RAINFALL REVIEW FOR SEPTEMBER 2018

- September marks the peak of the 2018 hurricane season for Belize. The month of September was forecasted to be below normal in the north, near normal to slightly below normal in the central areas and normal to slightly above normal in southern areas.
- The month saw generally dry conditions as expected over most parts of Belize, except for the southern and some central regions in areas like Central Farm and Punta Gorda which were slightly above normal and above normal, respectively.
- The highest monthly rainfall was recorded at the Punta Gorda station in the southern zone, with a total of 608.5 mm of rainfall with 15 rain days.
- The Punta Gorda station in the southern zone also recorded the highest one-day rainfall totals with values of 97.0 mm on September 4 and 96.0mm on September 23, 2018.
- The lowest monthly rainfall recorded at the Libertad station in the northern zone, was below normal for the of September with a value of 110.9mm, however, the Belmopan Station in the Central Inland zone with a value of 122.4 mm was the driest area with its rainfall total only 49 percent of its 30-year long term mean value.
- Most stations analysed recorded rainfall amounts below their long-term averages, except for the Central Farm, Spanish Lookout and Punta Gorda stations in the southern and some central areas, where near-normal to slightly above normal rainfall was observed (Figure 1).

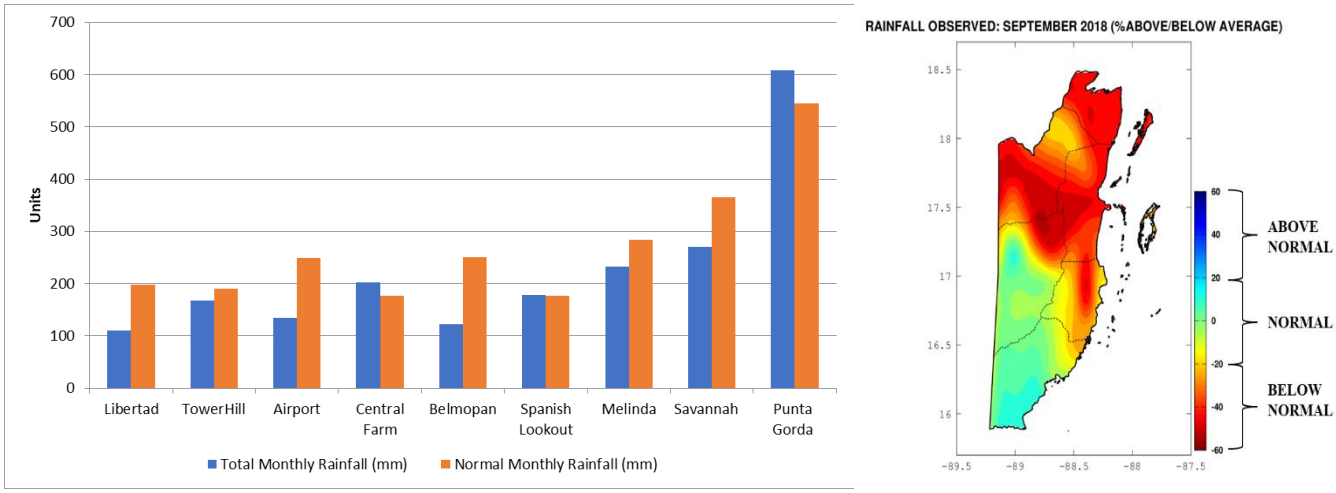


FIGURE 1: COMPARISON OF THE ACCUMULATED RAINFALL AND THE LONG-TERM AVERAGES OF SELECTED STATIONS FOR SEPTEMBER 2018 (LEFT) AND OBSERVED PERCENT (%) ABOVE/BELOW AVERAGE DISTRIBUTION MAP FOR SEPTEMBER 2018 (RIGHT) (NMS BELIZE).

