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Late Chills Affecting Crop Production

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Climate is mean total of prevailing weather conditions at a place over a long period of time. Climate has great influence on day-to-day human activities. Each individual is aware of the changing climatic conditions on national as well as on a global scale. It is a worrisome situation that the normal threshold of temperatures is tramped over previous decade. This crippling heat is devastating our natural resources and human health. According to World Meteorological Organization report, with the average global near surface temperature being 1.4 degree Celsius above the normal, 2023 was confirmed as the warmest year on the record and the temperature predicted to increase in further years. Moreover, the oceanic heat content was also recorded at maximum in 2023. Heat waves are becoming extremely intense and frequent globally. Unbearable temperatures over 40°C and even 50°C are increasingly frequent in many parts of the world. Climate change and increased adverse weather events in recent decades further add to the misery of the farmers causing widespread losses of agricultural output. Extreme heat is gripping large parts of India, affecting hundreds of millions of people and agriculture in particular. This heat entrapped in atmospheric layers for longer duration disrupts natural circulations and weather phenomenon including onset of winter season. It is observed from the average climatic data values after industrialization era begun that the onset of winters is delayed year after year, now initiates near mid-December which typically starts October or November, depending on the region.

Unusually Warm October and November

According to an article of Times of India, October and November this year recorded higher-than-normal temperatures, with October being Delhi's hottest since 1951. The average maximum temperature in October reached 35.1°C, and the minimum was 21.2 °C, both record-breaking figures. November also followed this trend, becoming the warmest in five years, with temperatures rarely dipping below 10°C. Long term climate change, shifts in atmospheric pressure patterns, El Niño and other factors contributes for 2023 stands out as the warmest year on record by a significant margin, which is continued in 2024. June 2024 was the thirteenth month in a row of record global temperatures. Extremely high temperature of 50.4 degree Celsius is recorded on 26th May 2024 in Churu district of Rajasthan. Pollution and lack of rain also contributes to warmer winters. Rainfall in October and November typically cools the region, which was absent this year, has been a key factor in the delay of winter. Moreover, higher pollution levels in northern cities, particularly Delhi further added to the warm conditions. Several factors can influence the timing and intensity of winter in India, and a delay can be caused by both natural variability and broader climatic factors.

Here are a few reasons why winter might arrive late in India:

- **El Niño Phenomenon**: El Niño is a climate phenomenon in which sea surface of the central and eastern Pacific Ocean warms and water temperature raises disrupting the normal patterns of monsoon rains leading to warmer-than-usual conditions across large

parts of the world, including India. El Niño affects the formation of cold winds and systems often result in delayed or weaker winter conditions in Indian subcontinent.

- **Changes in the Jet Stream:** The position and strength of the Westerly Jet Stream (a high-altitude wind system that plays a key role in controlling the weather in northern India) can also affect the onset of winter. A weakened or delayed jet stream can result in warmer air lingering over the region for a longer time, delaying the drop in temperature that marks the start of winter.
- **Global Warming and Climate Change:** Rising global temperatures due to climate change are also thought to have an effect on seasonal weather patterns, including the timing and intensity of winters. Warmer temperatures over the land can lead to a delay in the cooling of northern India, meaning winters could arrive later or not be as cold as in previous years.
- **Local Weather Systems:** The arrival of the northeast monsoon or local weather systems such as cyclones and low-pressure areas can also delay the onset of winter in certain parts of India. These systems bring moisture and warmth, especially in coastal and southern regions, which can prolong the warmer weather.
- **Northward Shifting of the Sun:** The timing of the sun's apparent movement northward (crossing the equator during the autumn equinox) can influence the general seasonal patterns. In years where this shift happens later, the cooling in northern India may also be delayed.
- **Regional Variations:** The timing of the winter onset can vary across India. Northern and northwestern regions (like Punjab, Haryana, Delhi, and Jammu & Kashmir) generally experience earlier winters, while the southern and coastal parts (like Tamil Nadu, Kerala, and Mumbai) see a much later transition. A late onset might affect the northern plains more directly, while the southern regions may not feel significant temperature changes until much later in the season.

Impact of late onset of winters on crop production

Even low and moderate intensity heat waves can impact the health and well-being of populations, particularly the vulnerable.

