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Crop-Weather Interactions: Sorghum, Groundnut and Pigeon pea

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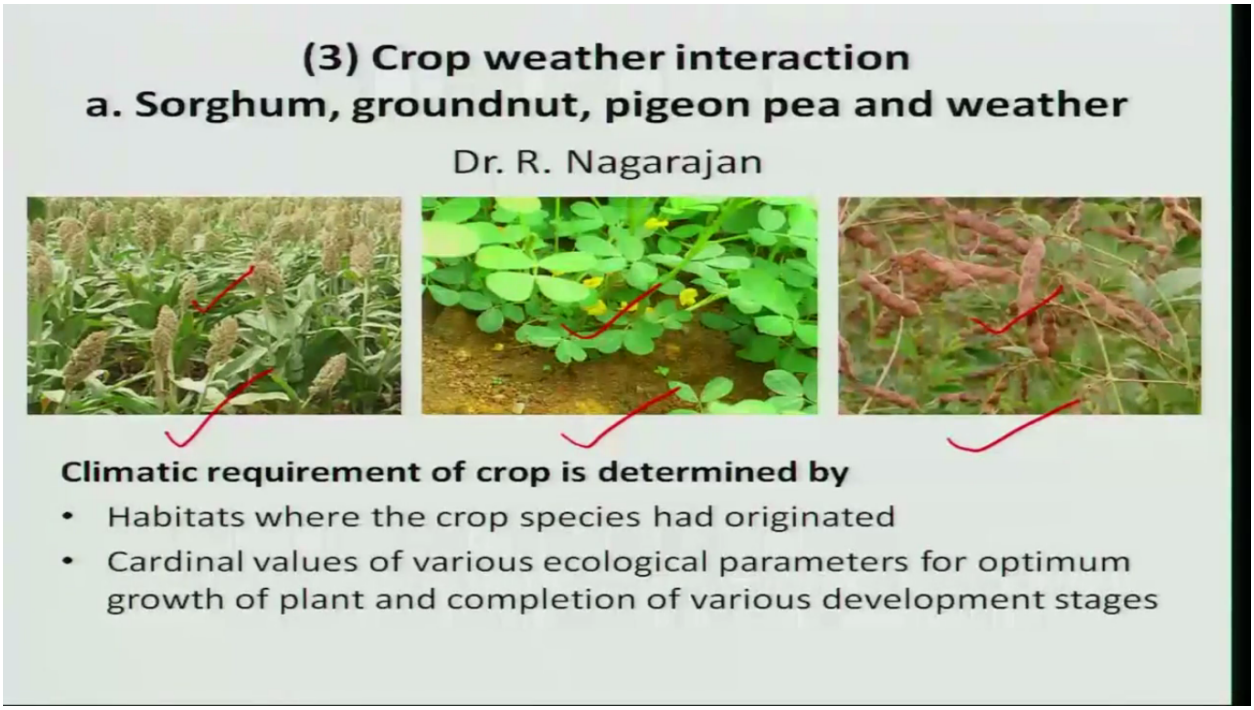
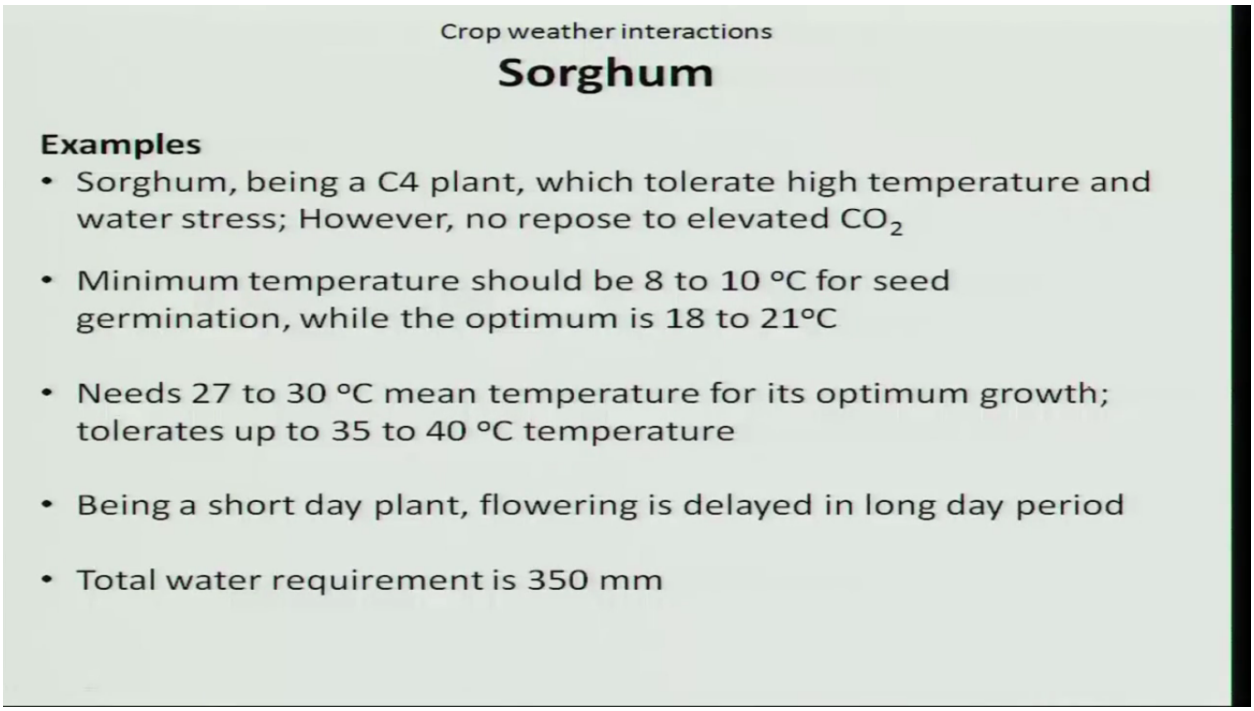
Dear students in continuation with the last class on crop weather interaction for three important crops namely wheat, maze, and rice has taken by Professor Dr. T.N.B I am going to present the other crops namely Sorghum, pigeon pea, and groundnut. In general the weather requirement of a crop is determined by the two important factors. One is habitat of the species where the plant is originated. For example, some crop may originate from the temperate region and some crop may originate from the tropical region. Therefore it differs with the weather variability. That is the requirement of the weather variables. The second one is the coordinate values or the ecological values, the optimum ecological values which includes soil as well as whether. The weather variables are a temperature, relative humidity, wind speed, sunshine hours, as well as rainfall. Those parameters should be needed at a optimum level for each crop. It may be vary with the crop or it may be vary with the season or it may be vary with a different phenological stages of the crop.



