



P-ISSN: 2349-8528
 E-ISSN: 2321-4902
 IJCS 2018; 6(3): 2803-2805
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 Received: 13-03-2018
 Accepted: 16-04-2018

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Effect of spacing and weed management on the growth and yield of sunflower

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Abstract

A field experiment was conducted at Tamil Nadu Agricultural University, Coimbatore during *Kharif* 2016-17 to investigate the effect of spacing and weed management on the growth and yield of sunflower hybrid. The experiment was laid out in strip plot design replicated thrice consisting of five horizontal factors as spacing viz 60cm×30cm, 75cm×25cm, 75cm×20cm, 90cm×20cm and 90cm×15cm and five vertical factors as weed management practices viz. Pre- Emergence herbicide Pendimethalin at 1kg per ha followed by hand weeding at 30DAS, Pre- Emergence herbicide Pendimethalin at 1kg per ha followed by power Weeder on 30DAS, power Weeder weeded twice, hand weeding twice and weedy check. Among the spacing, 75cm×25cm had resulted in higher growth components and seed yield of sunflower. Hand weeding twice at 15DAS and 30DAS among weed management factors had higher growth components and seed yield of sunflower compared to other weed management practices.

Keywords: Spacing, weed management, sunflower, Pre emergence herbicide, Weeder

Introduction

Sunflower is one of the most important oilseed crop due to its wide adaptability and very high seed oil content ranging from 40 to 50 percent, no cholesterol and high non saturated fatty acids content. It is one of the fastest growing oilseed crops in India popularly known as “Surajmukhi”. It stands third in production among oilseed next to soybean, rape and mustard. It is a photo and thermo- insensitive, short- duration, deep- rooted, drought- resistant, widely adaptable crop offers promise for its cultivation for boosting oilseed production. Sunflower being a wide row spacing crop and slow initial growth of sunflower provide enough room for weeds to establish and to take advantage of slower initial growth of the crop. Reduction of 64% of yield due to uncontrolled growth of weeds. It causes enormous loss of nutrients. The herbicide controls weeds in rows whereas mechanical weeding removes weeds between the rows. Vrataric (2004) ^[1] found that the level of weed infestation of sunflower crop differs over location and directly affects the intensity of the competitive relationship between the crops and weeds which results in lower or greater yield losses. Critical period of weed competition was found to be 20 to 49 days after sowing reported by Wanjari *et al.* (2000) ^[2]. Uncontrolled weed growth reduced the seed yield of sunflower upto an extent of 55%. Therefore, timely weed management is essential for optimizing sunflower yields.

Materials and Methods

A field experiment was conducted during *Kharif* season of 2016-17 to study the effect of spacing and weed management on the growth and yield of Sunflower at Tamil Nadu Agricultural University, Coimbatore. The experimental site is geographically situated in the western agro-climatic zone of Tamil Nadu at 11° N latitude and 77° E longitude and at an altitude of 426.7 meters above mean sea level (MSL). The experiment was laid out with strip plot design and replicated thrice. The treatment comprised of five horizontal factors as spacing viz 60cm×30cm, 75cm×25cm, 75cm×20cm, 90cm×20cm and 90cm×15cm. five vertical factors as weed management practices like Pre- Emergence herbicide Pendimethalin at 1kg per ha followed by hand weeding at 30DAS, Pre- Emergence herbicide Pendimethalin at 1kg per ha followed by Weeder weeded at 30DAS, two times Weeder weeded at 15DAS and 30DAS, two time hand weeding at 15DAS and 30DAS and weedy check. The soil of the experimental field was sandy clay loam in texture. The sunflower hybrid, TNAU Sunflower Hybrid CO2 was used as test crop. Weed management treatment were imposed as per the schedule. The recommended fertilizer dose followed for sunflower was 90:60:60 kg NPK ha⁻¹. Half dose of

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N and K and full dose of P were applied basally to all the treatments. The remaining N and K were top dressed at 30 DAS. The crop was harvested at maturity stage, seed yield per net plot of each treatment was recorded. The various biometric observations, analytical data of plant sample and the computed data were subjected to statistical scrutiny as per the procedures given by (Gomez and Gomez, 1984) [3]. The treatment differences were worked out at five per cent probability level.

