



World Meteorological Organization

Working together in weather, climate and water

Translating Daily Weather Forecast To Agrometeorological Forecasts

Robert Stefanski

Chief, Agricultural Meteorology Division



Weather Forecast Elements

- **Rainfall and snow**
- **Maximum, minimum and dewpoint temperatures**
- **Amount and type of coverage of sky by clouds**
- **Relative humidity**
- **Wind speed and direction**
- **Extreme events like heat and cold waves, fog, frost, hail, thunderstorms, wind squalls and gales, low pressure areas, different intensities of depressions, cyclones, tornados**



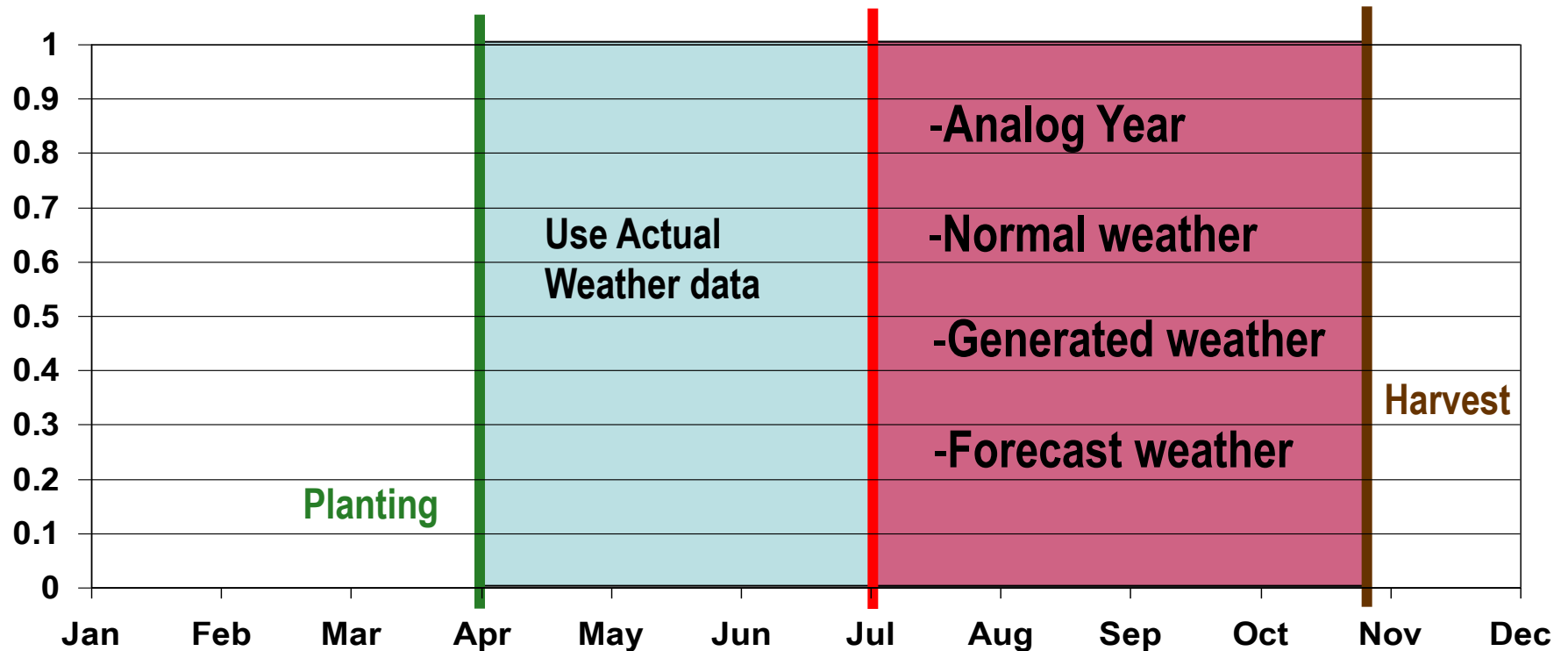
Agricultural Weather Forecast Elements

- **Pan evaporation**
- **Soil moisture stress conditions**
- **Advice for irrigation timing and quantity in terms of pan evaporation**

- **Hours of sunshine**
- **Solar radiation**
- **Dew**
- **Leaf wetness**
- **Evolution of meteorological variables in canopy layer**
- **Microclimate inside crops in specific cases**



Assessing In-Season Crop Conditions / Ag Production Forecasts





WMO OMM

Agricultural Advisories



Agricultural Advisories or Agrometeorological Services

- **‘Agricultural Advisories’ are advice given by internal experts of National Meteorological and Hydrological Services (NMHSs) to crop growers/livestock producers based on possible future weather and climatic conditions**

Table 5.14. Examples of the use of nowcasting and very short range forecasts for agriculture

<i>Objective</i>	<i>Principal forecasted variables</i>
Manage works without producing soil compaction	Precipitation
Manage field activities during the growing period of crops	Temperature, wind and precipitation
Minimize the waste of biocides applied against weeds, pests and diseases	Temperature, wind and precipitation
Manage mitigation activities against frost	Temperature of air and crop tissues
Manage harvest activities for different crops	Precipitation, relative humidity, wetness of crops
Prevent and mitigate the effects of flash floods or debris flow	Precipitation



Short & Medium Range Forecasts – Farmer Planning

- Land preparation and preparation of plant material
- Planting or seeding/sowing
- Crops, fruit trees and vine management; application of fertilizer, irrigation; thinning, topping, weeding; pest and disease control
- Management of grazing systems
- Harvesting, on-farm post-harvest processing and transport of produce
- Livestock production (dairy enterprises, beef systems, lamb and other livestock systems)

(Das et al 2010)



Preparation of agrometeorological advice I

- The preparation of advice requires close linking of various data providers and expertise from **different fields**.
- The basic requirement: forecast data must be for the desired period and for the specific location under consideration.
- Agromets then discusses the present, past and future status of weather and the current crop conditions.



