



Spacing and weed management influence on productivity and economics of sunflower

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ABSTRACT

Field experiment on economics and productivity of sunflower with response to spacing and weed management practices was conducted at Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, during rainy season of (*Khariif*) 2016 and 2017 with objective of checking the suitability of spacing for moment of power weeder. Experiment was laid out in strip plot design and replicated thrice. The treatment comprised of five horizontal factors as plant spacing and five vertical factors as weed management practices. The higher cost of cultivation was registered with spacing 90×15 cm among different spacing and increased in gross returns, net returns, B:C ratio, per day return and seed yield with the spacing 75×25 cm. Hand weeding twice at 15 and 30 DAS recorded the higher cost of cultivation, gross returns, per day returns and seed yield among the different weed management practices during the both years of experimentation. Results of two year experimentation revealed that increased in net returns with pendimethalin at 1 kg/ha followed by hand weeding at 30 DAS and higher B:C ratio was recorded with pendimethalin at 1 kg/ha followed by weeder at 30 DAS.

Sunflower being a wide spaced crop and slow growth during the initial stage of the crop, provides enough room for weeds to establish and take advantage of slower initial growth of the crop. Reduction in sunflower yield upto 64% due to uncontrolled growth of weeds which in turn cause enormous loss of nutrients has been reported (Legha *et al.* 1992). Row spacing plays an important role in determining yield and yield components. To sustain the productivity in sunflower, it is prime need to practice high density planting systems, with narrow and ultra narrow spacing which will cover the soil canopy as early as possible compared to the conventional row widths. It helps in shading out weeds and reduces their competition with the crop and permit to operate the mechanical weeder in the rows due to the change in the row spacing.

A field experiment was carried out during rainy season (*Khariif*) season of 2016 and 2017 to the study the response of spacing and weed management practices on economic and productivity of sunflower at Tamil Nadu Agricultural University, Coimbatore. The experiment was laid out with strip plot design and replicated thrice. The treatment comprised of five horizontal factors as plant spacing, *viz.* S₁ (60×30 cm), S₂ (75×25 cm), S₃ (75×20 cm), S₄ (90×20

cm) and S₅ (90×15 cm). Five vertical factors as weed management practices like W₁ (pre-emergence herbicide pendimethalin at 1.0 kg/ha followed by hand weeding at 30 DAS), W₂ (pendimethalin at 1.0 kg/ha followed by weeder at 30 DAS), W₃ (weeding with weeder at 15 DAS and 30 DAS), W₄ (two hand weedings at 15 DAS and 30 DAS) and W₅ (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 60:90:60 kg NPK/ha. Half dose of 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. Analytical data of yield sample and the computed data were subjected to statistical scrutiny as per the procedures given by Gomez and Gomez (1984). The treatment differences were worked out at five per cent probability level.

Effect on productivity

Amongst spacing combinations 75×25 cm, recorded maximum seed yield compared to the other

spacing treatments during two years of experimentation (**Table 1**). Significant increase in the seed yield with spacing 75×25 cm due to low damage by the power weeder moment and row spacing of 75 cm was favourable for obtaining higher seed yield which contributed to maximum number of seeds per unit area. Similar finding were obtained by Ion *et al.* (2015) and Ibrahim (2012). Hand weeding twice at 15 DAS and 30 DAS produced maximum seed yield and it was at par with the pendimethalin at 1.0 kg/ha followed by hand weeding at 30 DAS compared to the other weed management treatments. Due to the weed free environment 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 obtained by Bhuvaneshwari *et al.* (2010).

Interaction effect was significant in combination of spacing 60×30 cm and hand weeding twice at 15 DAS and 30 DAS among weed management practices 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.

Effect on economics

Higher cost of cultivation was registered with the spacing 90×15 cm (*i.e.*, 24189 ₹/ha) during *Kharif* 2016 and 2017 (**Table 2**). Wider spacing increased the labour cost which directly reflected on

the increased cost of cultivation. Lesser cost of cultivation was recorded with closer spacing 75×25 cm (*i.e.*, 23573 ₹/ha) during both the years. Among the weed management practices, lower cost of cultivation with pendimethalin at 1.0 kg/ha followed by weeder at 30 DAS (*i.e.*, 21460 ₹/ha) due to the early weed control by pre-emergent herbicide and later stage weed control by the moment of power weeder significantly reduced the labour cost.

Gross return was higher with the spacing 75×25 cm (₹ 50664 and 55524 ₹/ha during *Kharif* seasons of 2016 and 2017, respectively), this was followed by the spacing 75×20 cm during both the years of experiment. Because of optimum spacing helped the plant to effectively utilize the resources which results in increased growth and yield of crop and it showed significant effect in increased gross return. Hand weeding twice at 15 and 30 DAS among the weed management practices registered higher gross returns during both the years (₹ 55404 and 60186/ha during *Kharif* seasons of 2016 and 2017, respectively) Weed free situation helped the plants to utilize the available resources like light, nutrient and moisture which reflected on better growth and yield of crop. This is in accordance with the result of Kalhapure *et al.* (2013) who revealed higher gross returns with weed free check in groundnut crop.

