

## Effect of Temperature and Moisture on Germinability of Weed Seed

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**ABSTRACT:** The effect of different temperatures with and without moisture was studied over seed of weed species with the duration of exposure ranging from one to six days. Wet soil temperature with 55°C started reducing germination from 3rd day onwards while temperatures of 40°C and 30°C have not shown any ill effect on weed seeds in the presence of moisture for a shorter duration. Also, the effect of higher soil temperature (55°C) in combination with the soil moisture has doubled compared to dry soil at the same temperature. Less than these temperatures were effective mostly when soil was dry and when these temperatures were maintained continuously for more than 4 days.

The characteristics of producing a large quantum of weed seeds; longevity, viability and many ways of dispersal make the weeds persistent over time, unlike crops. This persistence is the cause for continuous weed menace. However, to carry out some weed management practices, the knowledge on differential germination due to depth variances, viability of weed seeds is important.

The factors like soil temperature, soil moisture, soil aeration have the greatest potential to manipulate the micro-environment of the weed seed. The non-chemical methods, to compete with the chemical control method, should work throughout the soil mass and over a wide range of intero-environmental changes. A non-chemical approach like solarization utilizes soil temperature as one of the key factors and if supplemented with moisture gives an effect on soil temperature. As per Mahrer *et al* (1984), presence of soil moisture helps in better conduction of heat into the deeper layers. Hence, this study was carried out to ascertain the interaction effect of soil temperature and soil moisture on weed seed viability. As per Pullman

*et al* (1981) extensive studies by many workers have shown that 30 minutes, at 65°C will kill most of the weeds. However, information concerning exposure time necessary to kill weeds at temperatures below and above 45°C is lacking. This type of information varies with the ambient temperatures and the type of soil as well. Some investigations have shown that <45°C can be lethal if maintained for longer periods or combined with soil moisture. Hence, the present experiment was carried out to understand the effect of temperature, its exposure time in the presence or in the absence of moisture.

### Materials and Methods

The seeds of weed cockscomb (*Celosia argentea*) were collected from the research farm of CRIDA, Hyderabad and kept counted in sets of hundred. About 100 seeds of this weed *spp.* were placed in petri dishes on the germination paper. Of the two sets, one was watered and the other was kept dry. Both the sets were subjected to different temperatures for one to six days and taken out and kept for germination.



These petri plates were subjected to temperatures of 30°C, 40°C and 55°C in a BOD. Weed seed germination (%) was drawn at different temperatures for different durations of exposure for 24 hrs and its multiples viz. 48 hrs, 72 hrs, 96 hrs, 120 hrs and 144 hrs. The recorded percentage germination was compared with the control that kept under room temperature.

The treatments were replicated thrice. The germination % was recorded everyday for all the sets upto 45 days after subjecting them to different temperatures with and without moisture. The germination % was plotted against different temperatures under dry and wet conditions.

The experiment was conducted in the laboratory in CRD. The data were analyzed by analysis of variance and significance was tested at 5% probability level.

### **Results and Discussion**

The microclimate under the mulch was depending upon the timing of application and the thickness of mulch. So, if high temperatures and moisture are major factors influencing weed seed germination, it is reasonable that raising soil temperature and moisture may affect weed seed germination and survival in soil (Roberts, 1972). The weed differ in their responses to heat. This experiment resulted in finding out the time necessary to kill weeds at a temperature range of 30-55°C with or without moisture.

Weed seed germination varied with temperatures as well as in combination with the soil moisture. At higher temperatures, presence of moisture for a shorter duration of one day had positive effect on germination i.e., high temperatures like 55°C for shorter durations like one day resulted in better germination which was observed from the Fig. 1. However, high temperatures if