Preparation of agrometeorological advice II

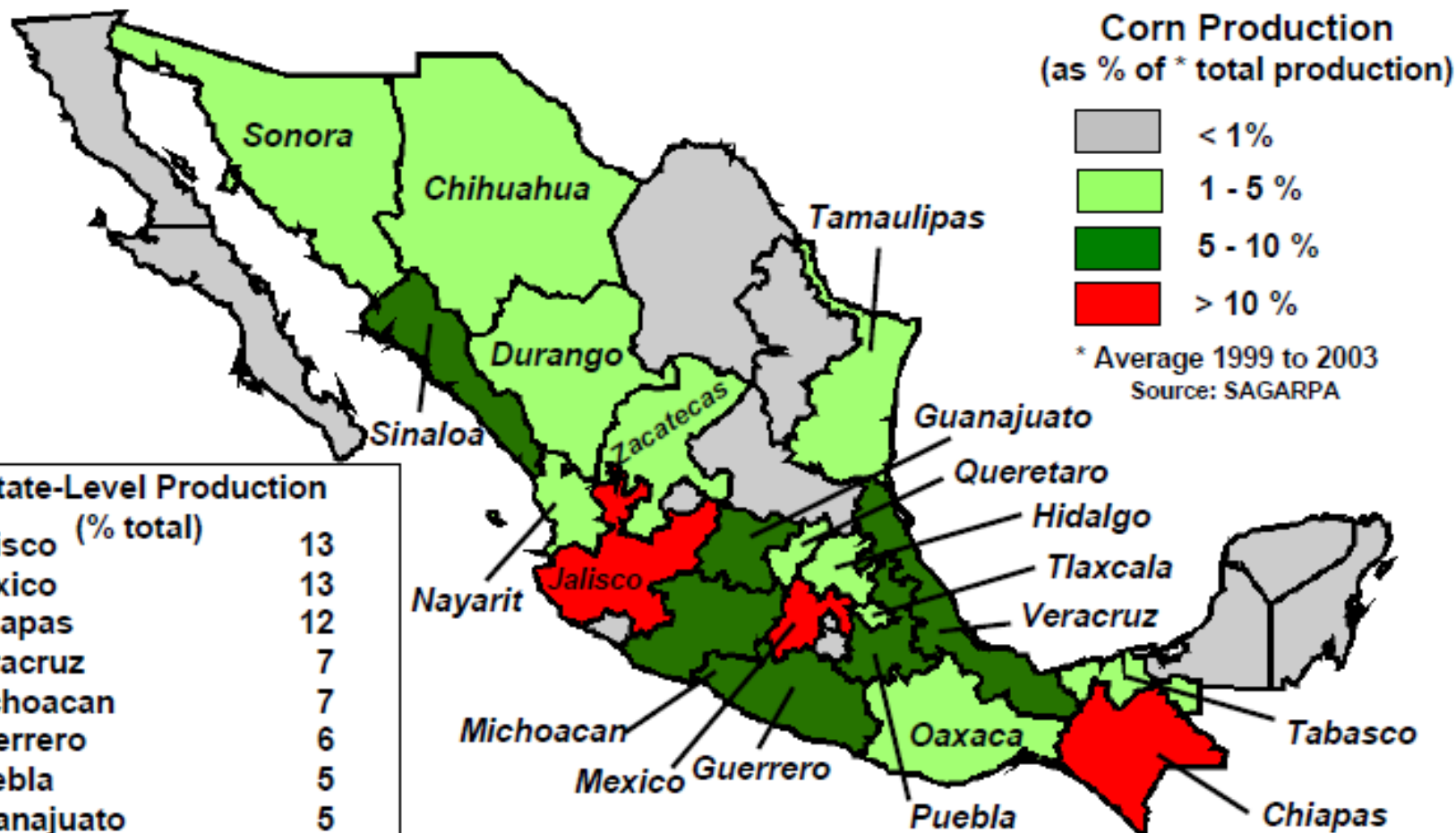
- On the basis of local agrometeorological and farming information and the weather forecasts, experts consider the **options and consequent effects** and then **decide** on the appropriate advices to be given to the farmers regarding the items that fall within the scope of their expertise.



Preparation of agrometeorological advice III

- Experts may include agrometeorologists, agronomists, soil scientists, plant pathologists, entomologists, horticulturists, and specialists from agricultural extension, animal husbandry and plant breeding.
- Priority is given to **predominant crops** of region and most prevalent problems including **animal conditions** and their **protection from stresses** caused by extreme temperatures and animal diseases.

Mexican Corn Production

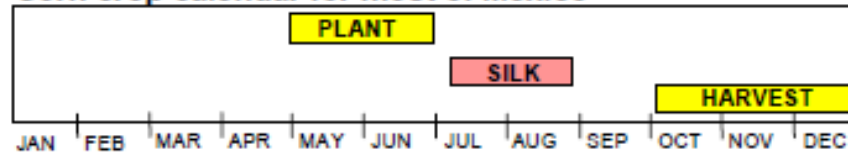


* State-Level Production

State	(% total)	Production (%)
Jalisco	13	13
Mexico	13	13
Chiapas	12	12
Veracruz	7	7
Michoacan	7	7
Guerrero	6	6
Puebla	5	5
Guanajuato	5	5
Sinaloa	5	5
Oaxaca	5	5
Hidalgo	4	4
Zacatecas	2	2
Others	~ 15	~ 15