STANDARD PRECIPITATION INDEX (SPI)

Standardized Precipitation Index (SPI) The Standardized Precipitation Index (SPI), developed by T.B. McKee, N.J. Doesken, and J. Kleist in 1993, is a tool used to monitor drought conditions based on precipitation. The SPI can be used to monitor conditions on a variety of time scales namely 1-month, 3-month, 6-month, 9-month and 12-month periods. This temporal flexibility allows the SPI to be useful in both short-term agricultural and long-term hydrological applications by providing early warning of drought and for making assessments on the severity of a drought. In primary agricultural regions, a 3-month SPI might be more applicable in highlighting available moisture, gives an indication of soil moisture conditions as the growing season begins and captures precipitation trends during the important reproductive and early growing stages of crop development. The National Meteorological Service (NMS) of Belize calculated the observed SPI (see Table 1) using a 3-month and 6-month time interval, respectively and classified the observed conditions using the severity classes of SPI (see Table 2).

TABLE 1: OBSERVED SPI FOR SELECTED STATIONS ACROSS BELIZE DURING THE JULY-SEPTEMBER 2018 AND APRIL TO SEPTEMBER 2018 PERIODS (NMS BELIZE).

Climatic Zone	Station	Sept Rainfall Total (mm)	Percent of 30-year Mean (%)	Observed SPI 3-month	Observed SPI 6-month
Northern Areas (Orange Walk and Corozal Districts)	Libertad	110.9	56	-1.42	-2.1
	Towerhill	167.8	88	-1.18	-1.39
Central Coastal Areas (Belize District)	Airport	135.3	54	0.22	-0.62
Central Inland Areas (Cayo District)	Central Farm	202.3	114	0.73	-0.04
	Belmopan	122.4	49	-1.26	-1.61
	Spanish Lookout	179	101	-1.19	-1.26
Southern Areas (Stann Creek and Toledo Districts)	Melinda	232.8	82	0.53	-0.05
	Savannah	270.3	74	1.53	-0.55
	Punta Gorda	608.5	112	0.29	-0.02

Note (3-month: July to September 2018, 6 month: April to September 2018)

TABLE 2: SEVERITY CLASSES OF THE SPI (CIMH).

SPI Value	Category	SPI Value	Impact
-0.50 to -0.01	Normal	**0.50 to 0.01**	Normal
-0.80 to -0.51	Abnormally Dry	**0.80 to 0.51**	Abnormally Wet
-1.30 to -0.81	Moderately Dry	**1.30 to 0.81**	Moderately Wet
-1.60 to -1.31	Severely Dry	**1.60 to 1.31**	Very Wet
-2.00 to -1.61	Extremely Dry	**2.00 to 1.61**	Extremely Wet
-2.00 or less	Exceptionally Dry	**2.01 or more**	Exceptionally Wet

Based on the SPI figures for the July-September period, stations across the country showed mostly dry conditions, one station with abnormally (dry) conditions, five stations experienced moderately (dry) to severely (dry) conditions, while three stations experienced normal to abnormally (wet) conditions. In the short to medium term, the dry spots, northern Belize and Central areas (Belmopan and Spanish Lookout) have very limited available moisture. For the April-September period, 5 of 9 stations across the country, showed near-normal (dry) to abnormally (dry) conditions and three stations experienced moderately (dry) to extremely (dry) conditions and one station with exceptionally (dry) conditions. For most of the start of the wet season to current, the observed trend was for normal to abnormally dry conditions over southern and central coastal Belize, moderately to severely dry in the central inland area and extremely dry in extreme northern Belize. Based on the observed (July-September 2018) and forecasted (up to January 2019) SPI values however, there is currently DROUGHT WATCH in the short and medium-term for Belize.

TEMPERATURE REVIEW FOR SEPTEMBER 2018

- For the month of September, maximum temperatures were below-normal for three sampled stations mostly southern stations, above normal for 3 northern and central stations and normal at the airport (Figure 2).
- The highest one-day maximum temperature was also recorded at the Savannah station in the southern zone, with a value of 35.4°C on September 30, 2018.
- Towerhill recorded the highest mean monthly maximum temperature with a value of 33.5°C.
- The Airport station (PGIA) recorded the highest mean minimum temperature of 24.9°C.
- Punta Gorda recorded the lowest daily minimum temperature of 18.8°C on September 5, 2018.
- Of the sampled stations, most recorded minimum temperatures near their long-term averages, except for the Airport and Belmopan with slight above normal night-time temperatures and Punta Gorda recording minimum temperatures below its long-term average (Figure 3).