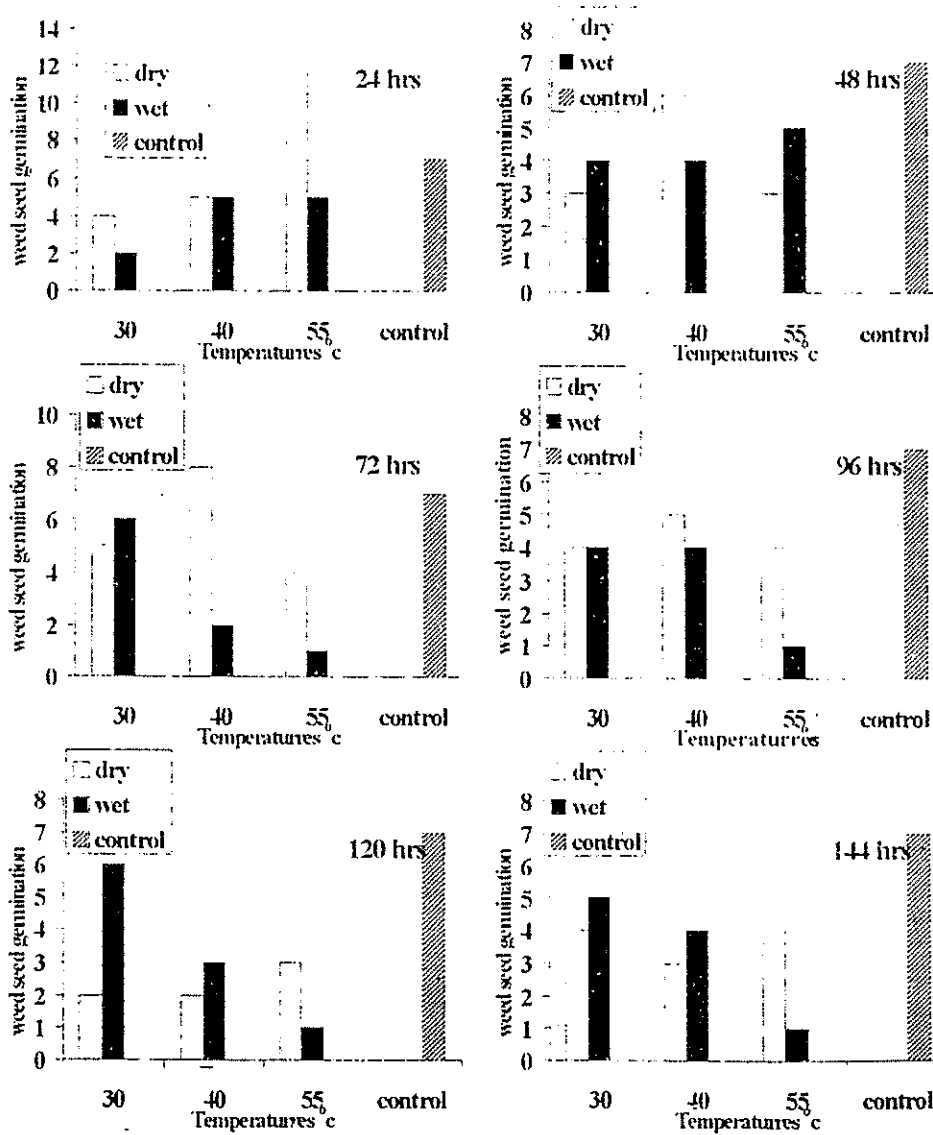
coupled with soil moisture from one day to 15 days, the germination was found to be 100% from 3rd day onwards. It clearly results in better germination in wet soil when exposed to high temperature (55°C) for more than two days, the germination of weed seeds was inhibited.

Some temperatures caused delays in germination and varied with the temperatures and duration of exposure. Germination delays will be 100% if the weed seeds were exposed to lower temperatures or higher wet temperatures. The longer seed was exposed to temperature and still survived, the longer it requires to germinate. Delay indicates that heat damage accumulates gradually to a point beyond which the seed cannot recover. Under optimal conditions, at a certain point there is possibility that some seeds may recover before a threshold temperature point is reached (Egley, 1983).

Statistical analysis has indicated that higher temperatures and duration of exposure affected germination independently upto 15 days i.e., the germination may be restricted by soil temperatures alone to an extent of 15 days (Fig. 2) and similarly by the number of days of exposure but the effect of temperature could be increased in the presence of moisture up to 15 days (Fig. 2).

At higher temperatures of 55°C except at 24 and 48 hr. exposure, all other durations shown reduced germination in presence of moisture rather than under dry condition. This shows that higher temperatures for two days in presence of moisture hastened the biological and physico-chemical processes in the seed and above this inhibited the germination due to the breaking down of biological constituents. At 40°C (a general temperature that can be attained with plastic mulch, even during monsoon season) without moisture had enhanced

Fig. 1 : Weed Seed Germination at different Temperatures



germination upto 4 days and from fifth day onwards germination was reduced. Dry soil temperatures of 40°C is required atleast for a minimum of >4 days to kill weed seed. At 30°C, only dry conditions had some ill effect on germination rather than the wet soil with 30°C as these temperatures had encouraged the physiological reactions suitable for germination.

The soil moisture coupled with high soil temperature (55°C) had significant negative effect on weed seed germination from 3rd day onwards, while 40°C (just above normal) temperature had significant effect from 5th day onwards only when the soil was dry. But 30°C (normal) significant effect was observed from 2nd day onwards only when the soil was dry.

Some seeds have oozed out a yellow substance and did not germinate later, which seems to be a defence mechanism.

It is concluded that if high temperatures like 55°C could be achieved in the soil, moisture can play greater role in maintaining higher temp for longer duration as well as better kill of weed seeds.

However, if the dry soil temperatures can be maintained to 40°C for >5 days, better control of weeds may be expected. It is also effective, if at all these temperatures were maintained continuously clarify the statement.

References

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Fig. 2 : Significant effect of temperature and moisture on weed seed germination