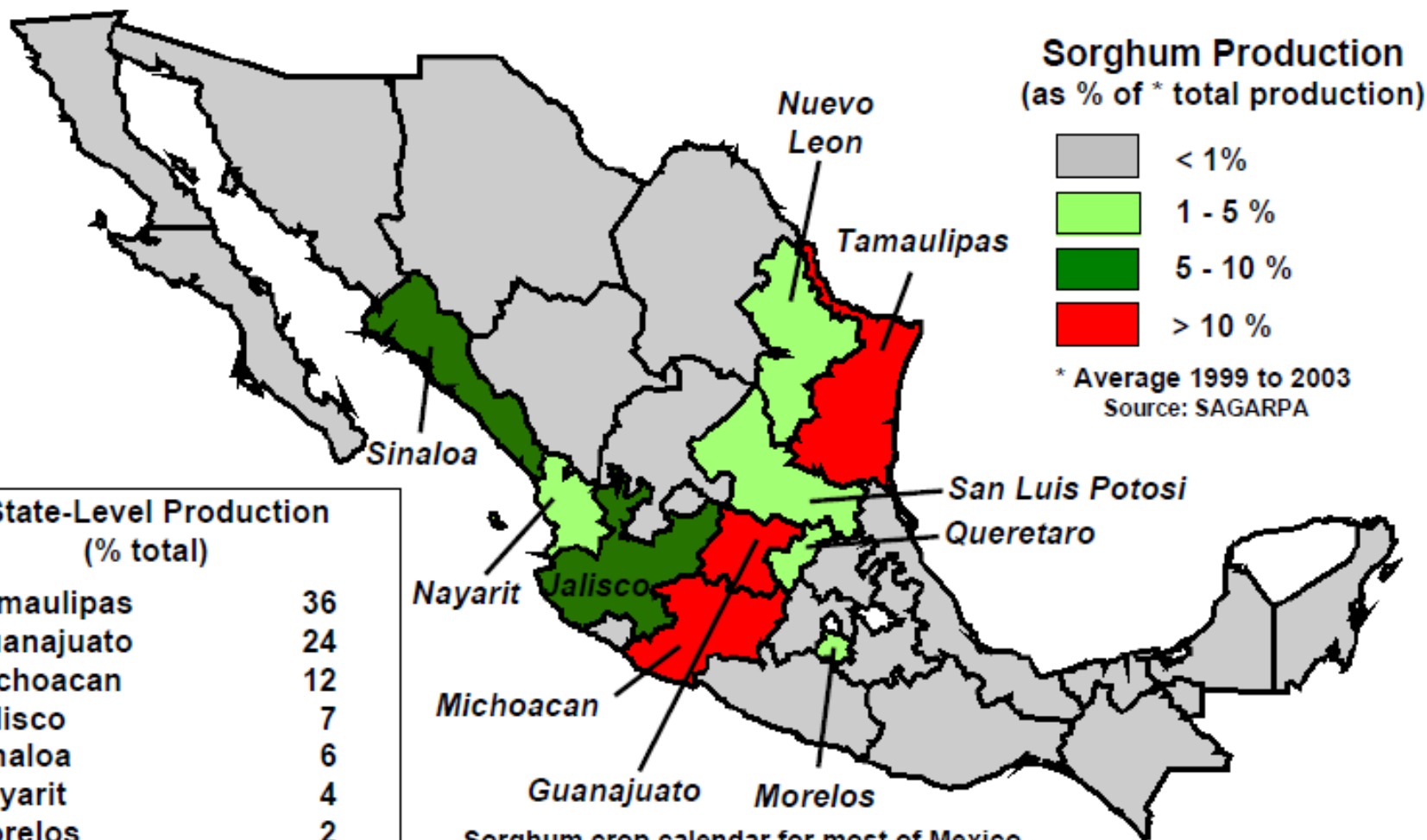
* 1999 to 2003 Average
Source: SAGARPA

Corn crop calendar for most of Mexico



Crop in northwestern Mexico harvested January to March

Mexican Sorghum Production

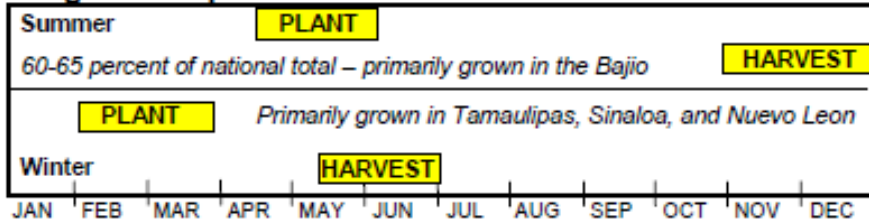


* State-Level Production (% total)

Tamaulipas	36
Guanajuato	24
Michoacan	12
Jalisco	7
Sinaloa	6
Nayarit	4
Morelos	2
Others	~ 9