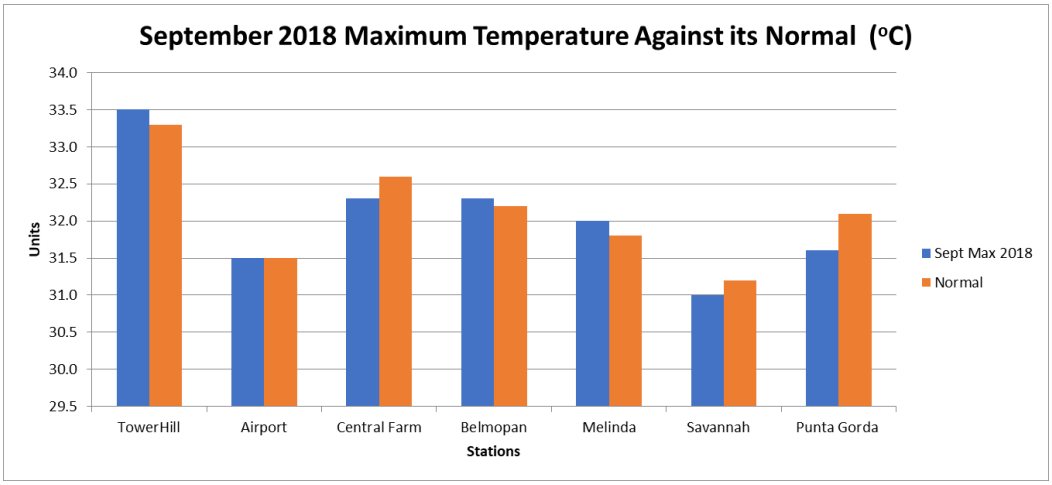


FIGURE 2: COMPARISON OF THE MEAN MAXIMUM TEMPERATURE AND THE LONG-TERM AVERAGES OF SELECTED STATIONS FOR SEPTEMBER 2018 (NMS BELIZE).

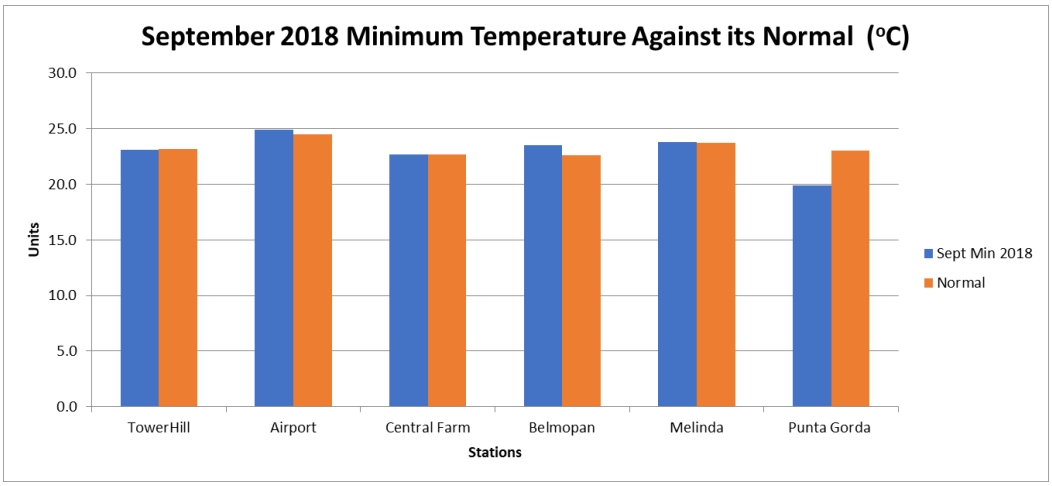


FIGURE 3: COMPARISON OF THE MEAN MINIMUM TEMPERATURE AND THE LONG-TERM AVERAGES OF SELECTED STATIONS FOR SEPTEMBER 2018 (NMS BELIZE).

