RESEARCH PAPER International Journal of Agricultural Sciences, January to June, 2010, Vol. 6 Issue 1 : 120-123

Influence of irrigation schedules and mulches on growth and quality of Sunflower (*Helianthus annuus* L.) in black soil of Northern Transitional Tract of Karnataka

RAGHUPATI DOMBER*, R.F. CHANNAGOUDAR, ANAND. S. KAMBLE, A.D. JANWADE AND M.M. NEKAR[1]

Institute of Organic Farming, University of Agricultural Sciences, DHARWAD (KARNATAKA) INDIA

ABSTRACT

A field experiment was conducted to find the Influence of Irrigation Schedules and Mulches on Growth and Quality of Sunflower (*Helianthus annuus* L.)in medium deep black clayey soil of Main Agricultural Research Station, University of Agricultural Sciences, Dharwad during *rabi* 2003-04. The experiment consisted of four main plot treatments (0.4, 0.6, 0.8 IW/CPE ratio and critical stages) and three sub plot treatments (control, maize straw mulch and polythene mulch) with three replications laid out in split plot design. The results indicated significantly higher head diameter, number of seeds per head and seed weight per head in 0.8 IW/CPE ratio irrigation schedules as compared to 0.4, 0.6 IW/CPE ratio and critical stages. The growth components like plant height, number of leaves per plant, leaf area index and total dry matter production per plant at harvest were also higher in 0.8 IW/CPE ratio. The significantly higher head diameter, number of seeds per head and seed weight per head was recorded in mulch with polythene over rest of the treatments. Similar trends were also observed in growth components. Higher seed oil content (41.07%) and oil yield (795 kg/ha) over 0.4, 0.6 IW/CPE ratio and critical stages.

Key words : Irrigation schedules, Mulches, Sunflower

INTRODUCTION

Sunflower (*Helianthus annuus* L.) is an important edible oilseed crop among the oilseed crops grown in India. In India, sunflower is being cultivated over an area of 1.34 million hectare with total production of 0.733 million tones with an average productivity of 549 kg per hectare (Anon. 2002). Which constitutes 6.17 per cent and 2.72 per cent of world's area and production respectively. However, the present productivity of sunflower in India is much less compared to other countries. In Karnataka, sunflower occupies an area of 6.9 lakh hectare with production of 2.55 lakh tones of seed with an averages productivity of 370 kg for hectare (Anon., 2002). The low productivity of sunflower in India in general and Karnataka in particular, is due to its cultivation in unfavorable environmental conditions such rain feed condition in marginal and sub marginal lands with poor nutrient supply, improper irrigation scheduling and inadequate plant protection measures. Water being a natural resource input and now a scare and costly input in the production of agricultural crops, has direct influence on the availability of nutrients from the soil. Judicious irrigation management is crucial in sunflower production. In post –rainy /simmer season sunflower responds better to man agement factors, especially irrigation. More than 62 per cent increase in seed yield has been observed due to irrigation compared to rainfed condition (Sunilkumar *et al.*, 1992)

Among different conservation practices, mulching is an important practice for crop production. According to Jackes *et al*. (1955), the English word mulch probably was derived from the German word 'Molsch' meaning "soft to decay", Mulch is any porous or non-porous material spread on soil surface in order to obtain beneficial effect on soil environment and crop productivity. The benefits from mulching are prevention and control of soil and runoff losses, check on evaporation of water, increase in moisture status of soil, controls fluctuation of soil temperature, improvement in physical, chemical and biological properties of soils, reduced weed, pest and disease infestation, building of soil fertility and ultimately influence on the yield of crop and profit. There fore, the present experiment was undertaken to find out the effect of irrigation schedules and mulches on growth, yield and quality of sunflower in *rabi* season on medium deep black clayey soil of Northern Transitional Tract of Karnataka.