* 1999 to 2003 Average
Source: SAGARPA

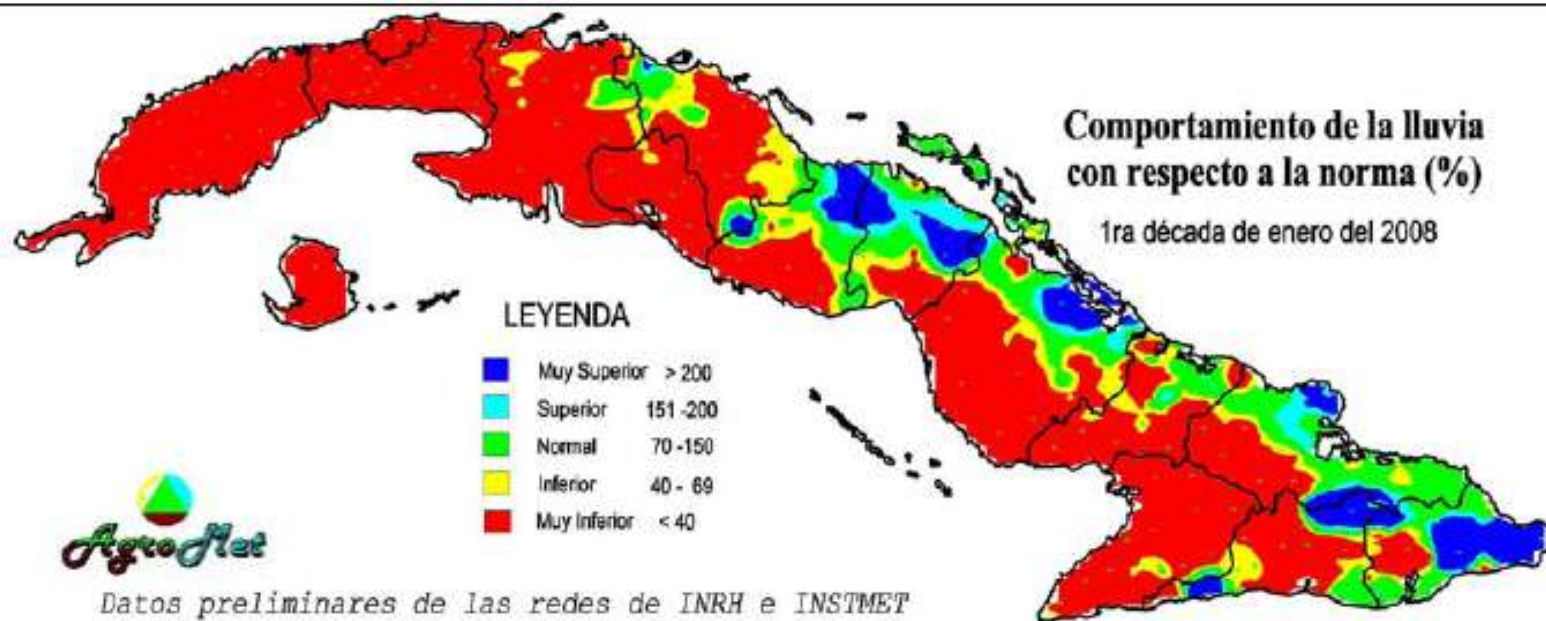
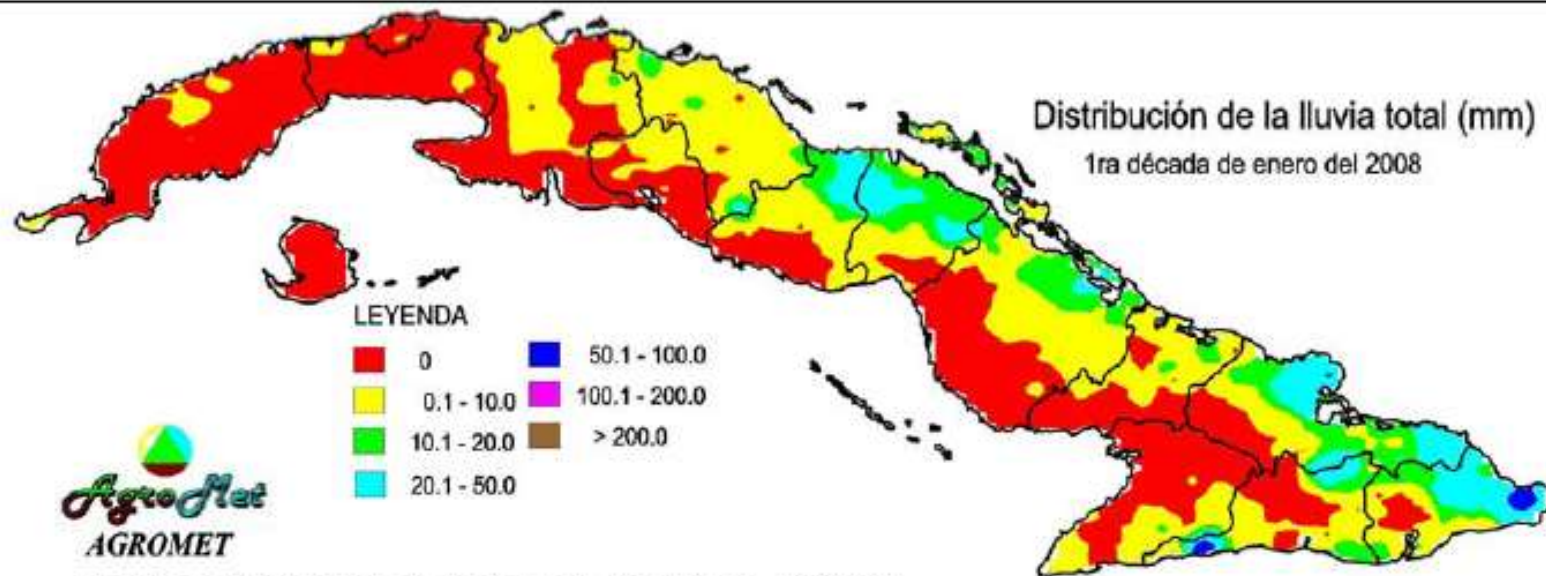
Sorghum crop calendar for most of Mexico