The spacing 75×25 cm (₹ 27091 and 31951/ha during *Kharif* seasons of 2016 and 2017, respectively) recorded the higher net return. With respect to weed management practices, pre-emergence herbicide pendimethalin at 1.0 kg/ha followed by hand weeding at 30 DAS (₹ 28260 and

Table 1. Effect of spacing and weed management practices on seed yield (kg/ha) of sunflower

Treatment	Pendimethalin PE at 1.0 kg/ha followed by HW at 30 DAS	Pendimethalin at 1.0 kg/ha followed by weeder at 30 DAS	Weeding with weeder at 15 DAS and 30 DAS	Two hand weedings at 15 DAS and 30 DAS	Weedy check	Mean
2016						
S ₁ 60×30 cm	1958	1328	1103	2072	969	1486
S ₂ 75×25 cm	1895	1922	1721	1997	909	1689
S ₃ 75×20 cm	1805	1842	1650	1886	932	1623
S ₄ 90×20 cm	1456	1487	1348	1551	736	1316
S ₅ 90×15 cm	1648	1669	1538	1728	803	1477
LSD (p=0.05)	S	W	S at W	W at S		
	122	129	191	196		
2017						
S ₁ 60×30 cm	2201	1488	1272	2225	981	1633
S ₂ 75×25 cm	2134	2145	1878	2170	927	1851
S ₃ 75×20 cm	2014	2021	1801	2076	953	1773
S ₄ 90×20 cm	1633	1668	1513	1699	767	1456
S ₅ 90×15 cm	1829	1846	1683	1861	820	1608
LSD (p=0.05)	S	W	S at W	W at S		
	134	141	211	215		

Table 2. Effect of spacing and weed management practices on economics of sunflower (Kharif, 2016)

Treatment	Kharif, 2016					Treatment	Kharif, 2017				
	Cost of cultivation (₹/ha)	Gross Returns (₹/ha)	Net Returns (₹/ha)	Benefit: cost ratio	Per day income (₹/ha)		Cost of cultivation (₹/ha)	Gross Returns (₹/ha)	Net Returns (₹/ha)	Benefit: cost ratio	Per day income (₹/ha)
<i>Spacing</i>											
S ₁	23729	44580	20851	1.86	469	S ₁	23729	49002	25273	2.04	516
S ₂	23573	50664	27091	2.15	533	S ₂	23573	55524	31951	2.35	584
S ₃	23636	48690	25055	2.06	513	S ₃	23636	53190	29555	2.25	560
S ₄	23989	39468	15479	1.64	415	S ₄	23989	43680	19691	1.82	460
S ₅	24189	44316	20127	1.83	466	S ₅	24189	48234	24045	1.99	508
<i>Weed management practices</i>											
W ₁	24312	52572	28260	2.16	553	W ₁	24312	58866	34554	2.42	620
W ₂	21460	49488	28028	2.31	521	W ₂	21460	55008	33548	2.57	579
W ₃	23984	44160	20176	1.85	465	W ₃	23984	48882	24898	2.04	515
W ₄	26930	55404	28474	2.06	583	W ₄	26930	60186	33256	2.24	634
W ₅	22430	26094	3664	1.16	275	W ₅	22430	26688	4258	1.19	281

S1 = 60 × 30 cm; S2 = 75 × 25 cm; S3 = 75 × 20 cm; S4 = 90 × 20 cm; S5 = 90 × 15 cm; W1 = Pre-emergence herbicide pendimethalin at 1.0 kg/ha followed by hand weeding at 30 DAS; W2 = Pendimethalin at 1.0 kg/ha followed by weeder at 30 DAS; W3 = Weeding with weeder at 15 DAS and 30 DAS; W4 = Two hand weedings at 15 DAS and 30 DAS; W5 = Weedy check

34554/ha during *Kharif* seasons of 2016 and 2017, respectively) and Increased B:C ratio with spacing 75 × 25 cm (2.15 and 2.35 during *Kharif* seasons of 2016-17 and 2017-18, respectively) This might be due to reduction in the cost of cultivation by use of power weeder for weeding instead of manual labour as well as optimum spacing for movement of power weeder without plant damage which might have increased the yield and increased the net returns and B: C ratio. These results were in confirmatory with the finding of Baskaran and Kavimani (2014) and Nagre *et al.* (2017).

Per day return was high with the spacing 75 × 25 cm (₹ 533 and 584/day/ha during *Kharif* seasons of 2016 and 2017, respectively), Hand weeding twice at 15 and 30 DAS in both the years (₹ 583 and 634 / day/ha during *Kharif* seasons of 2016 and 2017, respectively). Weed free situation due to hand weeding twice might have directly reflected on increase in yield of crop.

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