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INFLUENCE OF IRRIGATION AT CRITICAL STAGES ON YIELD AND QUALITY OF SUNFLOWER

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ABSTRACT

Field experiments were conducted in summer and *Kharif* seasons during 1991-92 at the Agricultural Research Station, Bhavanisagar to study the critical stages of irrigation requirement for sunflower. Results revealed that skipping irrigations at button initiation, flowering and seed filling stages significantly reduced the seed yield of sunflower by 19.6, 31.2 and 9.4 per cent in summer and 11.9, 10.2 and 11.5per cent in *Kharif* respectively over the optimal level of irrigations scheduled. Response to irrigations was more pronounced in summer than *kharif*

KEY WORDS : Sunflower, Stages, Irrigation, Yield

Sunflower is a recent entrant into India's vegetable oil scenario accounting for four per cent of the current indigenous production of oil seeds. To step up the production and realise maximum benefit in a short period, it is imperative to schedule irrigations need based. Proper use of irrigation water demands its application at the proper dryness at which maximum net profit is obtained. Ideal irrigation frequency varies with climatic conditions, soil type, stage of growth, tolerance to soil dryness and consumptive use rate. Depth of water applied per irrigation should be equal to the soil moisture deficit created in the root zone. Lindstorm *et al* (1982) found that flowering stage in sunflower is more sensitive to moisture stress. Rawson and Turner (1983) reported that crop has the capacity to recoup the loss in reduction in earlier leaf area due to moisture stress once it is alleviated. With this in view, an experiment was initiated to define the criteria or irrigation scheduling for sunflower growing tracts of Tamil Nadu.

MATERIALS AND METHODS

Field experiments were conducted in both summer and *kharif* seasons of 1991-92 at the Agricultural Research Station, Bhavanisagar, to assess the stagewise irrigation requirement in [illegible] soil [illegible] and [illegible] in texture, highly porous having 70 per cent sand 5 per cent silt and 25 per cent clay fractions. Field capacity and wilting point moisture contents were 19.2 and 8.5 per cent respectively. Fertility status is low in available N and P and medium in available K. Treatments comprised of moisture stress at germination phase, vegetative, button initiation, flowering, seed filling and seed maturity along with the conventional method of need based irrigation replicated thrice in randomised block design.Each plot was provided with buffer channels all the four sides to avoid seepage interference. Irrigations were monitored through a constant head module designed to deliver 6 1/sec. Common irrigations were given once to all the plots for better establishment.

Quantum of precipitation was taken into account while imposing treatments. Meterological parameters were recorded periodically during the crop period to derive valuable conclusion. The hybrid BSH-1 was used for the investigation. Sowing was taken up in ridges and furrows by adopting a spacing on 60 x 30 cm. Fertilizers were applied at the rate of 60:90:60 kg NPK ha^{-1}. Half of the N and full P and K were applied basally and remaining N top dressed at button initiation and flowering stages on equal basis. Standard

Table 1. Effect of stages of irrigation on flowering and days to maturity in sunflower

Investigation at (Phase)	Days to 50% flowering						Days to maturity					
	1991		1992		Mean		1991		1992		Mean	
	S	K	S	K	S	K	S	K	S	K	S	K
Garmination	52.3	54.7	53.7	54.3	53.0	54.5	94.3	94.7	94.7	94.3	94.5	94.5
Vegetative	52.3	54.0	52.3	53.7	52.3	53.9	94.0	94.3	94.3	94.0	94.2	94.2
Button initiation	51.3	53.3	51.0	53.0	51.2	53.2	92.7	94.0	93.0	93.3	92.9	93.7
Flowering	53.3	54.3	53.3	54.0	53.3	54.2	91.7	93.3	91.3	94.3	91.5	93.8
Seed fieling	53.0	54.3	53.7	54.0	53.4	54.2	92.0	92.0	92.	93.3	92.2	92.7
Seed Maturity	53.3	54.7	53.7	54.0	53.5	54.4	91.7	91.3	92.0	93.0	91.9	92.2
Need based	53.7	55.0	53.7	54.7	53.7	54.9	94.0	94.3	93.7	94.7	93.9	94.5
CD (P=0.05)	1.01	0.88	0.91	NS			0.82	0.90	0.92	0.94		

S : Summer; K : *Kharif*; NS : Not significant

agronomic practices were followed. During the course of study, observations on days to 50 per cent flowering, Maturity, seed filling and seed yield were recorded. Seed samples drawn treatmentwise were estimated for oil content using Nuclear Magnetic Resonance.