MATERIALS AND METHODS

A field experiment was conducted during *Rabi* 2003-04 at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad (Karnataka). The experiment was laid out in split plot design with three replications. There were 12 treatment combinations consisting of four irrigation schedules (0.4, 0.6, 0.8 IW/CPE and critical stages) assigned to main plots and three mulches (no mulch, mulch, maize straw and polythene

*** Author for correspondence.** [1]Department of Agronomy, University of Agricultural Sciences, DHARWAD (KARNATAKA) INDIA

mulch) to sub plots. The soil was medium deep blacks clayey with pH 7.53, available N, P_2O_5 and K_2O was 18:25:373 kg/ha and having field capacity of 33.97 per cent, wilting coefficient 16.92 per cent and bulk density of 1.29 Mg/$m^{3.}$ Sunflower hybrid (RSFH-1) was used for experimentation. This hybrid is derived from a cross between CMS-103 x RHA-64 NB. It is high yielder than MSFH-17 and also have 23 per cent higher in oil content. A uniform fertilizer dose of 60:90:60 kg N, P_2O_5 and K_2O per hectare was applied. Scheduling of irrigation was done based on IW/CPE ratio with 60 mm depth of water in each irrigation. Maize straw @ 6 tonne per ha and transparent polythene sheet of 7 micron thickness were mulched at 25 days after sowing as per the sub plot treatment. These were spread uniformity between the sunflower crop rows without giving any gap in the plots after weeding. Five plants from each plot were selected at random and tagged for recording various growth, yield and yield attributes. Oil content was determined by Nuclear Magnetic Resonance (NMR) spectrophotometer against a standard reference sample according to A.O.A.C (1975). The oil yield (kg/ha) was computed using the following formula:

$$\text{Oil yield (kg/ha)} = \frac{\text{Oil content (\%)}}{100} \text{ x seed yield (kg/ha)}$$

RESULTS AND DISCUSSION

Results of the experiment revealed that the significantly higher plant height (137.7 cm), number of leaves per plant (5.51), leaf area index (0.357) and total dry matter production per plant (159.8 g) were recorded in 0.8 IW/CPE ratio (Table 1) over rest of the irrigation schedules (0.4, 0.6 IW/CPE ratio and critical stages). This was mainly due to optimum moisture in root zone which favoured uptake of nutrients, resulting in better growth of the crop. These results were in accordance with results of Singh and Gupta (2002). The significantly higher plant height (131 cm) number of leaves (4.87), leaf area index (0.340) and total dry matter production per plant (156.2 g) were recorded in mulch with polythene treatment over rest of mulch treatments (no mulch and maize straw mulch). This could be attributed to higher availability of soil moisture in the root zone as the mulches are known to conserve the moisture, reduced weed and check the evaporation losses. Similar results were also reported by Shinde *et al.* (2001).

The significantly higher head diameter (14.34), number of seeds per head (662) and seed weight per head (25.61 g) (Table 2) were recorded in 0.8 IW/CPE ratio over rest of irrigation schedules (0.4, 0.6 IW/CPE ratio and critical stages). Increase in these yield components is mainly attributed to better performance of plants with respect to growth parameters like plant height, number of leaves, leaf area index and total dry matter production. This is mainly due to optimum moisture available in the root zone which favoured plant growth throughout growing period reflecting better growth attributes. These results are in accordance with results of Tomar *et al.* (2003).

Significantly higher head diameter (13.99 cm), number of seeds per head (634) and seed weight per

Table 1 : Growth parameters of sunflower at harvest as influenced by irrigation schedules and mulches