POSSIBLE IMPLICATIONS OF THE SEASONAL OUTLOOK ON AGRICULTURE

(October-November-December)

- Normal to slightly below-normal rainfall is likely over northern areas of the country, while normal to slightly above-normal conditions are expected over central and southern areas.
- The probability for the increase of pest and diseases associated with wetter conditions will increase as the season progresses.
- Maximum temperatures are expected to be slightly above normal, while minimum temperatures are expected to be above normal during this period.
- A general increase in surface wetness is likely as the season progresses over most areas leading up to the start of the dry season, with not as much dry spells for Belize.
- The occurrence of a few heat waves is still likely to temporarily increase heat stress in livestock.

ADVICE TO LIVESTOCK FARMERS:

- Monitor livestock for pests and diseases associated with an increase in wetter conditions.
- Provide proper shelter for animals in warm and dry conditions for the occasional heat waves during the period.
- Store fertilizer, animal feed and pesticides away from moist areas.
- Ensure proper drainage structures for water runoff.
- With a forecast for above-normal daytime temperatures and occasional heat waves, there is the possibility of heat stress for livestock and other animals, therefore, cooling and hydration provisions are being recommended.
- Increase monitoring of livestock population for outbreak of bronchitis, diarrheal infection and frog hopper.

TABLE 3: POSSIBLE WEATHER EFFECTS ON AGRICULTURE: LIVESTOCK (NMS, OIRSA, BAHA, MOA). AUGUST TO OCTOBER 2018

	ZONE	POSSIBLE EFFECTS AND ACTIONS TO MITIGATE EFFECT
POULTRY	**North** (Corozal & Orange Walk)	- Increase in newcastle, Avian Influenza and Bronchitis disease outbreak due to low temperature and - Increase active surveillance for early detection and control measures of poultry diseases. - Increase public awareness. - Increase biosecurity measures in poultry farms
	Central Inland/Coastal (Cayo & Belize)	- Increase in newcastle, Avian Influenza and Bronchitis disease outbreak due to low temperature and bird migration. - Increase active surveillance for early detection and control measures of poultry diseases. - Increase public awareness. - Increase biosecurity measures in poultry farms
	South (Stann Creek & Toledo)	- Increase in newcastle and Avian Influenza virus disease outbreak in Southern region; possible bronchitis disease outbreak as well. - Implementation of vaccination program against newcastle disease. - Training of farmer on how to vaccinate against newcastle - Public awareness and educational trainings. - Increase surveillance (active and passive) for early detection and control measures.
CATTLE	**North** (Corozal & Orange Walk)	**Can cause an increase in internal and external parasites; as well as increase in rabies outbreak.** - Recommend timely vaccination against rabies and deworming of animals along with pasture management (silvopastoral system) - Increase bat trapping for hematofagous bats - Ensure adequate water supply and hay storage, protein banks or citrus pellets **Can cause an increase in vesicular stomatitis in cattle and horses** - Increase management practice as well as pasture rotation. - Increase biosecurity measures. - Isolate and treat infected animal to prevent further infection.
	Central Inland/Coastal (Cayo & Belize)	**Monitoring for early detection in the increase of internal and external parasites; as well as increase in rabies outbreak.** - Recommend timely vaccination against rabies and deworming of animals along with - pasture management (silvopastoral system) - Increase bat trapping for hematofagous (vampire) bats - Monitor your water supply and hay storage, protein banks or citrus pellets **Monitor for early detection of vesicular stomatitis in cattle and horses** - Increase herd management practice as well as pasture rotation. - Increase biosecurity measures. - Isolate and treat infected animal to prevent further infection.
	South (Stann Creek & Toledo)	**Elevated risk of rabies transmission in cattle as well as vesicular diseases outbreak** - Increase surveillance for transboundary diseases. - Increase rabies vaccination where applicable. - Increase in bat trapping program required. **Can cause an increase in vesicular stomatitis in cattle and horses** - Increase management practice as well as animal rotation. - Increase biosecurity measures. - Isolate infected animal to prevent further infection. **Can cause an outbreak of frog hopper in pastures** - Monitor and control measures where possible **Can cause an increase in gastrointestinal infections** - Monitor for internal parasite in animals.
PIGS	**North** (Corozal & Orange Walk)	**INCREASE in gastrointestinal and respiratory infections.** - Proper farm management. - Implement deworming strategies and monitoring of symptoms.
	Central Inland/Coastal (Cayo & Belize)	**INCREASE in gastrointestinal and respiratory infections.** - Proper farm management. Implement deworming strategies and monitoring of symptoms.
	South (Stann Creek & Toledo)	**INCREASE in diarrhoea infection.** - Proper farm management. - Implement deworming strategies and monitoring of symptoms.

