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# Effect of Weather Variables on Pulses

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Pulses are a leguminous crop that constitutes an essential part of the Indian diet because pulses are an important protein source. India is the largest producer (25%), consumer (27%) & importer (14%) of pulses in the world. Enrich the soil through biological nitrogen fixation and improve soil physical conditions. They are called "Unique Jewels" of Indian crop husbandry. Pulses are consumed as Dal, which is a cheap source of plant protein. These are consumed because of body building properties having presence of various amino acids. These also have medicinal properties. By products of pulses like leaves, pod coats and bran are given to animals in the form of dry fodder. Some pulse crops like Gram, Lobia, Urdbean & Moongbean are fed to animals as green fodder. Moong plants are also used as green manure which improve soil health and adds nutrient into the soil. A number of pulse crops are grown in India and world. Among the crops, major ones are Gram, Pigeonpea, Greengram, Fieldpeas *etc*. According to history, the origin of Gram is in South West Asia – probably Afghanistan and Persia, Pigeonpea in Africa,

**Climatic Requirement**

Pulse crops are cultivated in *Kharif, Rabi* and *Zaid* seasons of the Agricultural year. Rabi crops require mild cold climate during sowing period, during vegetative to pod development cold climate and during maturity / harvesting warm climate. Similarly, *Kharif* pulse crops require warm climate throughout their life from sowing to harvesting. Summer pulses are habitants of warm climate. Seed is required to pass many stages to produce seed like germination, seedling, vegetative, flowering, fruit setting, pod development and grain maturity / harvesting.

**What is climate change??**

Climate change is primarily driven by the rise in temperature due to an increase in greenhouse gases in the atmosphere, which entraps the infrared radiation received from the Sun. The rise in temperature is threatening global food security, impacting the productivity of pulses adversely. Pulses are highly vulnerable to climate change as these crops are grown under rainfed conditions. Drought and high temperatures are the present scenarios of climate change. Rainfed pulses suffer due to severe water crises because of delayed monsoon and uneven distribution of rainfall or complete failure of rains. $C_3$ crops, especially pulses, have a narrow temperature tolerance limit for optimum physiological function, mostly in the range of 30-35 °C.

**Constraints in pulse production**

- Production of major pulses is constrained by both biotic/abiotic stresses & socio-political problems.
- Main biotic stresses that block pulse productivity include various pests.
- Most of pulses in India are grown in low fertility, problematic soils & unpredictable environments.
- More than 87% of area is under rainfed conditions. Thus they are subjected to drought & heat stress of arid and semi-arid regions, which brings down its yield.

**The weather elements affecting the crop are**

- Temperature
- Rainfall
- Relative humidity
- Solar radiation
- Wind

**Phenology:** It is the study of the timing of occurrence of biological events of growth, especially in relation to weather conditions, which can be used to specify the most appropriate rate and time of occurrence of specific developmental processes.

**Plant Phenological stages in general**

- Emergence - Total biomass Leaf
- Seedling to branching

- Branching to flower bud initiation
- Flower bud initiation to 50%flowering
- 50% flowering to 50% pod formation
- 50 % Pod formation to physiological maturity

**The major pulses crop included are:** _Chickpea and Pigeonpea

**Chickpea**

- ✓ It is the largest produced food legume
- ✓ Also known as bengal gram or chana
- ✓ Water requirement is 300-400 mm
- ✓ Average air temperature range during day vary from 24-30 °C
- ✓ Average night temperature must be from 20-25 °C
- ✓ These are long day plants with 12-16hrs of day length
- ✓ Though cool season crop temperature < 5°C inhibit pod set and high mean temperature *i.e.*, 28-33°C prevent flowering

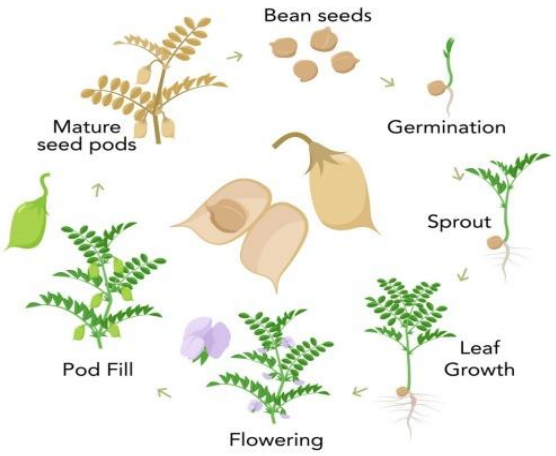
**Low temperature**

- Effect is More during seedling & early vegetative stages
- At germination -poor crop establishment & less seedling vigour, severe cases cell necrosis
- At vegetative stage-slow down plant growth & dry matter production intern decrease yield
- At reproductive stage- it causes flower and pod abortion. Pollen germination & vigor affected. It causes decrease in seed size &seed coat discoloration

**High temperature**

- Mostly sensitive during reproductive stage
- It accelerates days to flowering, podding & biomass reduction
- It affects plant pollen due to low sucrose levels & reduces its function, impaired fertilization and poor pod set
- It causes yield loss due to damage to reproductive organ, increased rate of plant development and reduced length of reproductive period

**Rainfall**




**Moisture stress**

- At vegetative stage decrease chlorophyll and the photosynthesis which in turn decrease assimilate production for growth & yield
- Terminal drought cause decrease in seed filling as >90% of seed nitrogen comes from pre-podding source *i.e.*, leaves

**Water logging**

- Most susceptible at flowering & early pod filling
- If occur at vegetative stage doesn't cause much effect but when occur at reproductive stage it causes drastic decrease in yield and sometimes no yield at all

**Frost**

- At vegetative stage, In chickpea elongation region is first affected by freezing and show sigmoidal curve around elongation point which is commonly called as 'Hockey stick'
- Frosts can cause bleaching of leaves, especially on margins
- At reproductive stage, freezing temperatures damage leaves and destroy flowers and developing seeds
- Normally affect the earliest formed pods and at later stages of development pods are generally more resistant but suffer from some mottled darkening of the seed coat.
- **Pigeon pea**

✓ Pigeon pea is also known as Red gram, Arhar or Tur

- ✓ Water requirement is 300-350 mm
- ✓ Threshold mean temperature for emergence is 12.8°C
- ✓ Temperature range for germination of 85% of plants 19-43°C
- ✓ It is a short day plant
- ✓ Growth increases with increase in temperature up to 35°C

**Temperature**

- Pigeon pea is highly sensitive to temperature fluctuations, causing massive flower drop, forced drying and bending of apical leaves when subjected to cold stress (<5°C)
- A High degree of pollen sterility was observed in pigeonpea at temperature exceeding 38°C

**Moisture stress**

- Water stress at different growth stages did not significantly affect Phenology but had varying effects on seed yield, TDM and yield
- At vegetative stage little effect
- Terminal water stress reduces the time to maturity

**Water logging**

- At seedling stage decreases the plant population
- Even short duration of water logging cause a decline in leaf area development, dry weight accumulation / plant
- Reduction in root dry weight

**Conclusion**

The observed variations in atmospheric temperature pose significant challenges to pulse production, affecting phenology and ultimately productivity. It is evident that earlier sowings result in higher biomass and yields due to optimal duration of phenophases. To adapt to changing weather variables, adopting agronomic practices such as optimal sowing dates and cultivating short-duration, climate-resilient pulse varieties is imperative. These measures not only enhance resilience but also ensure sustained pulse production in the face of evolving climatic conditions.

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