Irrigation schedules(I)	Plant height at harvest (cm)				Number of leaves per plant				Leaf area index				Total dry matter production per plant (g/plant)			
	Mulches (M)															
	M_1	M_2	M_3	Mean	M_1	M_2	M_3	Mean	M_1	M_2	M_3	Mean	M_1	M_2	M_3	Mean
I_1	119.6	118.6	127.5	121.9	4.00	4.53	4.73	4.42	0.326	0.314	0.318	0.319	143.7	145.2	153.4	147.4
I_2	126.1	126.3	133.7	128.7	4.00	4.00	4.40	4.13	0.298	0.346	0.355	0.333	144.3	148.9	153.8	149.0
I_3	133.8	136.3	142.8	137.7	5.27	5.53	5.73	5.51	0.344	0.347	0.380	0.357	152.9	158.2	168.3	159.8
I_4	114.2	116.6	120.1	117.0	3.93	4.33	4.60	4.29	0.286	0.305	0.308	0.300	142.5	144.0	149.1	145.2
Mean	123.4	124.4	131.0		4.30	4.60	4.87		0.314	0.328	0.340		145.9	149.1	156.2	
For comparison	S.E.±		C.D. (P=0.05)		S.E.±		C.D. (P=0.05)		S.E.±		C.D. (P=0.05)		S.E.±		C.D. (P=0.05)	
Irrigation schedules(I)	2.04		7.09		0.28		0.99		0.01		0.03		0.67		2.33	
Mulches(M)	1.26		3.80		0.12		0.37		0.01		NS		1.52		4.56	
I x M	2.91		NS		0.35		NS		0.01		NS		2.57		NS	

Note: I_1 : 0.4 IW / CPE; I_2 : 0.6 IW / CPE; I_3 : 0.8 IW / CPE; I_4 : Critical stages
M_1 : No mulch; M_2 : Mulch with maize straw; M_3 : Mulch with polythene
NS-Non significant

Table 2 : Yield parameters of sunflower at harvest as influenced by irrigation schedules and mulches

Irrigation schedules (I)	Head diameter (cm)				Number of seeds per head				Seed weight per head (g)			
	Mulches (M)											
	M_1	M_2	M_3	Mean	M_1	M_2	M_3	Mean	M_1	M_2	M_3	Mean
I_1	12.39	13.18	13.74	13.10	576.6	560.0	589.0	573.8	18.67	20.93	22.45	20.68
I_2	13.68	14.10	14.17	13.99	567.6	586.6	613.3	589.2	21.76	22.64	24.39	22.93
I_3	14.26	14.24	14.52	14.34	597.0	675.0	715.0	662.3	24.16	26.24	26.44	25.61
I_4	12.04	12.91	13.55	12.83	519.3	555.3	608.3	562.6	18.74	20.27	21.65	20.22
Mean	13.09	13.61	13.99		565.1	590.5	634.4		20.83	22.50	23.73	
For comparison	S.E.±		C.D. (P=0.05)		S.E.±		C.D. (P=0.05)		S.E.±		C.D. (P=0.05)	
Irrigation schedules(I)	0.18		0.64		10.4		36.0		0.40		1.40	
Mulches(M)	0.14		0.44		13.7		41.3		0.33		0.99	
I x M	0.30		NS		24.8		NS		0.67		NS	

Note: I_1 : 0.4 IW / CPE; I_2 : 0.6 IW / CPE; I_3 : 0.8 IW / CPE; I_4 : Critical stages
M_1 : No mulch; M_2 : Mulch with maize straw; M_3 : Mulch with polythene
NS-Non significant

Table 3 : Oil content (%) and oil yield (kg/ha) at harvest as influenced by irrigation schedules and mulches

Irrigation schedules(I)	Oil content (%)				Oil yield (kg/ha)			
	Mulches (M)							
	M_1	M_2	M_3	Mean	M_1	M_2	M_3	Mean
I_1	39.98	40.96	41.32	40.75	505	601	628	578
I_2	41.20	40.00	41.23	40.78	710	729	777	739
I_3	41.03	40.64	41.53	41.07	730	749	906	795
I_4	40.57	38.99	39.76	39.77	669	694	732	698
Mean	40.69	40.37	40.71		654	691	744	
For comparison	S.E.±		C.D. (P=0.05)		S.E.±		C.D. (P=0.05)	
Irrigation schedules(I)	0.15		0.55		12.1		43.0	
Mulches(M)	0.15		NS		9.71		29.1	
I x M	0.28		0.88		19.9		59.8	