RESULTS AND DISCUSSION

Days to 50 per cent flowering

The data on days to 50 per cent flowering (Table 1) clearly indicated that moisture stress at various growth stages significantly altered the flowering behaviour. It varied from 51- 54 and 53-55 days to attain 50 per cent flowering in summer and *kharif* seasons, respectively. Moisture stress imposed at button initiation stage reduced the time taken by 3 and 2 days in summer and *kharif* seasons respectively over optimal moisture regime. But initiation being critical stage of moisture requirement., it might have altered the normal course of flowering behaviour (Sindagi and Virupakshappa, 1987)

Days to maturity

Consequent to the alteration in flowering behaviour, days to maturity also fluctuated correspondingly. It varied from 91-95 and 92-95 days in summer and *kharif* seasons respectively. Stress experienced by sunflower at button initiations, lowered the number of days to attain 50 per cent flowering and later optimal moisture regimes helped in recouping and behaved normally as that of optimal need based irrigation treatment. However, skipping irrigation at critical stages of crop growth especially flowering, seed filling and seed maturity could not be recovered and registering lower values under these treatments over optimal moisture regimes which again signifies the need of irrigation at these stages. The results are in accordance with the findings of Hegde (1988).

Plant height

Plant height measured at harvest stage showed significant variations among the treatments in both the seasons. Highest values were recorded under

Table 2. Effect of stages of irrigation on plant height and seed filling in sunflower

Investigation at (Phase)	Plant height (cm)						Seed filling (%)					
	1991		1992		Mean		1991		1992		Mean	
	S	K	S	K	S	K	S	K	S	K	S	K
Garmination	163.2	142.3	160.3	148.1	161.8	145.2	97.4	97.3	96.4	96.2	96.9	96.8
Vegetative	162.1	141.0	159.0	140.6	160.6	140.8	96.9	96.8	95.6	96.0	96.3	96.4
Button initiation	160.1	136.9	158.8	141.6	159.5	135.3	96.4	96.6	95.4	96.0	95.9	96.3
Flowering	152.1	130.9	152.7	138.3	152.4	134.6	94.9	96.9	93.3	96.1	94.1	96.5
Seed fieling	160.2	141.1	158.1	142.3	159.2	141.7	96.9	96.0	96.5	94.7	96.7	95.4
Seed Maturity	160.4	140.2	159.2	141.9	159.8	141.1	96.5	97.2	96.5	96.1	96.5	96.7
Need based	165.4	141.7	162.1	148.4	163.8	145.1	97.0	97.6	96.4	96.1	96.7	96.9
CD (P=0.05)	3.94	5.27	4.38	4.84			1.15	0.72	1.54	0.94		

Table 3. Effect of stages of irrigation on seed yield and oil content in sunflower

Investigation at (Phase)	Plant height (cm)						Seed filling (%)					
	1991		1992		Mean		1991		1992		Mean	
	S	K	S	K	S	K	S	K	S	K	S	K
Garmination	1358	1339	1359	1374	1359	1357	40.1	37.4	40.0	37.0	40.1	37.2
Vegetative	122	1194	1146	1231	1188	1213	37.9	37.1	39.0	36.8	38.5	37.0
Button initiation	1124	1174	1061	1221	1093	1198	37.2	36.9	38.0	36.1	37.6	36.0
Flowering	959	1258	910	1178	935	1218	36.4	35.7	36.7	35.5	36.6	35.1
Seed filling	1215	1132	1247	1270	1231	1201	37.9	36.8	37.5	36.5	37.7	36.8
Seed Maturity	1262	1288	1216	1349	1239	1319	38.5	36.9	37.4	36.8	38.0	36.9
Need based	1297	1333	1339	1364	1318	1349	38.5	37.3	39.1	37.0	38.8	36.9
CD (P=0.05)	87.68	124.39	87.19	NS			2.06	6.82	1.92	0.89		

S : Summer; K : *Kharif*; NS : Not significant

optical moisture regimes and reduced significantly under treatments receiving moisture stress at irrespective of stages. However, the reduction in plant height was well pronounced in the treatment experiencing moisture stress at flowering.

Head diameter

There was no significant differences among the treatments experiencing moisture stress at various growth stages on the head diameter.

Seed filling

Seed filling showed significant differences among the treatments. Lower values were registered under treatment receiving moisture stress at seed filling and flowering stages in *kharif* and summer seasons respectively (Table 2).

Seed yield

Data on seed yield (Table 3) revealed that moisture strees at various growth stages reduced the seed yield significantly in both the seasons. Highest seed yields were recorded under treatment scheduled at optimal need based irrigation. Yield reduction was more pronounced in summer than *kharif* due to moisture stress experienced by the crop irrespective of crop growth stages. It is obvious that alleviation of moisture purforth ramification of secondary and tertiary roots thereby the reduction in seeds yields was more under treatments receiving stress at button initiation, flowering and seed filling stages exhibiting the necessity for irrigation at these critical stages.

Oil content

Oil content estimated showed a significant variation among treatments. Higher oil build up was registered in summer than *kharif*. Moisture stress at all growth stages significantly reduced the oil content over normal irrigation.

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