SHEEP	**North** (Corozal & Orange Walk)	**INCREASE in internal and external parasites** - Proper farm management - Implement deworming of animals and vitamin shots required.
	Central Inland/Coastal (Cayo & Belize)	**INCREASE in internal and external parasites** - Proper farm management Implement deworming of animals and vitamin shots required.
	South (Stann Creek & Toledo)	**INCREASE in risk for vesicular and transboundary disease that can potentially enter Belize.** - Continue surveillance (active and passive) program for these transboundary diseases. - Proper farm management.
BEES	**North** (Corozal & Orange Walk)	**Will favour an INCREASE in small-hive beetle population outbreak.** - Management practice in the control of the pest where present (Corozal District). - **INCREASE** monitoring and surveillance.
	Central Inland/Coastal (Cayo & Belize)	**Cause an expansion of the presence of the small hive beetle to these areas** Monitoring and surveillance must be conducted frequently
	South (Stann Creek & Toledo)	**Cause an expansion of the presence of the small hive beetle to these areas** - Monitoring and surveillance must be conducted frequently

Drought Warning

Drought Watch

ADVICE TO CROP FARMERS:

- Harvest water during the wetter days of the season.
- Adjust sowing and harvesting period to avoid negative effects of wet spells.
- Maintain clean crop beds to reduce the risk of flooding.
- Plant crop varieties that can be grown in wet conditions and that are not easily affected by pests and diseases.
- Plant crops on raised beds and replant grass or crops along flood plains to reduce soil erosion and flooding.
- Store fertilizers on shelves, in an enclosed, dry area away from moisture and water sources.

TABLE 4: POSSIBLE WEATHER EFFECTS ON AGRICULTURE: AGRICULTURE COMMODITIES (NMS, OIRSA, BAHA, MOA). AUGUST TO OCTOBER 2018