Therefore it is very essential to understand the science of crop weather interaction is most important. For example if you take a rainfall it is one among the weather variables which provides a water to the plants. Plant uptake water through the root system. It is one of the important prime component for photosynthesis as well as the respiration process. It also act as a solid for different minerals as well as a starch compound which helps the plants to move around the plant system. It can be used to uptake the nutrients. Most importantly water can be used to for maintaining the body temperature of the plants through the respiration process. Likewise each weather variables has their own uniqueness and role in controlling the plant system by altering the physiological process whether it may be a negative or it may be a positive as indicated by our professor in the earlier class.

He told that it may give us some positive effect where you can achieve a potential yield or it may be a negative effect which will harm the crop by altering the physiological mechanism. For example if you take a sunlight it is also one of the important weather variables. It is used for photosynthesis process. The lights are used to split the water into hydrogen and oxygen. Therefore all the weather variables are most important. Each variables adds their uniqueness in controlling the physiological mechanism of the plants.



Let us see crop weather interaction for sorghum. It is one of the important dryland crops grown in semi-arid region of the world. Based on the photosynthesis it belongs to a C4 type plant. In India it is being cultivated in Kharif as well as the Rabi season. Based on the photo period the sorghum is belongs to a short day plant. As I told you earlier two factor is responsible for controlling the weather requirement that is a cardinal values. Another one is the origin of the species. Likewise other factor is also responsible for the determination of the weather requirement. It may be a nature of the seed. It may be the growth duration of the crop and it may be the photosynthesis mechanism. It may be due to a photo period mechanism. Let us see the crop weather interaction during germination phase of sorghum. Being a warm season crop it requires an optimum temperature of 18 to 21 degree Celsius for better emergence of seedlings. While the minimum temperature is 7 to 10 degree Celsius. Being a C4 plants it can able to tolerate high temperature. However, it cannot be able to tolerate the cooler temperature during the germination hour. For example if the temperature goes below 5 to 7 degree Celsius it will affect the seedling emergence.