Results and Discussion

There was a significant influence observed with spacing and weed management practices.

Growth parameter

Among the spacing treatments S₂ (75cm×25cm) showed higher plant height(57.6cm,134.5cm and 163.6cm), leaf area index (1.95, 3.88 and 5.55) and dry matter production(364kg/ha,1601kg/ha and 2239kg/ha) at 30DAS, 60DAS and at harvest stages (presented in Table 1 and Table 2). The treatments S₁ and S₃ are on par with S₂ compared to the other two spacing. Hand weeding twice at 15DAS and 30DAS gives the higher plant height (64cm, 152.7cm and 174.5cm) and leaf area index(2.04, 4.40 and 5.79) and dry matter production(373kg/ha, 1704kg/ha and 2412kg/ha) at 30DAS, 60DAS and at harvest stage. Plant growth is the indication of utilization of the available resources by the crop. Increase in the plant height might be due to increase in the inter plant competition for light and other aerial resources. Plant height increases with the increase in the row spacing was in confirmatory with the finding of Cucci *et al.* (2012) [4] and Amjed *et al.* (2011) [5]. Increase in the leaf area index with increase in row spacing might be due to the utilization of better light energy and accumulation of higher photosynthates. Similar results are observed with Dev kumar and Shaik Mohammad (2001) [6]. Abdul Ghani Soomro *et al.* (2015) [7] reported that increased in dry matter production with increase in row spacing was due to higher leaf area index and effective utilization of essential resources like light energy and nutrients. Effective weed control had resulted in better utilization of light, water and nutrients by the crop effectively than other treatments. Weed free situation

increased the plant height, leaf area index and dry matter production was earlier reported by Patel *et al.* (2013)^[8] and Dhanalakshmi (2015) ^[9]. Early control of weeds with herbicidal management and subsequent removal by a manual weeding on 30 DAS might have provided favorable environment for better growth of crop plants as against weed growth. Weeds in unweeded control treatment caused severe competition from early growth stages for available nutrients, light and moisture between crops and weeds. Similar results were reported by Poonghuzhalan (1992) ^[10] who have observed that integrated weed management with herbicidal and manual weeding recorded higher plant height than weedy check due to the reduction in the competition offered by weeds for nutrients and moisture.

Seed yield

Among the spacing, 75cm×25cm produced higher seed yield (1689kg/ha) compared to the other spacing treatments (Table 3). Significant increase in the seed yield with spacing 75cm×25cm due to less damage by the power Weeder and row spacing of 75cm was favourable for obtaining higher seed yield which contributed to increased number of seeds per unit area. Similar results were obtained by Ion *et al.*(2015) ^[11] and Hossam Ibrahim(2012) ^[12].

Hand weeding twice at 15DAS and 30DAS produced higher seed yield (1847kg/ha) and it was on par with the Pre-Emergence herbicide Pendimethalin at 1kg per ha followed by hand weeding at 30DAS (1752 kg/ha) compared to the other weed management treatments. Due to the weed free situation and early application of the broad spectrum selective herbicide which controlled the weeds at the early stage of the crop helped better utilization of light, nutrient and moisture for growth of crop followed by intercultivation gave higher seed yield of sunflower. Similar results were reported by Kumar *et al.* (1998) ^[13] and Bhuvaneshwari *et al.* (2010) ^[14]. Interaction effect was significant in combination of spacing 60cm×30cm and weed management practice. Twice hand weeding at 15DAS and 30DAS resulted in higher dry matter production and seed yield of sunflower. It might be due the weed free situation and optimum row spacing checks the weed growth. It had lead to increase in dry matter production and seed yield of sunflower crop.