	ZONE	POSSIBLE EFFECTS AND ACTIONS TO MITIGATE EFFECT
SUGARCANE	**North** (Corozal & Orange Walk)	**This condition will not favour the pest population outbreak of the frog hopper and sugar cane borrers.** - Continue surveillance and monitoring of the pest - Monitor soil moisture and implement irrigation where possible
	Central Inland/Coastal (Cayo & Belize)	**This condition will not favour the pest population outbreak of the frog hopper and sugar cane borrers.** - Continue surveillance and monitoring of the pest - Monitor soil moisture and implement irrigation where possible
	South (Stann Creek & Toledo)	**Still poses a possibility of pest population increase of frog hopper.** - Increase surveillance and monitoring of pest population
CITRUS	**Central Inland/Coastal** (Cayo & Belize)	**Will favour psyllid population growth and possible outbreak.** - Increase monitoring of population dynamics - Initiate area wide control measures - Monitor soil moisture and implement irrigation where possible **Can increase the mite population a vector for the citrus leprosis virus.** - Miticide spray might be necessary for control.
	South (Stann Creek & Toledo)	**Will not favour psyllid population growth.** - Continue monitoring for the pest.
BANANAS	**South** (Stann Creek & Toledo)	**Will favour an increases in outbreaks of Sigatoka** - Increase monitoring and preventative control measures. **Will favour flooding in certain areas** - Maintenance of drainage systems **Will favour increase in nematodes outbreak** - Continue monitor and implement control measures where possible
GRAINS: CORN, RICE, BEANS, SOY BEANS, & SORGHUM	**North** (Corozal & Orange Walk)	**This will increase chances of mite population outbreak.** - Monitoring and preventative spray with miticide. **Will favour army worm population outbreak** - Increase monitoring and effective control measures if necessary **This will favour the yellow sorghum aphid population increase.** - Increase surveillance and control where necessary. - Monitor soil moisture and implement irrigation where possible
	Central Inland/Coastal (Cayo & Belize)	**This will increase chances of mite population outbreak.** - Monitoring and preventative spray with miticide. **Will favour army worm population outbreak** - increase monitoring and effective control measures if necessary **This will favour the yellow sorghum aphid population increase.** - Increase surveillance and control where necessary. - Monitor soil moisture and implement irrigation where possible
	South (Stann Creek & Toledo)	**This will favour fungal problems as well as bacterial outbreak.** - Increase monitoring and control measures where necessary. - Ensure proper drainage system to avoid excess moisture
HORTICULTURE: TOMATOES, PEPPERS, ONIONS, CABBAGE, CARROTS, & POTATOES	**North** (Corozal & Orange Walk)	**This will favour white flies, thrips and mite outbreak along with viral diseases.** - Monitoring and implementing effective control measures. - Cover structure production where possible **This will favour increase in population for diamond back moth** - Increase surveillance and monitoring of the pest and apply insectide where necessary - Monitor soil moisture and implement irrigation where possible
	Central Inland/Coastal (Cayo & Belize)	**This will favour white flies, thrips and mite outbreak along with viral diseases.** - Monitoring and implementing effective control measures. - Cover structure production where possible **This will favour increase in population for diamond back moth** - Increase surveillance and monitoring of the pest and apply insecticide where necessary - Monitor soil moisture and implement irrigation where possible
	South (Stann Creek & Toledo)	**This will favour fungal problems as well as bacterial outbreak.** - Increase monitoring and control measures where necessary. - Ensure proper drainage system to avoid excess moisture

