there is a high incidence of Downy mildew (*Pseudoperonospora cubensis*), causing leaves loss between 60% to 75% of plant foliage and yield reduction. Furthermore, weather conditions (low temperature, 5°C; and high temperature, 27°C) have exacerbated the disease-mildew.

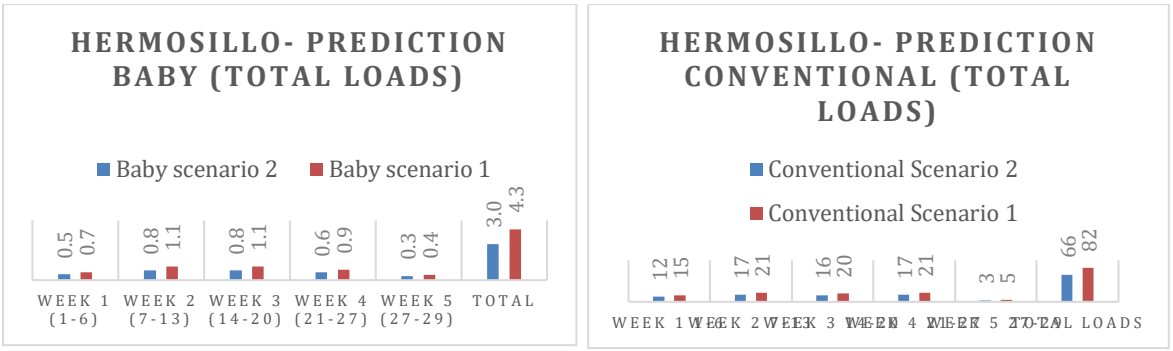
## Bernstein variety

The Bernstein variety yields, in optimal weather and management conditions, with a plant density of 35,000 to 45,000/ha could yield between 100 to 120 tonne/ha (vertical growth) and 60-70 tonne/ha (traditional growth) for conventional pickle, while 40 tonne/ha, for baby production (Medina Lopez, 2022). Similar values were registered in Hermosillo with 80 tonne/ha.

## Forecast production

A forecast conducted on November 2nd, 2022, by Bruno – Field Administrator of Copa Farm, indicated the number of loads that will be produced for baby and conventional under the

current climate scenario (low temperatures less than 16°C) (Figures 7a and 7b). Climate conditions will worsen for cucumbers in Hermosillo in the coming months, expecting to harvest 24 loads by December 15th, 2022, according to the field administrator. On November 9th, 2022, 65 ha were for conventional production and 10 ha for baby production. On November 11th, 2022, five ha for conventional production were incorporated into the last part of the Hermosillo production. However, current conditions have caused crooked and stunted fruits.




(a) (b)

*Figure 6. Prediction of Hermosillo fields- Sonora -Mexico conducted on 2sd November 2022 for baby and conventional fresh cucumber graphs (a) and(b). Scenario 1 refers to a minimum temperature no low than 12°C and a maximum temperature of 30°C. Yield reduction of 60-70%. Scenario 2 refers to a minimum temperature between 12 to 16°C. Yield reduction of 50-60%. Predictions deducted load shipped to Fresh farm (16 conventional loads – scenario 1 and 20 loads -scenario 2).*

### *Los Mochis- Sinaloa*

Los Mochis is a city in northern Sinaloa, Mexico, with semi-arid wet and dry climate conditions. Summers are hot, reaching 40 °C, overnight low temperatures of 26 °C and high humidity and heat index reaching 45°C in the day. From January to June, the average daily temperatures are 18.9, 19.9, 21.5, 24, 26.8, and 30.1°C. Low temperatures are 11.7, 12.1, 13.3, 15.5, 18.4 and 23.1°C from January to June (Servicio Meteorologico Nacional- Mexico. Climate Data 1951-2010). Precipitation is 10, 7, 2, 0, 2, and 13 mm from the same period—Figure 7 (Weather Spark, 2022).