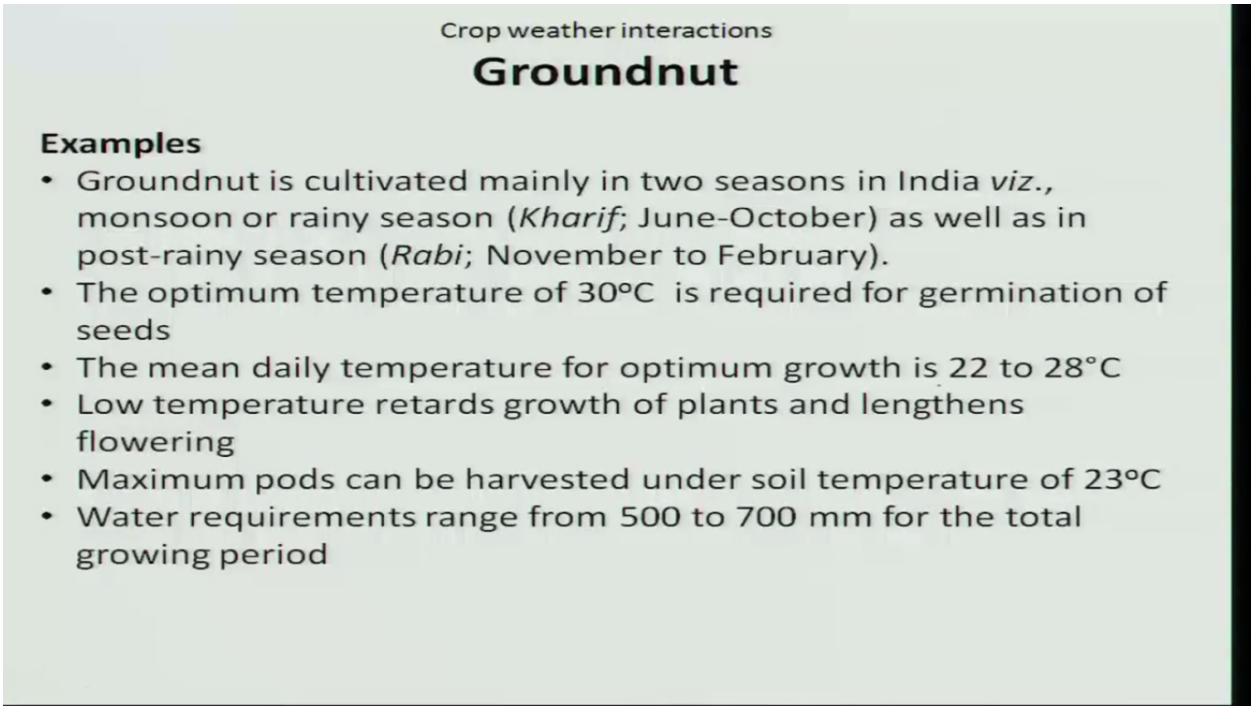
The total duration requirement for seedling emergence is 6 to 9 days. Let us go to the other growth stages. The sorghum has 3 different growth stage; stage 1, stage 2, and stage 3. The stage 1 consists of emergence of the leaves. It requires an optimum period of a 30 to 35 days to complete this stage 1. During this phase sorghum has produced more biomass in terms of number of leaves. It can produce up to 15 to 18 leaves per plant. It may be very with the variety. It depends upon the variety. For that it needs a higher rate of photosynthesis to accumulate more biomass. For that an optimum temperature of 27 to 30 degree Celsius is required. Likewise, it is C4 plants it can able to tolerate under high stress as well as high temperature hence it can able to tolerate up to 30 to 35 degree Celsius and above 40 degree Celsius it will harm the crop.

The next stage is stage 2 it consists of panicle initiation, emergence of a flag leaf as well as boot stage. During this stage water requirement is most critical factor otherwise it will affect the potential growing number of a plant. Let us go to the stage 3.