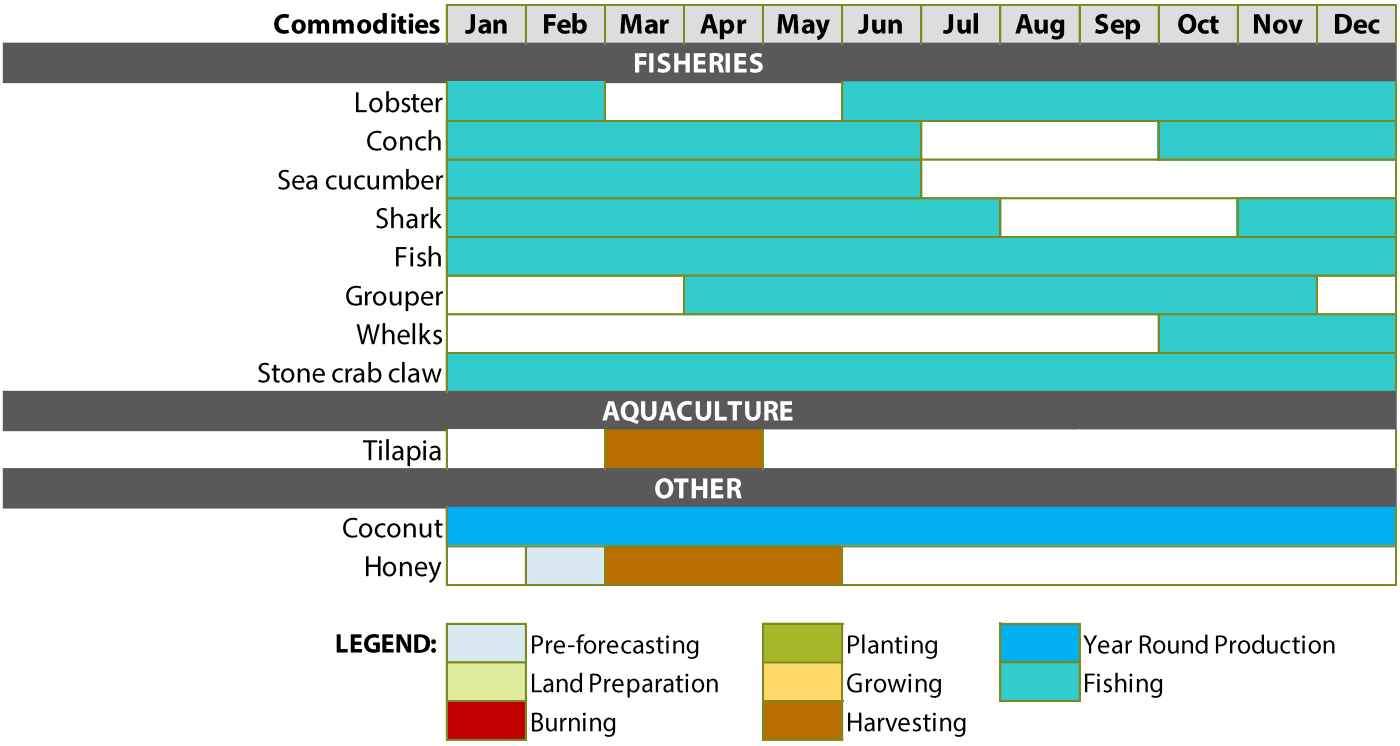
FRUIT TREES: COCONUTS, AVOCADOES, SOURSOP, CACAO, & PINEAPPLE	**North** (Corozal & Orange Walk)	**Will increase red mite population in coconuts.** - Spray with miticide where possible **Increase in white fly population in avocadoes and soursop** - Monitoring and spray with systemic insecticide **Possible increase in the wasp population that affects soursop fruits.** - Monitoring of the wasp and insecticide application where necessary followed by bagging of fruits **Can increase weevil (Rhyncophorus palmarum) infestations that causes red ring disease** - Increase monitoring and trapping - Monitor soil moisture and implement irrigation where possible
	Central Inland/Coastal (Cayo & Belize)	**Can increase red mite population in coconuts.** - Monitor and Spray with miticide where possible **Can increase in white fly population in avocadoes and soursop** - monitoring and spray with systemic insecticide **Possible increase in the wasp population that affects soursop fruits.** - monitoring of the wasp and insecticide application where necessary followed by bagging **Can increase weevil (Rhyncophorus palmarum) infestations that causes red ring disease** - Increase monitoring and trapping - Monitor soil moisture and implement irrigation where possible
	South (Stann Creek & Toledo)	**This will favour an increase incidence of pyhtophtora problems in coconuts and pineapple.** - Continue monitoring and control measures where necessary. **Will favour an increase in monilia problems in cacao.** - Continue monitoring for moniliasis and control measure where necessary - Ensure proper drainage system to avoid excess moisture

Drought Warning

Drought Watch

TABLE 5: PRE-PROCESSING, LAND PREPARATION, BURNING, PLANTING, GROWING, HARVESTING, YEAR ROUND PRODUCTION AND FISHING DATES FOR DIFFERENT COMMODITIES (MOA, POLICY UNIT).

COMMODITY PRODUCTION CYCLE



Prepared by: PPU & Extension Unit, Ministry of Agriculture
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LAND PREPARATION, PLANTING AND HARVESTING CHART INTERPRETATION:

The purple, black, green, yellow, and orange represents the pre-forecasting, land preparation, burning, growing and harvesting phases respectively, of the production cycles. The beige and blue colours signifies year round commodities and fisheries production, respectively. Seasonal crops are crops that are planted during the colder days of the year and are also short-day plants.