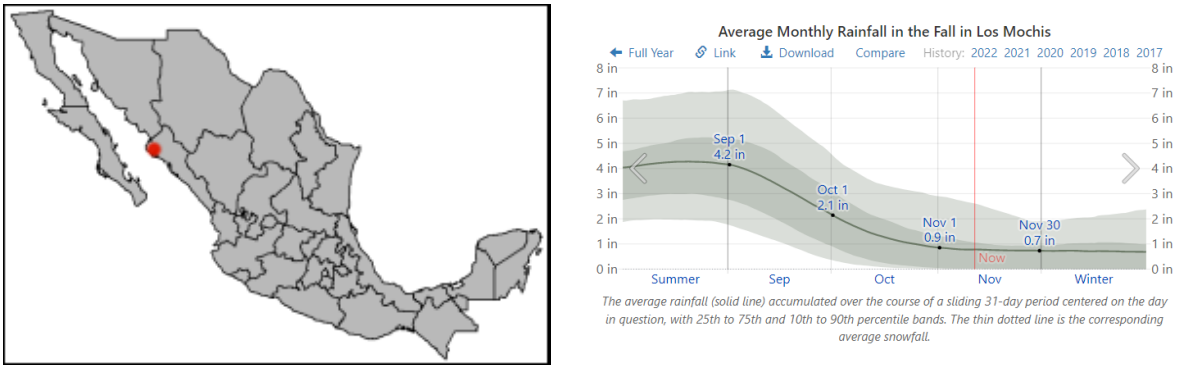



*Figure 7. Left-Los Mochis location. Right-average monthly rainfall in the fall (Weather Spark, 2022).*

The areas visited in Mochis are described in the following map. The map also shows the griding facility and dispersed areas around the city. Production areas are in two principal spots. The first area has 40 ha under vertical production and 20 ha under no stick management. The water source comes from a canal that serves the production areas and passes through the urban areas; therefore, water quality will be required. In addition, field production areas are close to other production areas under different owners and different pest management practices. Los Mochis area sowed 45 ha and will sow 20 ha in the following weeks after the field trip.


*Figure 8. Location of current cucumber areas in Los Mochis-Sinaloa, Mexico. Sources: Benalcazar, 2022.*

## *RECOMMENDATIONS and AREAS TO IMPROVE PRODUCTION*

To improve crop production in the visited areas, I recommend three main actions to help manage pickle production in Mexico according to the available resources.

### MONITORING – cucumber diseases

1. Soil monitoring

    a. Soil sample analysis considering physical and biological properties so we can assess soil aggregation and compaction. Conditions are required to understand how the soil can cope with heavy rain or how traffic machinery has impacted cucumber growth roots. Also, biological components such as active carbon and soil protein could provide information on C and N available to microorganisms. Currently, only soil chemical analysis is conducted.

    b. Soil sampling by zones. According to the administrator, there are more than six zones in the Hermosillo area where soil properties differ. Therefore, soil sampling analysis should consider zone variation to manage soils accordingly. Unfortunately, during the field trip, I could check only one soil chemical test for all production areas.

2. Crop monitoring

    There are currently 75 ha in production in Hermosillo, from which 65 ha are conventional, and 10 ha are baby managed by one person (field manager). Field monitoring is conducted driving on fields that are accessible by vehicle. This process requires a lot of energy and time to visit all fields. However, mildew monitoring requires better assessment in a brief time because it can cause crop loss in less than six days. Remote sensing on the unmanaged aerial vehicle (UAV) is a viable alternative to improve crop monitoring in fields for disease monitoring, especially mildew. In addition, drone monitoring could benefit checking, fertigation, irrigation applications, growing stage, flooding, or drought areas assessment.

### TRAINING – soil -water- irrigation

Continuing training in the following areas is vital to improve farm management practices.

a. Soil management
b. Soil sampling
c. Soil analysis
d. Downy mildew diseases cycle and pathogenicity
e. Relationship between soil-water-plant and environment
f. Irrigation schedule and principles
g. Precision agriculture and remote sensing principles
h. Monitor and assess using the vegetation index

## PRECISION AGRICULTURE PRACTICES

Precision agriculture practices are required. Soil sampling analysis using precision agriculture technology would reduce the amount of fertilizer and pesticide and reduce losses due to percolation. Currently, all areas receive the same amount of nutrients without considering inherent soil properties due to their location.

## ACTIONS ALREADY TAKEN

I have taken some actions to help improve crop production in Hermosillo.

a) I prepared a two-page extension document explaining how precision agriculture helps monitor and assess plants on time. The document has already been shared with the field administrator in Hermosillo (http://xon.sdsu.edu/~benalcazar/53001NDVI.html)

b) I contacted Nuhemns, a seed supplier, to evaluate new varieties that could use next year to increase crop production and reduce disease resistance in Hermosillo.

c) I prepared a video of Hermosillo and Los Mochis field areas to show how diseases and low temperatures can destroy crop production. In addition, visual material can be used in other areas to provide crop monitoring and assessment evidence.

d) I explained the importance of weather stations and forecast climate conditions to plan fumigations and reduce mildew severity.

e) I explained how soil moisture could be conducted using simple tools described as "T" water moisture.

f) I sent information about UAVs, known as Drones, that can serve to monitor crop conditions.

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