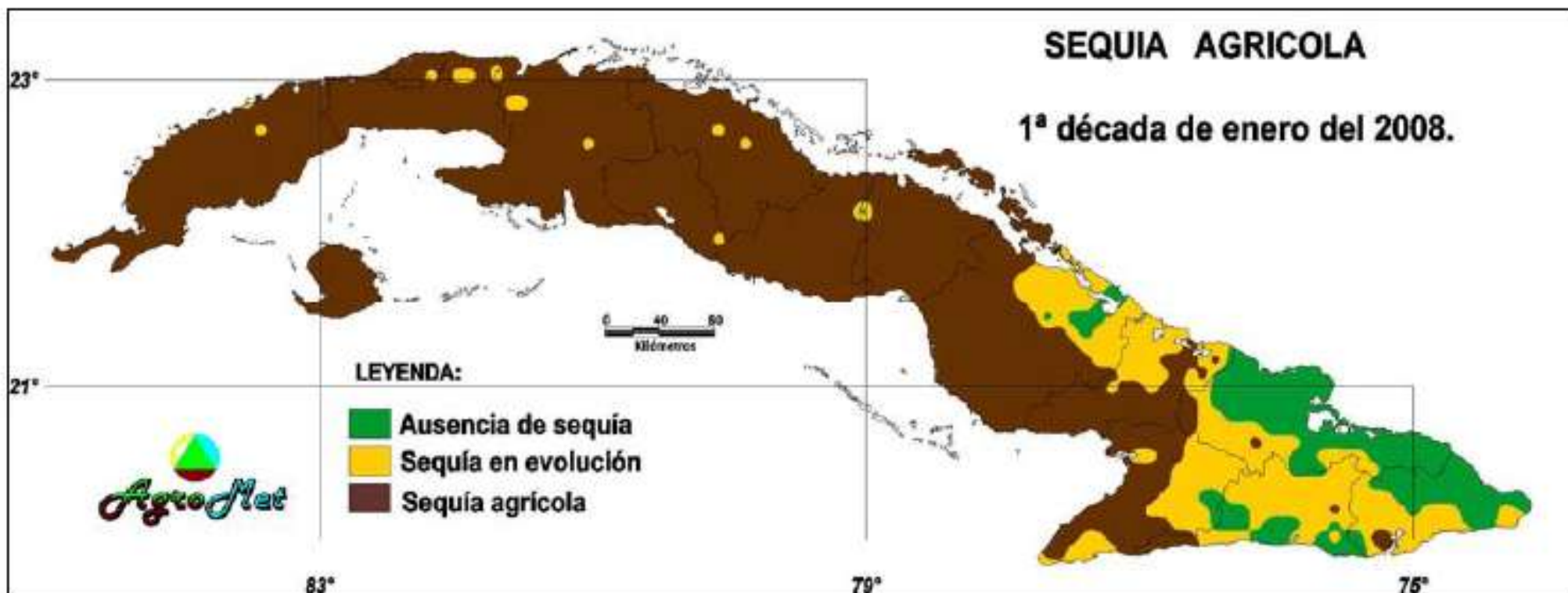
Information requirements for preparation of advice I

- **Weather information** required includes weather summaries of the recent past, such as the preceding week, climatic normal for the advisory period and weather forecasts for the advisory period.
- Required **agrometeorological information** includes some indices relating to agricultural production such as the **crop moisture** and drought index from the recent past.



SEQUÍA AGRÍCOLA

Continuaron incrementándose las áreas con presencia de sequía agrícola establecida y en evolución. Sólo se mantienen con ausencia de sequía agrícola las provincias orientales y áreas aisladas de la porción nordeste de la provincia La Habana.





Information requirements for preparation of advice II

- Crop information includes information on present crop status detailing **type, state and phenological stage of crops**; infestations of **pests and diseases** and their severity; and other crop stresses such as nutrient, water, and thermal stress.

CROP WEATHER CALENDAR

STATE : **ANDHRA PRADESH**

CROP : **GROUNDNUT (K)**

VARIETY : **TMV-2, JL-24, TMV-2, K3 (IMPROVED)**

SOIL : **RED SANDY LOAM/
SANDY CLAY LOAM**

DISTRICTS : **KHAMMAM, WARANGAL, KRISHNA, KARIMNAGAR**

NON-IRRIGATED

DURATION : **100-110 DAYS**

Weather warnings		Rain	> 50 MM	> 50 MM	> 30 MM																				
		Duration Of Wet Spell	> 10MM FOR 3 DAYS	> 30 MM FOR 3 DAYS	> 30 MM FOR 3 DAYS																				
Cloudy Weather		CLOUDY WEATHER	CLOUDY WEATHER																						
Drought	> 20 DAYS	> 20 DAYS	> 20 DAYS																						
High Winds																									
Temperature	MAX.TEMP.>35°C,MIN.TEMP.<10°C	MAX.TEMP.>40°C,MIN.TEMP.<18°C	MAX.TEMP.>40°C,MIN.TEMP.<18°C																						
Hail Storm			HAILSTORM																						
Weather conditions favourable for incidence of pests and diseases		Pests	APHIDS, ROOT GRUB, LEAF FOLDER, LEAF MINOR	APHIDS, THRIPS, LEAF FOLDER, LEAF MINOR	RED HAIRY CATERPILLAR																				
		Weather	CLOUDY WEATHER, RAIN, HIGH RH WITH LOW TEMP.	LOW TEMP AND HUMIDITY, CLOUDY WEATHER, AND RAINS	LOW TEMP AND LOW RH, CLOUDY WEATHER RAINS																				
		Diseases	COLLAR ROT, STEM, ROT, WILT, LEAF WEBBER	TIKA, LEAF SPOT, SPEDDOTIVE, BUDNECROSIS	TIKKA, LEAF SPOT, RUST, ROOT ROT, COLLAR ROT																				
		Weather	HIGH RH, LOW TEMP, CLOUDY WEATHER	HIGH RH, LOW TEMP, CLOUDY WEATHER	HIGH RH, LOW TEMP, CLOUDY WEATHER																				
Normal phase wise Water requirement(mm)		54.3	118.4	172.5	127.6	99.5																			
Weekly normal weather	Rainfall(mm)total	28.3	44.2	48.8	50.3	54.9	57.4	64.1	51.7	42.1	43.2	48.2	43.3	47.3	39.8	42.7	38.6	25.1	21.2	23.0	18.1	19.0	13.3		
	Max.temp. °C	37.5	36.0	34.0	33.6	33.1	33.1	32.7	31.8	32.2	32.5	31.8	32.2	32.2	32.6	32.7	32.7	33.3	33.1	32.6	32.3	31.6	31.5		
	Min.temp. °C	26.6	26.3	25.4	25.0	24.9	25.0	24.7	24.5	24.5	24.6	24.6	24.4	24.2	24.4	24.3	24.1	23.7	23.3	22.7	22.0	21.5	20.4		
	Sunshine hours	5.6	5.6	4.0	4.0	4.9	4.7	4.8	4.1	4.9	5.9	4.3	5.0	4.5	6.0	5.4	5.8	5.3	6.7	7.2	7.3	7.8	8.1		
Life history and mean dates of important epochs of crop growth																									
		<p>Standard weeks: 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48</p> <p>Months: JUNE, JULY, AUGUST, SEPTEMBER, OCTOBER, NOVEMBER</p>																							