Note: I_1 : 0.4 IW / CPE; I_2 : 0.6 IW / CPE; I_3 : 0.8 IW / CPE; I_4 : Critical stages
M_1 : No mulch; M_2 : Mulch with maize straw; M_3 : Mulch with polythene
NS-Non significant

head (23.73 g) were recorded in mulch with polythene over no mulch and maize straw mulch. This is attributed to higher plant height, number of leaves, leaf area index and total dry matter production in this treatment. Moody (1963) who reported increased availability of moisture in the root zone because of conservation of the soil moisture and reduced evaporation losses with application of mulches.

Interaction effects between irrigation schedules and mulches were not significant with respect to plant growth and yield components.

The significantly higher seed oil content (41.07%) and seed oil yield (795 kg/ha) were recorded in 0.8 IW/CPE ratio irrigation schedule over 0.4, 0.6 IW.CPE ratio and critical stages. The higher oil yield with more frequent irrigation could be attributed to higher growth and yield parameters. Similar observations were also made by Singh and Gupta (2002). Oil content (%) of sunflower not significantly influenced by mulches, but oil yield (kg/ha) was significantly higher in polythene mulch (761 kg/ha) over no mulch (654 kg/ha) and maize straw mulch (693 kg/ha) respectively. The higher oil yield in polythene mulch is due to higher growth and yield parameters in this treatment. Such difference in oil yield due to mulches was noticed earlier by Khanvilkar *et al.* (1987). Thus scheduling of irrigation at 0.8 IW/CPE ratio and mulch with polythene was found better for maximum growth, seed yield and quality of sunflower on medium deep black clayey soils of Northern Transitional Tract of Karnataka.

REFERENCES

A.O.A.C. (1975). Official method of analysis (12th Edition William Storwetzled publication by A.O.A.C., Washington, D. C. pp 506-508.

Anonymous (2002). Directorate of oilseed development, Government of India, Ministry of Agriculture, Department of Agriculture and Co-Operation, Hyderabad, Andhra Pradesh.

Jacks, C.V., Brind, W.D. and Smitha, R. (1955). Mulching technology commission, Common wealth, *Bulletin of Soil Science*, No. 49.

Khanvilkar, S. A., Singh, N.P. and Hukkeri, S. B. (1987). Response of spring sunflower to irrigation mulch and anti transparent. *J. Maharastra Agric. Univ.*, **12**: 322-325.

Moody, J. E., Jones, J.N. and Lillavd, J.H. (1963). Influence of straw on soil temperature and growth of corn, soil science society. *American Proceedings*, **27**: 700-703.

Shinde, S. H., Kaushik, S.S., Bhilave, R.C. and Thokale, J.G. (2001). Effect of plastic mulch and fertilizers with foliar spray if nitrogoska on growth and yield of groundnut. *J. Oil Seed Rec.*, **18**: 281 – 282.

Singh, O. and Gupta, P.C. (2002). Influence of sowing date and irrigation levels on hybrid seed production and oil quality of sunflower (PSFH-67). *J. Oilseed Res.*, **19**: 204-206.

Sunil Kumar, Dixit, R.S. and Tripathi, H.P. (1992). Effect of moisture regimes and nitrogen levels on growth and yield of sunflower (*Helianthus annuus* L). *Narendra Deva J. Agric. Res.*, **7**: 192-194.

Tomar, S.S., Shivran, A.C. and Dungarawal, H.S. (2003). Influence of irrigation scheduling on yield, consumptive use of water, water use efficiency and economics of rabi sunflower (*Helianthus annuus* L.) *Annals of Agric. Res. News Series*, **24**: 432-433.

Received : February, 2009, Revised : June, 2009; Accepted : September, 2009