THE FREQUENCY AND EFFECTS OF WEATHER EVENTS ON BANANA PRODUCTIVITY – RESULTS OF A GLOBAL SURVEY

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What can adaptation to weather variability teach us?

Although bananas prefer warm, moist conditions for year round production, they are cultivated with locally adapted practices in a wide variety of climates. This wide range of cultivation zones suggests that bananas will prosper even under higher temperatures associated with climate change.

Unfortunately the predicted increasing temperatures due to climate change are also predicted to increase weather variability– more moderate and extreme weather events such as droughts, more intense, less frequent rains, cold snaps, heat waves and more violent storms. These events have serious implications for banana productivity and profitability.

Currently across the many different climatic zones where bananas are produced, banana growers use practices to manage the negative effects of current climate variability and moderate or extreme weather events. These practices aim to prevent or buffer the negative impacts or to accelerate recovery in cases when impacts are inevitable.

We hypothesized that current grower practice to manage weather variability can provide insight into the challenges of building more robust climate smart agricultural practices addressing increasing weather variability. Improved short and medium term management of moderate and extreme events will serve as a laboratory for addressing longer term climate change.

Objective of study

Document the practices commonly used to address the effects of common weather events in different banana growing regions of the world

Methods used

A two stage electronic survey was conducted using a list of over 500 banana experts identified through the regional banana networks (www.banana-networks.org) in Asia, Africa and Latin America.

Round 1: Respondents prioritized the most important 4 weather events from a list of 16 events (see below) in their locality and described the short and medium term effects on banana. They also identified events with positive effects on banana productivity

16 weather events proposed in round 1 of the survey	
Rain distribution:	**Floods:**
Delay in the beginning of rainy season	Strong flowing water in plantation
Early start of dry season	Standing water in plantation
Extended rains in rainy season	**Wind:**
Dry spell in rainy season	Bursts of winds for short period
Out of season rains in dry season	Extended high winds in dry season
Extended high humidity without heavy rains	Extended high winds with rains
Extended cloudiness	**Temperature:**
Hail	Frost
	Cold snap in tropics or subtropics
	Heat wave

Round 2: Respondents quantified the duration and intensity of the 4 weather events which most effect banana production in their locality and identified practices used by growers to prevent effects, to reduce impact of events or to recover from the event.

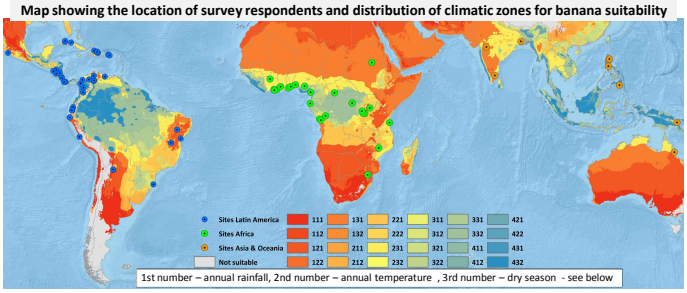
Response rate

Respondents came from different production systems and climatic zones. Cavendish (28%), East African Highland (25%) and plantain (30%), were most frequent but cooking banana and Lacatan were also well represented. The respondents, pinpointed on the map above, represented a wide range of climates.

About 25% of banana experts responded to the first survey. Their distribution by region is detailed in the table below. The rating of important weather events provided quantifiable information, while the response to the short term and future effects of events was quite general and did not provide concrete and specific information. The response rate in the second round was lower and responses less precise than expected. The frequent difficulties to quantify the nature of weather events suggest that management of weather variability remains a key challenge for banana adaptation to climate change.

