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Influence of Planting Pattern and Weed Management Practices on Yield Attributes and Yield of Sunflower

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ABSTRACT

A field experiment was conducted in *rabi*, 2009-10 at the wetland farm of S.V. Agricultural college, Tirupati to study the influence of planting pattern and weed management practices on yield attributes and yield of sunflower. The experiment was laid out in split plot design, replicated thrice with three planting patterns 45 × 20 cm, 45 × 30 cm and 60 × 30 cm and seven weed management practices *viz*., unweeded control, weed free check, one intercultivation at 30 DAS, one intercultivation at 30 DAS + 1 HW at 45 DAS, pendimethalin @ 1.0 kg a.i ha^{-1} + 1 HW at 30 DAS, oxadiargyl @ 0.3 kg a.i ha^{-1} + 1 HW at 30 DAS and oxyflourfen @ 0.1 kg a.i ha^{-1} + 1 HW at 30 DAS. The lowest weed density, biomass of weeds and the highest growth parameters, yield and yield attributes were noticed with the planting pattern of 45 × 30 cm. Among the weed management practices tried, pre-emergence application of pendimethalin @ 1.0 kg a.i ha^{-1} + 1 HW at 30 DAS resulted in the lowest weed density, biomass of weeds and the highest growth parameters, yield attributes and yield.

Key words : Planting Pattern, Sunflower, Weed Management, Yield.

Sunflower with its versatile nature is expected to play a crucial role in the oil seed economy of the country. Planting pattern has been observed to influence the yield of many crops. Sunflower expresses its full genetic potential when it is grown in an ideal ecological environment with optimum availability of resources and plant population levels. It is imperative to adopt optimum plant population for better utilization of all the available resources more efficiently. Sumati *et al.,* (2009) recorded 8.5% higher seed yield with the planting pattern of 45 × 30 cm over 60 × 22.5 cm. Weeds pose serious problem in the cultivation of sunflower. If unchecked, weeds can reduce the seed yield to an extent of 42 to 67 per cent. Use of herbicides has become a necessary practice to reduce the weed menace during early growth stages of sunflower. However neither herbicide nor intercultivations are adequate for consistent and acceptable weed control. Thus, integrated weed management is gaining importance in the management of weeds.

MATERIALS AND METHODS

The experiment comprising three planting patterns in main plots and seven weed management practices in sub-plots was conducted on sandy loam soil of wet land farm of S.V. Agricultural college, Acharya N.G. Ranga Agricultural University, during *rabi*, 2009-10 in a split plot design with three replications. The main plot treatments comprised of 45 × 20 cm, 45 × 30 cm and 60 × 30 cm and weed management practices unweeded control, weed free check, one intercultivation (IC) at 30 DAS, one intercultivation at 30 DAS + HW at 45 DAS, pendimethalin @ 1.0 kg a.i ha^{-1} + 1 HW at 30 DAS, oxadiargyl @ 0.3 kg a.i ha^{-1} + 1 HW at 30 DAS and oxyflourfen @ 0.1 kg a.i ha^{-1} + 1 HW at 30 DAS. The recommended dose of fertilizers applied for sunflower crop was 75 kg N, 90 kg P_2O_5 and 30 kg K_2O ha^{-1}. The entire dose of phosphorus and potassium and half of nitrogen was applied as basal and the remaining half of nitrogen was applied in two equal splits at 25 and 55 DAS as top dressing. Herbicides were applied using flat fan nozzle as pre-emergence at 24 hours after sowing, using a spray volume @ 600 l ha^{-1}. The experimental data recorded for growth, yield attributes and yield were statistically analyzed. The data on weed density and dry weight were transformed to square root ($\sqrt{X+0.5}$) transformation to normalize their distribution.

