**Influence of high temperature on seed yield of Sunflower in India**

Lakshmi Prayaga, C. Sarada, P. Lakshmamma, A. Vishnuvardhan Reddy

ICAR-Indian Institute of Oilseeds Research, Rajendranagar, Hyderabad - 500030. Telangana

Sunflower is grown throughout the year in India due to its photo-insensitive nature. But the crop is highly sensitive to temperature. Major area is in southern peninsula where increasing temperatures during crop growth period pose a threat to sunflower productivity. Even small increases in temperature can adversely affect plant growth. Up to optimum temperature, each increment from the base temperature is positively related to productivity. Optimum temperature for sunflower growth has been reported as 25-30 °C. The crop is more sensitive to heat stress during anthesis and grain filling stages. Air temperature >30°C was reported to affect pollen viability, stigma receptivity and pollen tube growth .

The present study was conducted with six genotypes replicated four times in a 3x3 m plot with four staggered sowings (S1 to S4) from November 2013 to February 2014. Plants were irrigated as and when required to ensure that the crop is not subjected to water stress but only to heat stress. Number of days to 50% flowering, days to maturity and seed yield decreased from S1 to S4 with increase in maximum temperature from 29.0 to 35.8 °C and minimum temperature from 15.0 to 21.9 °C. Rise in mean temperatures from 22 to 28.8 °C (+6.8°C ) during crop growth period, reduced crop yield by 54 % and duration by 20 days. Regression analysis indicated reduction of about 8% yield per every 1°C rise in temperature.

 **Influence of high temperature on seed yield of Sunflower in India**

Lakshmi Prayaga, C. Sarada, Lakshmamma P, A Vishnuvardhan Reddy

ICAR-Indian Institute of Oilseeds Research, Rajendranagar, Hyderabad - 500030. Telangana

Introduction:

Major area of sunflower is in southern peninsular India where increasing temperatures during crop growth period pose a threat to sunflower productivity. Because of its photo insensitive nature, the crop is grown throughout the year in India. But sunflower is highly sensitive to temperature. Even small increases in temperature can adversely affect plant growth. Up to optimum temperature, each increment from the base temperature is positively related to productivity.

Rationale:

Optimum temperature for sunflower growth has been reported as 25-30$°$C. The crop is more sensitive to heat stress during anthesis and grain filling stages. Air temperature >30°C was reported to affect pollen viability, stigma receptivity and pollen tube growth .

Materials & methods:

The present study was with six genotypes replicated four times in a 3x3 m plot with four staggered sowings (S1 to S4) from Nov 2013 to Feb 2014. Plants were irrigated as and when required to ensure that the crop is not subjected to water stress but only heat stress.

Results & Conclusions:

Number of days to 50% flowering, days to maturity and seed yield decreased from S1 to S4 with increase in maximum temperature from 29.0 to 35.8$ °$C and minimum temperature from 15.0 to 21.9$°$C. Rise in mean temperatures from 22 to 28.8 °C (+6.8$°$C) during crop growth period , reduced crop yield by 54 % and duration by 20 days.

(S1=12-11-2013, S2=10-12-2013, S3=03-01-2014, S4=28-02-2014).

Table 1: Days to flowering and maturity as influenced by temperature (°C) in different sowings

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Sowing** **number** | **Days to 50% flowering** | **Days to maturity** | **Maximum****temperature** | **Minimum temperature** | **Mean temperature**  | **Seed weight****(g/plant)** | **% reduction** |
| S1  | 70 | 99 | 29.5 | 14.5 | 22.0 | 35.1 | - |
| S2 | 68 | 102 | 33.0 (+3.5)\* | 16.0 (+1.5) | 24.5 (+2.5) | 30.5 | 14 |
| S3  | 65 | 93 | 31.7 (+2.2) | 17.6 (+3.1) | 25.7 (+3.7) | 20.6 | 41 |
| S4 | 54 | 79 | 36.0 (+6.5) | 22.5 (+8.0) | 29.3 (+7.3) | 16.3 | 54 |

\* values in parentheses indicate increase in temperature from S1

Table 2 : Seed weight (g) per plant in different sowings

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **S.No** | **Genotype** | **S1** | **S2** | **S3** | **S4** | **% reduction from S1** |
| **S2** | **S3** | **S4** |
| 1 | APSH -66 | 33.2 | 18.3 | 14.5 | 14.3 |  45 | 56 | 57 |
| 2 | DRSH-1 | 36.0 | 32.9 | 24.3 | 17.3 | 9 | 32 | 52 |
| 3 | DRSF -108 | 32.3 | 31.2 | 20.2 | 16.3 | 3 | 37 | 50 |
| 4 | DRSF -113 | 39.7 | 41.2 | 23.9 | 16.5 | -4 | 40 | 58 |
| 5 | KBSH -41 | 38.6 | 35.6 | 21.9 | 19.4 | 8 | 43 | 50 |
| 6 | KBSH -42 | 30.5 | 23.9 | 19.0 | 14.0 | 22 | 38 | 54 |
|  | **mean** | **35.1** | **30.5** | **20.6** | **16.3** | **14** | **41** | **54** |

 **Conclusion**

 Rise in mean temperatures from 22.0 to 29.3 $°$C during crop growth period , reduced crop duration by 20 days and yield by 51 %.

**References**

Kalyar T, Rauf S, Teixeira Da Silva JA, Shahazada M. 2013. handling sunflower (helianthus annuus L.) populations under heat stress. Archives of agronomy and soil science.60(5): 655-672

Moriando M, Giannakopoulos C, Bindi M. 2011. Climate change impact assessment: the role of climate extremes in crop yield simulation. Climate Change.104: 679-701

Qadir G, Hassan FU, Malik MA. 2007. Growing degree days and yield relationship in sunflower (Helianthus annus L.). International Journal of Agricultural Biology. 9: 564-568.

Rondanini D, Mantese A, Savin R, Hall AJ. 2006. Response of sunflower yield and grain quality to alternating day/night temperature regimes during grain filling: effect of timing, duration and intensity of exposure to stress. Field crops research.96: 48-62

Rondanini D, Savin R , Hall AJ. 2003. Dynamics of fruit growth and oil quality of sunflower exposed to brief intervals of high temperature during grain filling. Field crops research: 83 : 79-80