

INFLUENCE OF AGRONOMIC PRACTICES ON WATER USE, WATER USE EFFICIENCY AND MOISTURE EXTRACTION PATTERN IN SUNFLOWER

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Sunflower is an important oilseed crop with wide adaptability, short duration and low cost of cultivation. Quantum of irrigation water, fertilizer use and plant population are known to have definite bearing on the total water use, water use efficiency and soil moisture extraction patterns by sunflower crop. To gather more information on this aspect, field experiments were conducted during rabi cropping seasons of 1983-84 and 1984-85 at the Main Research Station, University of Agricultural Sciences, Bangalore. The red sandy loam soil had pH 5.6, low nitrogen content, (152 kg/ha) and medium contents of phosphorus (28.5 kg/ha) and potassium (166 kg/ha). The treatments included three depths of irrigation (2.50 cm, 3.75 cm and 5.0 cm), three levels of plant population (55,555, 1,11,111 and 1,66,666 plants per ha obtained by maintaining row x plant spacings of 60 cm x 30 cm, 45 cm x 20 cm and 45 cm x 16 cm, respectively). The experiments, laid in split plot design, had depth of irrigation and fertilizer levels in the main plots and plant population levels in sub-plots of size 5.4 m x 2.4 m. In 1984, the first crop was sown on 25 January and harvested on 30 April. The crop of second season was sown on 10 December 1984 and harvested on 18 April, 1985. Soil moisture was estimated gravimetrically at four soil layers (0-15, 15-30, 30-60 and 60-90 cm) during two growth stages (vegetative and flowering). The field capacity of the soil was 16.29% and permanent wilting point was 4.80%. For water use computation, contributions from the soil, irrigation water given and rainfall received were taken into consideration. The water use efficiency (WUE) was worked out as ratio of seed yield to water use.

Moisture, fertilizer and plant population levels significantly influenced the water use, water use efficiency and water extraction patterns of sunflower. Seed yield (Table 1) realised by 5.0 cm depth of irrigation was 15.0% higher over 3.75 cm depth and 24.6% higher over 2.50 cm depth. The increase in yield with increase in fertility levels was linear. Application of 80 kg N + 80 kg P₂O₅ per ha resulted in 10% more yield over 40 kg N + 40 kg P₂O₅ per ha and 276% higher yield over no nitrogen. Highest population of 1,66,666 plants per ha gave 3.3 and 15.5% more yield over 1,11,111 and 55,555 plants per ha, respectively. Water use by sunflower was affected by the depth of irrigation. Different fertility levels did not influence the water use, indicating that slow growing nutrient deficient plants have same requirement of water as that of

nutritionally balanced plants. Different plant population levels also did not differ in their water use as also earlier reported by Allesi et al. (1977).

Table 1. Seed yield, water use and water use efficiency of sunflower as influenced by different agronomic practices

Agronomic practices	Seed yield (kg/ha)	Water use (cm)	*WUE (kg ha ⁻¹ cm ⁻¹)
Depth of irrigation (cm)			
2.50	1110	37.19	30.75
3.75	1246	48.98	26.55
5.00	1384	60.79	23.20
CD (P=0.05)	74.73	—	ns
Fertility levels (N+P ₂ O ₅ , kg/ha)			
0 + 0	457	48.96	9.87
40 + 40	1563	48.99	33.83
80 + 80	1720	49.04	36.81
CD (P=0.05)	74.73	—	5.78
Plant population/ha			
55,555	1151	49.05	24.58
1,11,111	1286	48.98	27.58
1,66,666	1329	48.96	28.35
CD (P=0.05)	75.36	—	ns

*Means of 27 observations

Water use efficiency decreased with increase in the depth of irrigation but increased with increase in fertility and plant population levels (Table 1). Relatively low WUE was recorded without use of fertilizer. Conner et al. (1985) also reported higher WUE with increasing plant populations in sunflower.

In general, moisture extraction was more from deeper layers at flowering as compared to vegetative stage (Table 2). Bulk of the moisture was depleted by sunflower upto 60 cm soil depth during both the stages of crop growth. Rao et al. (1976) reported that sunflower extracted 36.8% of moisture from 0-15 cm, 27.3% from 15-30 cm and 35.4% from 30-60 cm layer in red loamy soils. More moisture was extracted from deeper layers with a decrease in the depth of irrigation or with an increase in fertility levels.

Table 2. Influence of depth of irrigation, fertility and plant population levels on per cent water extraction from four different depths (cm) of soil by sunflower

Factors	Per cent water extraction in vegetative stage				Per cent water extraction in flowering stage			
	0-15	15-30	30-60	60-90	0-15	15-30	30-60	60-90
Depth of irrigation (cm)								
2.50	28	42	22	8	24	30	26	20
3.75	30	42	20	8	26	32	26	16
5.00	31	43	20	6	24	36	24	16
Fertility level (N+P ₂ O ₅ kg/ha)								
0 + 0	42	44	10	4	36	41	13	10
40 + 40	32	41	18	9	22	32	27	19
80 + 80	34	38	18	10	24	30	26	20
Plant population/ha								
55,555	32	42	16	10	26	36	26	12
1,11,111	32	38	18	12	23	32	31	14
1,66,666	31	36	22	11	20	32	34	14

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