Brazil Sugarcane

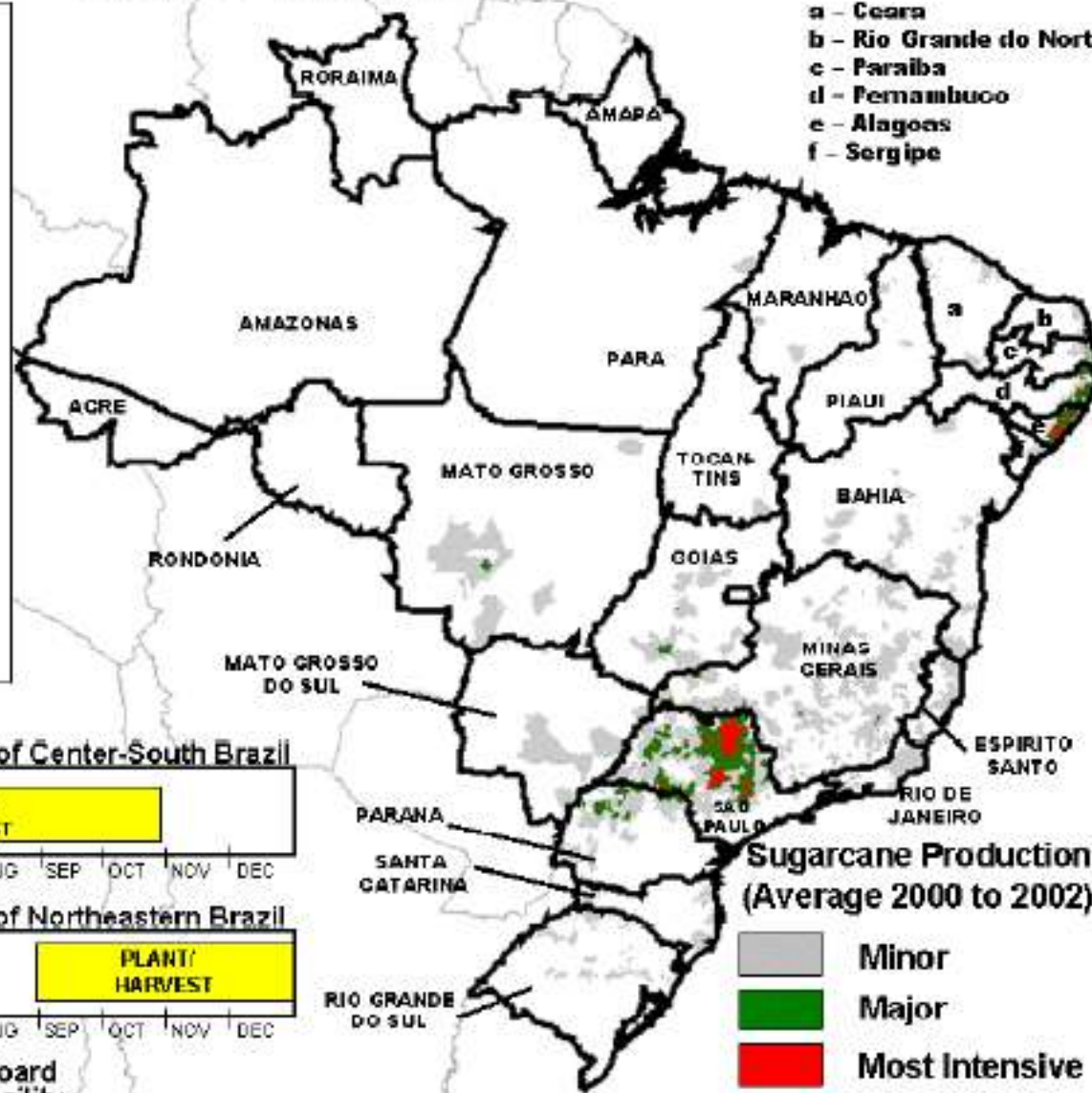
* State-Level Production (as % of total)

Sao Paulo	58
Alagoas	8
Parana	8
Minas Gerais	5
Pernambuco	5
Mato Grosso	3
Goias	3
Mato Grosso do Sul	2
Rio De Janeiro	2
Other States	6

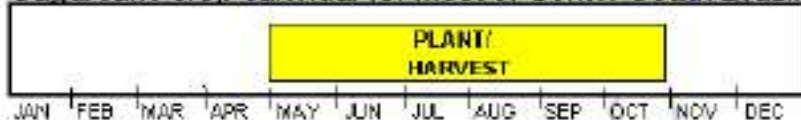
*1999/2000 to 2001/02 Average

Source: IBGE Brazil

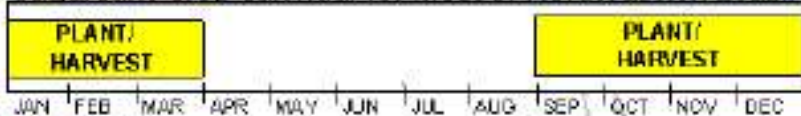
- a - Ceara
- b - Rio Grande do Norte
- c - Paraiba
- d - Pernambuco
- e - Alagoas
- f - Sergipe