Region	Language	Banana network	# Surveys sent	# respondents [Survey 1]	# respondents [Survey 2]
Latin America	Spanish	MUSALAC	281	65	24
Asia	English	BAPNET	154	35	11
East /Southern Africa	English	BARNESA	130	28	13
West /Central Africa	English	INNOVATE PLANTAIN	19	7	6
West /Central Africa	French	INNOVATE PLANTAIN	78	16	15

Map showing the location of survey respondents and distribution of climatic zones for banana suitability



Areas not suitable : ≥3 months with temperatures below 13 °C				
Rainfall (mm) [1st digit]	1: <900	2: 900-1500	3: 1500-2500	4: >2500
Temperature (°C) [2nd digit]	1: 13-18	2: 18-24°C	3: >24°C	4: >35°C
Length of dry season [3rd digit] Dry month (>60mm)	1: ≤ 3 dry months	2: ≥ 3 dry months		
	EXAMPLE: 421	>2500mm annual rainfall, 18-24 °C, ≤ 3 dry months		

Results

Since respondents came from a wide diversity of climates, all 16 events were cited. Drought and rainfall events were equally common followed by winds (see below). The 3 most frequently mentioned events globally were delay in start of normal rain season, extended dry period during rainy season and very strong winds for short periods (gusts). Events related to extreme temperatures were more common in the subtropics.

The type of beneficial weather events was sounded out (see below), but not their duration and intensity. Respondents provided a wide range of quantified data on negative events, sometimes outside of expected ranges, indicating a challenge to addressing weather effects.

	Asia	West /Central Africa	East /Southern Africa	LAC	Global
Category/ Weather event	Frequency with which ranked in the top 4				
DROUGHT	**33**	**55**	**48**	**97**	**233**
Extended dry period during rainy season	12	20	19	33	84
Delay in start date of normal rain season	10	19	18	38	85
Advance in the start of normal dry season	11	16	11	26	64
EXCESS RAIN	**50**	**52**	**43**	**105**	**250**
Extremely intense rainy period during rainy season	12	13	14	27	66
Over-saturated soil	10	8	6	28	52
Water standing in plantations	12	11	6	22	51
Flows of water in plantations	7	10	10	14	41
Prolonged period of high relative humidity	9	10	7	14	40
CRITICAL TEMPERATURES	**16**	**21**	**23**	**43**	**103**
Periods of high temperatures	9	16	13	27	65
Periods of low temperatures (without frost)	5	5	8	12	30
Frost	2	0	2	4	8
WIND CATEGORY	**30**	**32**	**27**	**60**	**149**
Very strong winds for short periods (gusts)	13	14	16	28	71
Prolonged strong winds during the dry season	8	11	5	22	46
Prolonged strong winds (associated with storms and hurricanes)	9	7	6	10	32
OTHER	**13**	**10**	**12**	**14**	**49**
Prolonged cloudy periods	8	8	3	10	29
Hail	5	2	9	4	20

Category	Beneficial events tropical regions	Beneficial events subtropical regions
Drought	Shorter dry season	
Rainfall	Less heavy rainfall during the rainy season Rain during the dry season Increase of rainfall without hail or strong winds Well distributed regular rainfall	Rain during the dry season Late rain before winter
Temperature	Temperature above 20°C throughout the year Lower temperatures in the dry season	High summer temperatures. Warmer than normal winter Warmer periods during the end of spring
Wind	Less violent winds Low wind speed during heavy rainfall season	Reduction of wind during spring
Other	Moderate humidity (60-70%) Higher humidity in dry season More sunshine during the rainy season	

Duration and intensity of extreme weather events					
Category	**Event**	**Characteristics**	**Asia**	**Africa**	**LAC**
Drought	Delay in the start date of the normal rainy season.	**Duration of the delay (days)**	29	31	40
		Deficit in rain as a (%) of the amount of rain needed	46	36	58
Excess rain	Extremely intense rainy period during the normal rainy season	**Duration of the intense rainy period (days)**	12	22	13
		Quantity in mm of daily rainfall during heavy rain period	260	105	78
Critical temperatures	High temperatures	**Duration of the event**	5 h to 5 days	4 h to 50 days	3 h to 3 days
		Threshold temperature above which damage begins (°C)	38	35	38
Wind	Very strong winds for short periods	**Duration of the event**	30 s to 60 min	5- 60 min	5 - 40 min
		Wind speed (km/h)	100 km/h	4 - 160 km/h	50 km/h

Conclusiones and next steps

- The weather events cited in the survey are exactly the types of events projected to increase with climate change representing a major threat for banana yields and livelihoods.
- Quantification of magnitude and frequency of events is a challenge to research which needed to guide work on management practices which currently often do not offset the impact.
- A global exchange to share response strategies to specific extreme events would build resilience to climate change. An inventory of practices by weather event could encourage innovation.