

Project No. 5

Crop weather relation studies in Sunflower

Objectives:

- To study the effect of weekly weather variables on crop yield
- Develop Crop yield prediction models
- To optimize the time of sowing of sunflower

Results:

1997

Past data from experimental records of the AICRP on Dryland Agriculture for the period 1988 to 1997, and weather data of Regional Research Station, Bijapur were collected and analysis performed. The crop data concerned - date of sowing, flowering-time and crop yield were collected from the records of the Dryland Project reports. The Table 5.1 provides the correlation coefficients between agrometeorological variables in different weeks after sowing and the sunflower seed yield.

Table 5.1 Correlation coefficient between agrometeorological variables in crop growth period and final seed yield of sunflower

WAS	Rain-fall	R.H. (M)	R.H. (E)	Max. T.	Min. T.	T. R.	Evap	MAI
W1	0.50	-0.55	-0.22	0.0	-0.24	0.20	-0.45	0.40
W2	0.15	0.0	0.17	-0.30	-0.19	-0.20	-0.55	0.25
W3	0.76	0.53	0.37	-0.75	-0.67	0.41	-0.66	0.80
W4	0.31	0.64	0.17	-0.65	-0.69	0.11	-0.59	0.79
W5	0.47	-0.07	0.28	-0.41	-0.54	-0.04	-0.30	0.34
W6	0.30	-0.12	-0.20	0.20	-0.40	0.39	-0.07	0.25
W7	0.37	-0.33	0.03	0.02	-0.13	-0.07	-0.24	0.45
W8	0.21	0.02	-0.35	0.02	-0.56	0.43	0.13	0.68
W9	-0.48	-0.62	0.43	0.44	0.0	0.17	0.48	0.28
W10	0.47	-0.16	-0.32	-0.35	-0.36	0.34	0.29	0.51
W11	0.77	-0.02	0.01	-0.04	-0.19	0.30	-0.31	0.68

In the first four weeks after sowing (WAS) – the establishment stage of the crop, the atmospheric moisture factor – higher rainfall and humidity – plays a major role in determining the yield. While increase in rainfall and higher humidity are favorable, higher temperature is detrimental for higher sunflower yield. The influence of rainfall and morning relative humidity during the flowering stage, i.e., 9th week after sowing, is negative on final yield. This has been ascribed to washout of pollen due to rainfall, and higher morning humidity causing stickiness – which is not favorable for pollination. Higher temperature is also seen to be favorable. Rainfall during the succeeding couple of weeks resulted in appreciation of yield.

Crop yield modeling of sunflower:

Based on the association between weather variables and seed yield regression models were developed for forecast of sunflower seed yield, and presented in Table 5.2.

Table 5.2 Agrometeorological regression models for sunflower seed yield (kg/ha)

S. No.	Parameters	Equation	R ²
1.	RF &MAI	Y= -2.86 RF(3) + 65.64 RF(11) + 5.88 MAI(3) + 112.09	0.85**
2.	RF&MAI	Y= 1.51 RF(3) + 4.01 MAI(3) + 202.45	0.66*
3.	RF	Y= 1.60 RF(3) + 39.97 RF(11) + 404.84	0.66*
4.	MAI	Y= 6.04 MAI(3)	0.64*

Numerals in the parentheses indicate week after sowing

The best relation used rainfall and moisture availability index (MAI) in WAS 3 and rainfall during WAS 11, with a model accuracy of 85%. By advancing the time of forecast, it is possible to forecast the yield with 66% accuracy. Hence, Model No. 2 can be used for an initial estimate after the third WAS, and the Model No. 1 can be used for the final forecast of sunflower seed yield after the 11th WAS.