During this phase it consists of 50% flowering, soft dub stage, hard dub stage as well as physiological maturity. It starts with the flowering, pollination, and fertilization and maturation of the grains. Though it is a short day plant flowering is controlled by the temperature. For example pollination is highly controlled by the temperature. If the temperatures go below 12 to 15 degree Celsius it will harm the crop. Pollination will be affected. The pollen aviability is also lost when the temperatures goes below 10 degree Celsius as well as above 40 degree Celsius. During this phase maturation sugars, amino acids, and proteins whichever stored in the leaves and root system translocated into the kernel for maturity.

Let us see the water requirement of a crop. It requires a minimum water of 350 mm almost it is equal to 7 irrigation. As I told you earlier that this crop can able to tolerate under high water stress as well as high temperature situation. It can be maintained by the plan physiological mechanism. Sorghum can produce three different types of routes. Seminal, crown, and bracelet root. The bracelet roots are formed from the root primordial on the upper portion of the plants which give anchorage to the sorghum plants that can travel up to 1 to 1.5 meter length. Therefore it take the water from the deeper layer and the second one is sorghum comes under early pollinator that is the pollination occur between 2 to 8 A.M. Therefore the pollination not affected with temperature and the third one is the leaves are covered with the thick waxy layer that will prevent the entry of water transpiration. It will allow the water at slow water transpiration rate.

These are all the factors which are responsible for drought tolerance as well as it can be able to tolerate under high moisture stress. This is about the crop weather interaction for sorghum.