Sugarcane crop calendar for most of Center-South Brazil



Sugarcane crop calendar for most of Northeastern Brazil

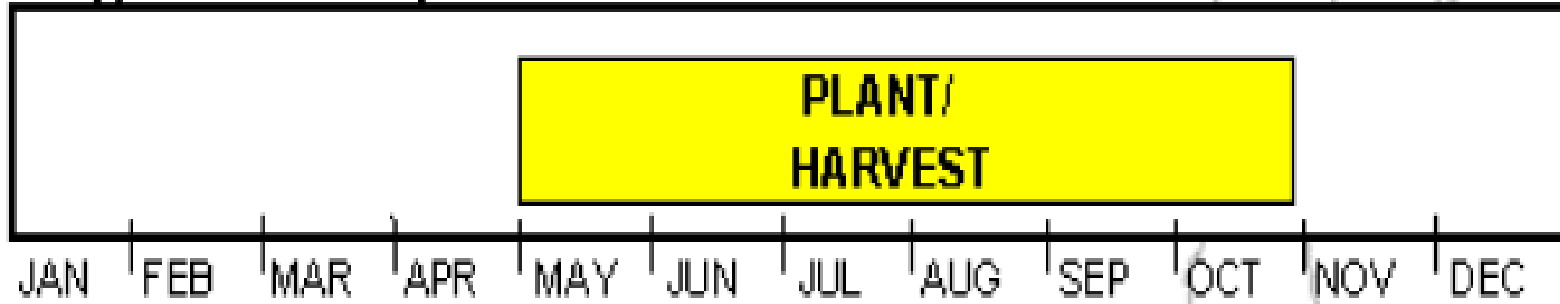


Sugarcane Production (Average 2000 to 2002)

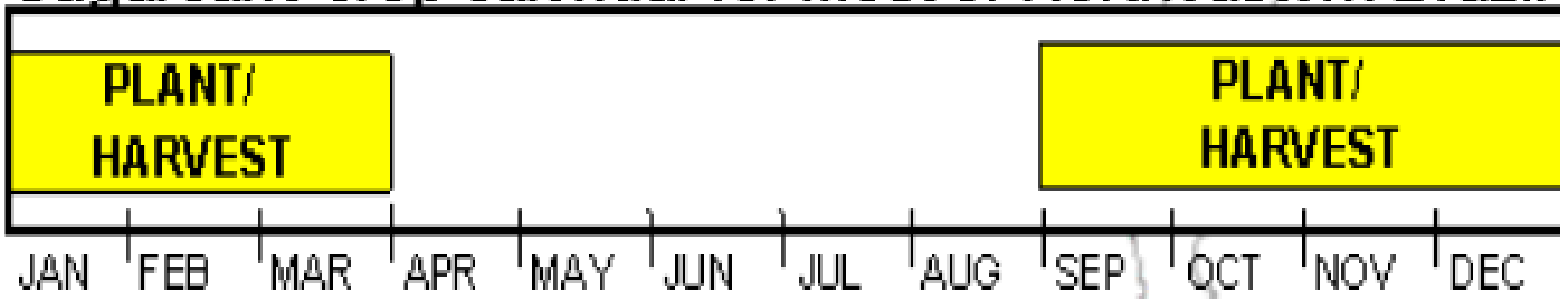
- Minor
- Major
- Most Intensive

Source: IBGE Brazil

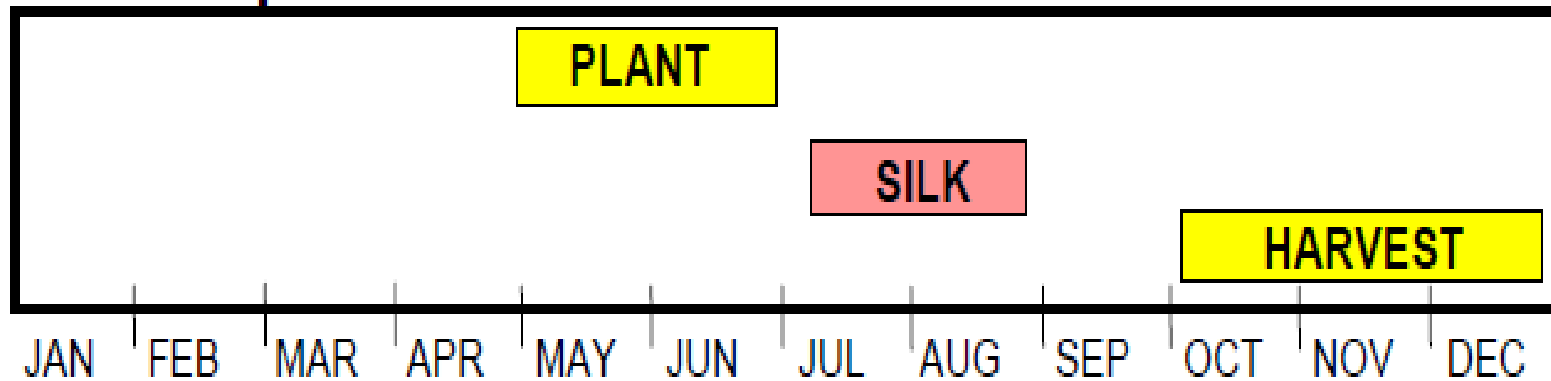
Sugarcane crop calendar for most of Center-South Brazil



Sugarcane crop calendar for most of Northeastern Brazil



Corn crop calendar for most of Mexico



Crop in northwestern Mexico harvested January to March



Information requirements for preparation of advice III

- Other information on **soil information** (types, water holding capacity), topography of the region, land cover and land use, irrigation facilities, **irrigated and rainfed areas**, availability of agricultural inputs and market trends is also considered for the preparation of advisories



Types of Agricultural Advisories I

- **Sowing/transplanting** of rainy season crops based on onset of rainy season
- **Sowing** of post rainy season crops using residual soil moisture for better germination and plant stand
- **Fertilizer application** based on wind condition
- **Delay in fertilizer application** based on intensity of rain
- **Prediction of occurrences of pest and disease** based on weather
- **Measures at appropriate time to eradicate pest and diseases**



