**ENVIRONMENTAL OPTIMA FOR CROP GROWTH AND DEVELOPMENT**

Agro-climatic normal of a crop can be defined as the ranges of temperature, rainfall, humidity and other climatic factors that are considered optimum for the growth and yield of that crop and that are distinguished from sub-optimal or abnormal conditions due to their deviation in the form of excess or deficiency. Agro-climatic normal of crops have been elaborated below:

**1. Groundnut:**

It is tropical crop that can be successfully grown between 45oN to 30oS. The optimum temperature for its growth is 14-16oC. Temperature below 14oC causes reduction in its yield. A soil temperature of 23oC gives the highest yield. At appropriate temperatures, there is good stem elongation occurs and higher number of flowers and pods are produced. It requires rainfall between 75 to125 cm that is considered ideal for it. Groundnut demands 3 irrigations among which one must be applied at flowering / pegging.

**2. Cotton:**

This crop requires 4-5 months of high temperature i.e. a dry hot season having temperature of 28-45oC. The optimum temperature for its vegetative growth is 21-29oC whereas for reproductive growth 27-32oC. If temperature becomes high during reproductive phase, then boll shedding and square shedding may occur. The cotton plant demands 8-9 sunshine hours, relative humidity more than 70% also causes boll and square shedding. Growth rate remains high at temperature above 25-30oC while temperature below 15oC results in growth retardation. During both the reproductive and boll opening periods that happen in months of September-November, the conditions in Pakistan usually remain 8 hours sunshine period and relative humidity below 70%, thus result in higher productivity of cotton. Cotton needs 8 irrigations throughout its growing period and 500-650 mm rainfall. The crop does not like excessive rains because lint quality is deteriorated due to high humidity and insect-pest and disease attack was also high. However, during early growth stages, crop can grow on high rainfall. Best production of cotton is usually observed in years when autumn months remained dry i.e. rainfall ranges between 150-250 mm. Excess rainfall enhances vegetative growth but reduced reproductive growth. Higher humidity results in boll shedding, high disease and insect-pest infestation, top growth and delayed maturity, and deteriorated lint quality with its color affected.

**3. Sugarcane:**

Sugarcane is originated in hot and humid areas as it requires higher water supply. Mean temperature for its germination is 30oC whereas for growth, it is 35oC. Low temperature below 20oC reduces growth of sugarcane crop. A period of 4-6 months with high temperature (30-35oC) followed by 6-8 weeks with cooler temperature is considered best for sugarcane maturity. In the months of May-June, intermodal distance in sugarcane stem was observed to be less while in monsoon season, it was noted to be high.

**4. Rice:**

The mean temperature requirement for rice crop during its entire growth is 22oC while the lowest temperature is 15oC. If the temperature becomes lower than this, vegetative growth is reduced and sterile spikelets are produced. The lowest temperature is more critical 10-15 days before heading. This crop requires 300 candles per m2 per day sunshine. Low sunshine hours during vegetative growth affect grain production while during reproductive stage, deteriorates production. Rice plant is hydrophyte and likes submergence in water at least 1.5 months in early crop stages. A rainfall of at least 200 mm for ow lands while 100 mm for upland crop is required. Low daily mean temperature along with high solar radiation boosts its yield. Rice crop needs 16 irrigations each of 4 acre inches throughout its growing period. Thus delta of water for this crop is 64 acre inches. During spike initiation, low water supply results in sterile or opaque kernals and also causes grain chalkiness.

**4. Wheat:**

It is a long day winter season crop. The temperature at its sowing should be 15-20oC. If temperature is less than 15oC, then germination is reduced. A high temperature during mid March is detrimental for wheat crop as it is miking stage and high temperature during this stage causes grain shriveling. An average temperature of 25oC and 9-10 hours of sunshine are needed by this crop. The highest temperature is 30-35oC. Wheat demands 2500-3000 tonnes of water for maturing one care crop. A minimum of 3 irrigations need to be applied to this crop, first at crown root initiation, second at tillering and third at milking. Shortage of water causes grain shriveling.

**5. Maize:**

The maximum temperature for maize crop is 34oC while minimum temperature is 15oC. Temperature above 34oC causes yield reduction in maize. It requires 75 mm rainfall. This crop is sensitive to moisture and exhaustive C4 crop. The water requirement during its germination and ear formation is less compared to that needed during flowering. Silking / flowering is considered to be the most critical stage with respect to moisture stress.