Table 1: Effect of spacing and weed management on the Plant height and leaf area index of sunflower

Treatment	Plant height(cm)			Leaf area index		
	30DAS	60DAS	At harvest	30DAS	60DAS	At harvest
S ₁	54.4	131.5	157.1	1.84	3.55	5.23
S ₂	57.6	134.5	163.6	1.95	3.88	5.55
S ₃	52.7	126.7	153.5	1.79	3.35	4.90
S ₄	48.7	119.5	144.1	1.60	2.91	4.12
S ₅	51.9	121.5	148.9	1.70	3.13	4.56
SEd	1.7	4.0	4.9	0.06	0.11	0.16
CD (P=0.05)	4.1	9.9	11.9	0.14	0.27	0.39
W ₁	54.7	129.2	160.7	1.86	3.47	5.09
W ₂	55.5	144.8	169.7	1.91	3.79	5.23
W ₃	54.3	121.1	153.7	1.74	2.90	4.89
W ₄	64.0	152.7	174.5	2.04	4.40	5.79
W ₅	36.8	85.9	108.7	1.34	2.27	3.36
SEd	1.8	4.3	5.2	0.06	0.12	0.17
CD (P=0.05)	4.5	10.4	12.7	0.15	0.28	0.41

Table 2: Effect of spacing and weed management practices on total dry matter production (DMP) (kg ha⁻¹) of sunflower

Treatment	30DAS						60DAS						At harvest					
	W ₁	W ₂	W ₃	W ₄	W ₅	Mean	W ₁	W ₂	W ₃	W ₄	W ₅	Mean	W ₁	W ₂	W ₃	W ₄	W ₅	Mean
S ₁	437	385	230	469	178	340	1984	1764	1035	2167	612	1512	2817	2523	1449	3142	801	2146
S ₂	415	424	377	431	173	364	1876	1933	1621	1983	593	1601	2626	2726	2237	2835	771	2239
S ₃	326	344	284	384	165	301	1467	1562	1164	1759	562	1303	1995	2155	1560	2480	725	1783
S ₄	244	253	189	280	139	221	1090	1140	839	1254	458	956	1439	1528	1090	1719	577	1271
S ₅	245	272	217	300	153	238	1099	1230	958	1356	509	1030	1473	1673	1264	1885	652	1389
Mean	334	336	259	373	162		1503	1526	1123	1704	547		2070	2121	1520	2412	705	
	S	W	S at W	W at S			S	W	S at W	W at S			S	W	S at W	W at S		
S. Ed	10	10	17	17			46	43	78	77			64	60	109	107		
CD (P=0.05)	25	24	39	38			112	105	173	169			156	146	242	236		

Table 3: Effect of spacing and weed management on the seed yield of sunflower

Treatment	W ₁	W ₂	W ₃	W ₄	W ₅	Mean
S ₁	1958	1328	1103	2072	969	1486
S ₂	1895	1922	1721	1997	909	1689
S ₃	1805	1842	1650	1886	932	1623
S ₄	1456	1487	1348	1551	736	1316
S ₅	1648	1669	1538	1728	803	1477
Mean	1752	1650	1472	1847	870	
	S	W	S at W	W at S		
SEd	50	53	86	88		
CD (P=0.05)	122	129	191	196		

	Spacing		Weed management
S ₁	60cm×30cm (55,555 plants/ha)	W ₁	Pre- Emergence herbicide Pendimethalin at 1kg per ha followed by hand weeding at 30DAS
S ₂	75cm×25cm (53333 plants/ha)	W ₂	Pre- Emergence herbicide Pendimethalin at 1kg per ha followed by Weeder weeded at 30DAS
S ₃	75cm×20cm (66666 plants/ha)	W ₃	Power Weeder at 15DAS and 30DAS
S ₄	90cm×20cm (55555 plants/ha)	W ₄	Hand weeding twice at 15DAS and 30DAS
S ₅	90cm×15cm (74074 plants/ha)	W ₅	Weedy check

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