RESULTS AND DISCUSSION

Effect on weed

The major weed flora of the experimental field consisted of *Cynodon dactylon* (L) Pers.*, Cyperus rotundus* L.*, Celosia argentea* L. and *Digera arvensis.*

The density and dry weight of weeds were significantly influenced by planting pattern and weed management practices. While, the interaction effect of planting patterns and weed management practices were found to be non-significant. The

Table 1. Weed density, dry weight of weeds and growth parameters of sunflower at harvest as influenced by planting pattern and weed management practices

Treatments	Weed density (No. m^{-2})	dry weight of weeds (g m^{-2})	Plant height (cm)	LAI	DMP (kg ha^{-1})
Planting pattern (P)					
45 × 20 cm	194.25 (12.34)	45.22 (5.97)	119.0	0.96	4024
45 × 30 cm	161.38 (11.15)	41.78 (5.72)	117.4	1.08	4230
60 × 30 cm	224.56 (13.36)	48.80 (6.21)	113.3	0.95	3800
CD (P=0.05)	0.27	0.13	3.99	0.05	130.7
Weed management (W)					
Unweeded control	582.10 (24.09)	139.03 (11.80)	95.1	0.38	2742
Weed free check	0.00 (0.71)	0.00 (0.71)	136.8	1.23	4682
IC at 30 DAS	225.74 (15.00)	60.93 (7.83)	103.6	0.93	3698
IC at 30 DAS + HW at 45 DAS	197.97 (14.04)	49.21 (7.04)	112.5	0.99	3982
Pendimethalin @ 1.0 kg a.i ha^{-1} + HW at 30 DAS	103.85 (10.14)	21.49 (4.68)	123.8	1.20	4470
Oxadiargyl @ 0.3 kg a.i ha^{-1} + HW at 30 DAS	129.54 (11.36)	23.70 (4.91)	121.3	1.10	4214
Oxyflourfen @ 0.1 kg a.i ha^{-1} + HW at 30 DAS	114.59 (10.64)	22.51 (4.79)	122.9	1.14	4339
CD (P=0.05)	0.72	0.29	4.95	0.08	175.1
Interaction effect (P×W)	NS	NS	NS	NS	NS

Figures in parenthesis indicates square root transformed ($\sqrt{X+0.5}$) values.

DMP-Dry matter production NS-Non-significant

lowest density and dry weight of weeds were recorded with the planting pattern of 45 × 30 cm over the rest of the planting patterns tried. Denser plant stand per unit area have provided lesser space for weed emergence and modified the canopy structure, which in turn reduced the light transmittance to ground to stimulate the weed growth. Besides the weed free treatment, the lowest dry weight and density of weeds were recorded with pendimethalin @ 1.0 kg a.i ha^{-1} + 1 HW at 30 DAS, however, it was at par with oxyflourfen @ 0.1 kg a.i ha^{-1} + 1 HW at 30 DAS. This might be due to prevention of emergence of weeds during the early stages of crop growth because of the suppressive action of herbicides applied as pre-emergence which has effectively reduced the weed density and biomass of weeds. The results are in conformity with Rathore and Gautham (2003).

Effect on crop growth

The highest plant height was recorded with the planting pattern of 45 × 20 cm, being on par with 45 × 30 cm. The planting pattern of 45 × 20 cm, which accommodated 1,11,111 plants ha^{-1} with narrow row spacing produced the tallest plants, which might be due to mutual shading and intense competition among plants for light under the higher level of plant population. The increase in plant height with increasing plant population and narrow row spacing has been reported by several researchers Patel and Thakur (2003), Sivajyothi and Rao (2004). Leaf area index and dry matter production were significantly higher with the planting pattern of 45 × 30 cm than the rest of the planting patterns tried. This might be probably due to the higher number of plants per unit area producing more number of larger leaves being produced due to reduced mutual

Table 2. Yield components and yield of sunflower as influenced by planting pattern and weed management practices