- A delay in winter can affect the sowing and growth cycles.
- The problem arises when temperatures rise above the usual range for these types of vegetables, leading to physiological and growth issues.
- **Reduced Germination Rates**-Heat stress can inhibit the germination of seeds, particularly for cool-season crops. If soil temperatures are too high, seeds may fail to sprout or take much longer to germinate. For instance, spinach, which is commonly grown in winter, tends to have poor germination rates when soil temperatures rise above 75°F (24°C).
- **Wilting and Leaf Damage**- When temperatures rise unexpectedly, plants often struggle to maintain moisture balance. Winter vegetables like lettuce and spinach have delicate leaves that are especially prone to wilting, curling, or even scorching when subjected to high temperatures. These stressed plants may also drop leaves prematurely.
- **Stunted Growth**- High temperatures can interfere with photosynthesis, slowing down plant growth. Even though winter vegetables are adapted to cooler weather, extreme heat can cause them to "bolt" (flower prematurely) or stunt their growth. For example, plants like broccoli and cauliflower can become stressed and fail to produce good-quality heads.
- **Altered Taste and Quality**- Heat stress often leads to a reduction in flavor and texture. Winter vegetables like spinach and kale may become bitter or tougher when exposed to heat. This is particularly true when plants experience rapid shifts in temperature or inconsistent weather patterns.
- **Pest and Disease Pressure**- Heat can also encourage pests and diseases. High temperatures often make plants more vulnerable to aphids, flea beetles, and fungal infections, as stressed plants are less able to defend themselves.

- **Reduced Yield**- Heat stress during the growing period can lead to a reduced yield. This is particularly concerning in regions where winter vegetables are grown for harvesting during milder spring months. Crops may fail to reach their full size or may go to seed prematurely, leading to lower overall harvests.
- **Flowering or Bolting**- Many winter vegetables, such as kale, spinach, and certain varieties of cabbage, will "bolt" (go to seed) prematurely in response to heat. This is a survival mechanism where the plant shifts from vegetative growth to reproduction. While this may ensure the plant's survival, it also means a loss of edible parts for harvest.

Strategies to Mitigate Heat Stress in Winter Vegetables

Despite the adversity of temperature highs, here are opportunities to reduce extreme heat risk, and actions and tools at our disposal to save lives and significantly limit the impacts of extreme heat.

- **Shade Cloth**: Installing shade cloth or netting can help reduce the amount of direct sunlight and lower temperatures around the plants, offering protection from midday heat.
- **Mulching**: Apply mulch around the base of plants to help conserve soil moisture and regulate temperature fluctuations.
- **Irrigation Management**: Consistent, deep watering can help maintain moisture levels in the soil. Be mindful of watering early in the morning to prevent water evaporation.
- **Cool-Weather Varieties**: Choose vegetable varieties that are more heat-tolerant. Some varieties of lettuce, spinach, or kale are bred for higher temperatures, though they may still have limits.
- **Row Covers**: Lightweight row covers can protect plants from extreme temperatures while still allowing light and air to reach them.
- **Timing of Planting**: Adjusting planting schedules to ensure that plants are grown during cooler times of the year, or making use of heat-tolerant early season varieties, can help mitigate heat stress.
- **Proper Spacing**: Ensure proper plant spacing to improve air circulation, which can help prevent heat buildup around plant.

Summary

The world needs a strategy to deal with heat that serves to mobilize Governments, policy makers and all stakeholders to act, prevent and reduce heat risk; to increase resilience to heat; to manage extreme heat crises; and to mitigate its worst impacts.

The crisis we see unfolding globally requires an urgent response. Deadly heat is becoming commonplace.

Now is the time to strengthen global action on extreme heat that:

1. Recommends concrete measures that can be taken now by Governments and communities to ease the suffering of people everywhere, while building resilient economies and protecting lives and livelihoods.
2. Supports Governments and communities everywhere by collecting good practices in policy and governance, risk reduction and management, and including the latest data and science on extreme heat. This is information that can help Governments, and their partners, build resilience to heat risk and save lives.
3. Identifies key areas of national and international cooperation to help address extreme heat risk.

Heat stress can significantly affect winter vegetables, although these crops are typically grown in cooler temperatures. So, we can conclude tha the late onset of winter in India is likely a result of a combination of factors, including climatic events like El Niño, and longer-term trends such as global warming. This delay can have both immediate and long-term impacts on agriculture, energy and health in different regions.