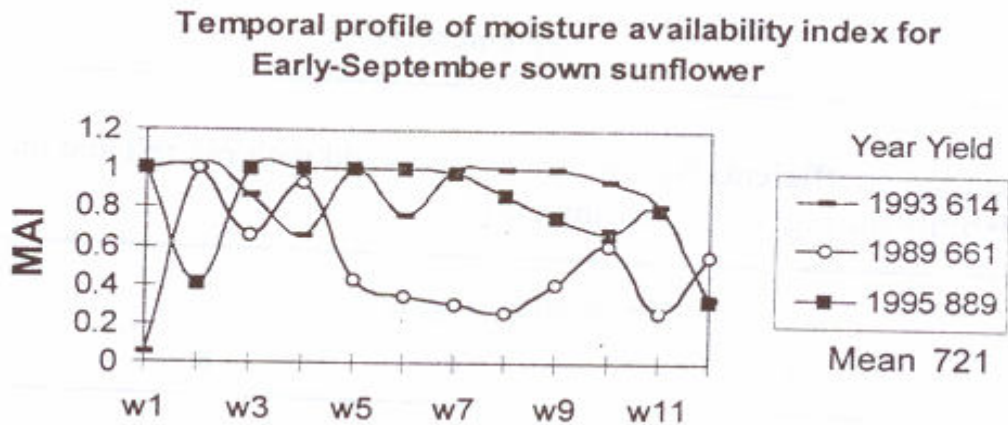
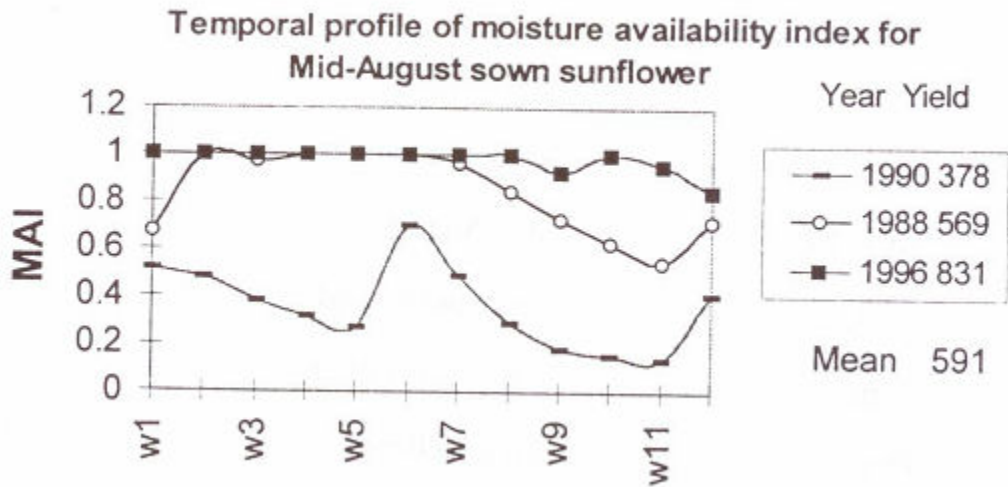
1998

Optimization of sowing time of sunflower:

The weekly rainfall pattern of Bijapur indicates mild rainfall peaks in the 30th, 33rd and 35th to 37th Standard weeks and high peaks during 38th to 41st Standard weeks. After this practically no rainfall occurs. Comparing these periods with the recommended time of sowing of sunflower, it was realized that the Weeks 30, 33 and 35-40 have to be utilized for the purpose. In the experiments from which the sunflower yield data was collected, the sowing period covered the Week numbers 33 - 37, and 39 - 40.

From the results obtained in the year 1997, it was noticed that the third and the fourth weeks after sowing were critical for moisture requirement for sunflower crop. The crop can experience this condition only when rainfall is received in the third week after sowing. However, the Week numbers 38-41 are the most assured for rainfall at Bijapur. This rainfall can be of maximum benefit to the sunflower crop if it is sown during the Standard weeks 35-37, i.e. in early September. In contrast, the crop sown after 39th

Standard week will not experience much soil moisture availability in the critical period of the crop. On the other hand, for the crop sown in mid-August, the chances of rainfall are more variable in the critical period and also it may experience rainfall in the flowering period (Standard Weeks 41 and 42) which would affect pollination. The yield levels of crop sown during Mid-August, Early September and late September are given in Fig 5.1 along with moisture availability during crop growing period. The figure unanimously supports the hypothesis of the Scientist. The conclusion: Early September (1st to 11th) is Optimized as the most suitable sowing time for sunflower crop, with highest reliability of favourable conditions of high moisture in the third and fourth weeks after sowing, and low rainfall probability in the flowering period.



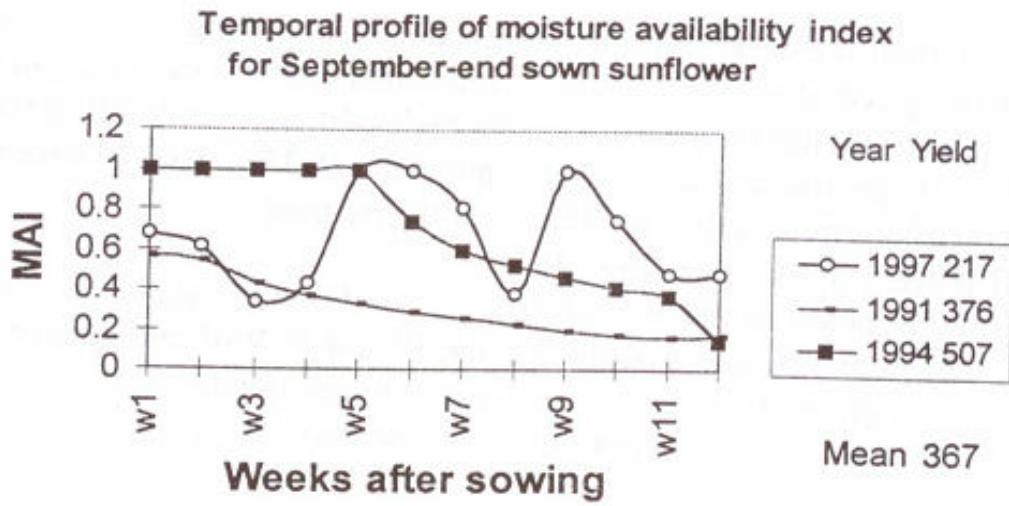


Fig 5.1 Situations indicating variations of moisture availability index and sunflower seed yield with time of sowing