Treatments	No.of filled seeds head^{-1}	Total number of seeds head^{-1}	100 seed weight (g)	Seed yield (kg ha^{-1})	Stalk yield (kg ha^{-1})	Net returns (Rs ha^{-1})	Benefit-cost ratio
Planting pattern (P)							
45 × 20 cm	736	837	5.32	1405	2717	6917	1.36
45 × 30 cm	829	925	5.80	1559	2823	10299	1.57
60 × 30 cm	694	804	5.15	1280	2539	5478	1.29
CD (P=0.05)	35	39	0.13	94	85	-	-
Weed management (W)							
Unweeded control	600	732	4.34	814	1806	-1567	0.90
Weed free check	853	927	6.29	1852	3110	13905	1.72
IC at 30 DAS	664	786	4.78	1067	2442	7092	1.14
IC at 30 DAS + HW at 45 DAS	771	882	5.31	1488	2759	9263	1.53
Pendimethalin @ 1.0 kg a.i ha^{-1} + HW at 30 DAS	803	888	5.88	1614	2975	10623	1.58
Oxadiargyl @ 0.3 kg a.i ha^{-1} + HW at 30 DAS	786	886	5.63	1511	2839	8243	1.44
Oxyflourfen @ 0.1 kg a.i ha^{-1} + HW at 30 DAS	795	887	5.77	1557	2919	10123	1.56
CD (P=0.05)	57	60	0.28	72	117	-	-
Interaction effect (P×W)	NS	NS	NS	NS	NS	-	-

NS-Non-significant

shading and better functioning of roots. Among the weed management practices tried, weed free check resulted in the highest plant height, leaf area index and drymatter production. The next best treatment was pendimethalin @ 1.0 kg a.i ha^{-1} + 1 HW at 30 DAS, however, it was at par with oxyflourfen @ 0.1 kg a.i ha^{-1} + 1 HW at 30 DAS. This might be due to nearly weed free environment that facilitated better availability of nutrients and moisture for crop growth and development. The interaction effect of planting patterns and weed management practices did not influence the crop growth parameters significantly.

Yield attributes and yield

Yield attributes as well as seed and straw yield were significantly influenced by different planting patterns and weed management practices, while their interaction effect was found to be non-significant. The highest stature of all the yield attributes were noticed with the planting pattern of 45 × 30 cm, this might be due to higher drymatter production and effective partitioning of assimilates during post-anthesis period, allocating current as well as reserved assimilates towards the economic part of the plant. Besides weed free check the highest yield attributes like number of filled seeds head^{-1}, total number of seeds head^{-1} and 100 seed weight, seed yield and stalk yield were recorded with pendimethalin @ 1.0 kg a.i ha^{-1} + 1 HW at 30 DAS being at par with oxyflourfen @ 0.1 kg a.i ha^{-1} + 1 HW at 30 DAS. This might have effectively controlled weeds, providing ideal conditions during critical stages of crop growth for improved availability of growth resources, especially nutrients, which in turn accelerated the production of photosynthates and their translocation to sink. These findings are in accordance with those of Shylaja and Sundari (2008). The cumulative effect of all those improved growth and yield parameters enhanced the seed yield. These results confirm the findings of Pooguzhalan *et al.,* (2002).

Economics:

Highest net return (Rs. 10299 ha^{-1}) and benefit cost ratio (1.57) were recorded with the planting pattern of 45 × 30 cm. Among the weed management practices tried, the highest net returns (Rs. 13905 ha^{-1}) and benefit-cost ratio (1.72) were recorded with weed free check. The next best treatment was pendimethalin @ 1.0 kg a.i ha^{-1} + 1 HW at 30 DAS.

Thus, it is inferred that the highest yield as well as economic returns could be realized in sunflower with the planting pattern of 45 × 30 cm coupled with weed free check. In case of the areas where the labour scarcity or prohibitive cost exists, the next alternative without draining either economic yield or the net profit, the weed management practice of pendimethalin @1.0 kg a.i ha^{-1} + 1 HW at 30 DAS can be followed.

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