Types of Agricultural Advisories II

- **Weeding** at regular interval for better growth and development of crops
- **Irrigation** at critical stage of the crop
- **Amount and timing of irrigation** using meteorological threshold
- **Harvesting advice** to obtain optimum crop maturity, quality and the like
- **Added benefit: Reduced environmental pollution through the optimal use of agricultural chemicals.**

Table 5.3. Summary of weather requirements for each rice farming operation in the humid tropics

<i>Farming operation</i>	<i>Sky condition during farming operation</i>	<i>Soil (moisture) condition</i>	<i>Leaf wetness duration</i>	<i>Air temperature (°C)</i>		<i>Wind speed (km/h) during farming operation</i>
1. Land preparation (Hand hoeing/plowing/harrowing/rotavating of lowland farms)	Clear or cloudy day desirable	Moist or wet dry surface and moist sub-surface desirable	Not applicable	≤40 desired	≥15 desired	≤50 for comfort of workers
2. Seeding in seedbed or field, A ₁ dry seeds A ₂ pre-germinated	Clear or cloudy	A ₁ moist, A ₂ wet	Not applicable	<33 desired	≥15 desired	<20 desired to minimize evaporation
3. Transplanting seedlings	Clear or cloudy day	Wet	Not critical	≤40 desired	≥15 desired	0–30 for comfort of workers
4. Hand weeding/cultivating (upland farms)	Clear to partly cloudy day	Moist or dry	Not critical	≤40 desired	≥15 desired	≤50 during operation
5. Irrigation	Clear or cloudy day	Moist or dry	Not critical	Not critical	≥15 desired	Not critical
6. Spraying Pesticide or foliar fertilizer B ₁ ground application B ₂ aircraft application	Clear day desired; partly cloudy day and/or night acceptable. (Visibility should be adequate for low-level flight of aircraft)	B ₁ Moist or dry desired for dry application in upland farms B ₂ Not critical for lowland rice farms or aircraft application	Leaves should be dry at spraying time; no rain until at least 4 h after spraying	<33 desired	≥15 desired	B ₁ 0–18 (for ground application) B ₂ 4–14 (for aircraft application)
7. Threshing/sun-drying/cleaning grain	Clear to partly cloudy for threshing and cleaning grains; clear for sun-drying	Dry surface for operation	Not applicable	No upper limit	≥15 desired	≤25 during grain cleaning operation



Forecasts of precipitation expressed by means of words

Probability of Precipitation	Terms Used
0%	NONE
10%	Slight Chance – Isolated
20%	Slight Chance
30-50%	Chance – Scattered
60-70%	Likely – Numerous
80-100%	Categorical ("Rain this afternoon")



Key Questions in AgroMeteorology

- **What are the weather / climate events that impact agricultural decision-making?**
- **How to relate weather / climate information to meaningful agricultural actions / practices?**



Example from India - Weather based agro-advisories

1. Weather summary of **preceding week** and **forecast** on parameters for **next three days** along with their likely impact on crops;
2. **Soil and crop conditions** indicating their state and stage, pest infestation etc.
3. Advice giving **specific information** for sowing/harvest, irrigation schedule, fertilizer management, and integrated pest management.
4. Based on the **weather prediction**, suggestions related to the measures to **minimize the losses** and to **optimize available resources** are also given.



Examples of agro-advisories

- **For south India:**
- **“There was no rainfall for the last five weeks in all the districts of Andhra Pradesh and no significant rainfall is expected for the next five days. Under the circumstances, apply irrigation to the standing crops to bring the soil moisture to its field capacity.”**



Examples of agro-advisories

- **Forecasts for application of agricultural chemicals:**
 - **Wind speeds are expected to be mostly favourable for application of agricultural chemicals today and tomorrow. Wind direction will be variable and wind speed will range from 6 to 13 km/h in the forenoon and will become southerly with speeds of 13 to 24 km/h during the late afternoon. Temperatures are likely to exceed 27°C tomorrow. So caution should be exercised in applying oil-based sprays.**
 - **Heavy rain is expected in the next 24 hours, so foliar application of chemicals may be postponed.**



Examples of agro-advisories

- **Water loss forecasts:**
 - **Free water loss during the past 24 hours averaged 0.6 cm. Expected free water loss is 0.6 cm today and 0.8 cm tomorrow. Rainfall probability will remain low for the remainder of the week and crops will begin to suffer from moisture stress in four days' time. Supplementary irrigation of 7 cm in two days' time is recommended.**
 - **Rain is likely to occur in the next 24 hours in most of the areas in this region and so farmers may postpone their irrigation for this period.**



Examples of agro-advisories

- Weeding forecasts:
- Rain is likely to occur in the next 24 hours in most of the areas in this region, so farmers may postpone application of chemical herbicides and hand/mechanical weeding operations.
- Following the rain spell of the last three days, weather will remain dry for the rest of the week. Hand/mechanical weeding and chemical weeding in two to three days' time are recommended.



Examples of agro-advisories

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In the coming dekad the rain bearing meteorological phenomena will be a better strength over most of Kiremet rain benefited areas. As result, normal rainfall will be expected over Tigray, Amhara, central and western Oromia, Benshangul-Gumuz and Gambela. The **near normal and in some place below normal rainfall** will be expect over eastern Oromia, Afar, northern Somali and northern half of SNNPR. This situation will have a **positive impact for Kerimt agricultural activities, general agricultural activities, perennial crops and for drinking water and pasture over pastoral and agro-pastoral areas**. On the other hand, **dry and cloudy weather condition** will be dominant over southern Oromia and southern Somali. The situation will have a **negative impact for pastoral and agro pastoral activities**.



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Thank You

rstefanski@wmo.int