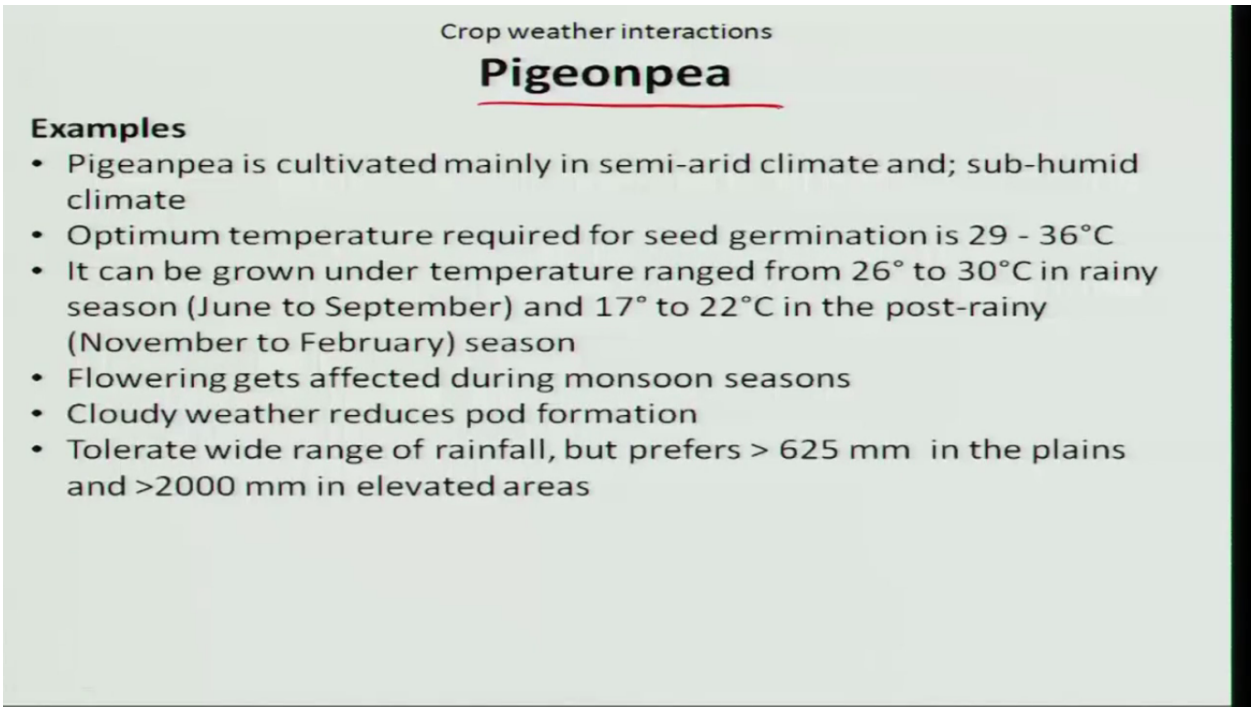


Let us store the crop weather interaction for groundnut crop. It is one of the important oil seed crop cultivated widely in the tropical region. It is one among the warm season crop. It comes under C3 type of photosynthetic mechanism and belongs to a day neutral plant based on the photo period mechanism. It can be cultivated in India during a Kharif as well as Rabi season. Let us see the weather requirement during germination phase. Though the seats are very bigger in size it will not able to germinate as like a other oilseed crop. For example it contains a thinner seed coat which allows more entry of water into the seed. By this way the plant germination is not affected with the under the adequate moisture level. However, the temperature is controlling the germination process. The optimum germination for groundnut is 30 degree Celsius. If the temperature goes below 19 degree Celsius it will affect the germination.

Let us see the crop weather interaction during the different growth phases. It consists of vegetative as well as the reproductive phase. The vegetative phase it produce main streams as well as the number of branches and accumulates more number of leaves. Therefore it requires a higher rate of photosynthesis which can be triggered by the a bright sunny hours as well as the warm temperature. During this period cloudy weather as well as prolonged cool temperature harm the crop by altering the photosynthesis process.

Similarly the optimum the current of the temperature during the vegetative stage is 22 to 28 degree Celsius. Similarly low temperature retard the growth as well as it lengthen the flowering. The next stage is the reproductive stage which consisting of flowering, peck formation, pod formation, as well as the maturity phase. During this phase though it is a day neutral plant it is not able to controlled by the photo period mechanism. However, it is controlled by the temperature. Pollination was severely affected with the low temperature as well as water stress situation. After the pollination, after the fertilization the pecks are formed like a tube and that can able to reach the soil by forming a tube to the length of 15 to 18 centimeter. For that it requires an energy. During this situation prolonged cyclone or continuous rainfall for a period of one week increases the inter long internode elongation. Therefore, it will laugh at the peck formation. It cannot be able to penetrate into the soil system because pods are formed inside the soil it requires some energy beyond which it cannot be able to form the tubes. Therefore, it will affect the number of pods per plant. As I told that the pods are grown under the soil. Therefore the soil temperature is very important factor for optimum maturity. The maximum pods can be harvested with a temperature of 20 degrees Celsius is also reported in India.

The next two stages the maturity stage. It requires 21 days for grain filling, pod maturity, and complete the life cycle. The water requirement of groundnut is 500 to 700 mm. This is about the weather requirement of groundnut.



Let us see the crop weather interaction for pigeon pea. It is one of the important crop which supplements protein to the human being which can be cultivated during the Kharif and Rabi season. It is also one of the C3 plants based on the photosynthesis process and based on the photo period mechanism it comes under a quantitative a short-day plant. The quantitative short day plant means a critical period is surrogate for flowering above which the flowering does not exist. Let us see the crop weather interaction during the germination phase.

The optimum temperature arcade for seed germination is 29 to 36 degree Celsius. If the temperature goes below 19 degree Celsius it will adversely affect the seedling emergence. Let us see the crop weather interaction for different growth stages. Let me start with the seed germination. It requests an optimum temperature of 29 to 36 degree Celsius. If the temperature goes below 19 degrees Celsius that will harm the seedling emergence. Let us see the crop weather interaction for a vegetative period. During its entire growth stages it requires an optimum temperature of 29 to 30 degree Celsius for rainy season crop and it requires 17 to 22 degree Celsius during the post rainy season. Being a quantitative short day plants which affects the flowering during the critical hours if the photo period goes about 10 to 12 hours it will harm the flowering. Likewise cloudy weather, prolonged cold temperature during the flowering stage affect the pollination also.

The water requirement of a pigeon pea is around 625 mm in the plains. 2000 mm in the elevated areas. It has a wider adaptability both under plains as well as under the hilly region.

This is about the crop weather interaction for sorghum, groundnut and pigeon pea. In the next class we would like to see the other crops namely cotton and sugarcane.

Thank you.