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Growth and yield of sunflower as influenced by weed control methods under graded levels of nutrients

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Abstract : A field experiment was undertaken at University of Agricultural Sciences, Bangalore to assess the feasibility of using sunflower stalks as mulch to control weeds in sunflower and to study the influence of nutrient levels on the growth and yield of sunflower. Six weed control treatments (Weedy check, Pendimethalin 1 kg ha^{-1}, Pendimethalin 0.5 kg ha^{-1} + hoeing at 30 DAS, Mulching sunflower stalks @ 10 t ha^{-1}, Pendimethalin 0.5 kg ha^{-1} + mulching sunflower stalks @ 5 t ha^{-1} and hoeing at 20 & 30 DAS) were tested under three graded levels of nutrients (100, 75 or 50% of recommended NPK) in a split plot design, replicated thrice. The results revealed that application of 100% recommended NPK registered significantly higher growth components and seed, stalk and oil yields *viz.* 11.82, 13.03 and 3.75 q ha^{-1}, respectively, as compared to 75 or 50% levels. Among the weed control treatments, Pendimethalin 0.5 kg ha^{-1} +hoeing at 30 DAS gave efficient control of weeds and registered maximum seed, stalk and oil yields *viz.* 16.97, 18.27 and 5.48 q ha^{-1}respectively. Mulching sunflower stalks either alone (@ 10 t ha^{-1}) or in combination with pendimethalin 0.5 kg ha^{-1} (@ 5 t ha^{-1}) recorded significantly lower yields than weedy check owing to poor control of weeds and higher intensity of leaf spot disease.

Keywords : Sunflower, Nutrient, Weed management, Mulching, Pendimethalin, Hand hoeing.

Introduction

One of the ways to raise the productivity of sunflower, particularly in non-irrigated areas, is through judicious fertilizer use, which is very crucial in view of the high fertilizer cost. Weed problem in sunflower is so acute that they deprive the crop of available nutrients and the failure of the crop is not uncommon, if weeds are left uncontrolled. Pendimethalin has been found to be a promising herbicide for controlling weeds in sunflower (Reddy *et al.* 1992). Of late, there is greater emphasis not to pollute the environment with the indiscriminate use of chemicals. Hence, it is necessary to integrate herbicides with other methods or switch over to alternative methods of weed control, which are environmental friendly. The use of left over crop materials as a mulch offers a great scope for weed control, in addition to conserve soil moisture and enhancing soil organic mater content. Sunflower stalks are not used for any purpose other than that for fuel. Hence, they may be used as a mulch to control weeds.

Information on use of sunflower stalks, as a mulch to control weeds is void. Considering this, a filed experiment was undertaken to assess the feasibility of using sunflower stalks as a mulch to control weeds and to study the influence of nutrient levels on the growth and yield of sunflower.

Materials and Methods

The field experiment was conducted at University of Agricultural Sciences, Bangalore during *kharif* 1995 on a red sandy loam soil (pH 6.45), low in organic carbon (0.36 %) and medium in available N and K (274 kg N and 133 kg K_2O ha^{-1}) and high in P (32 kg P_2O_5). Six weed control treatments (Weedy check, Pendimethalin 1 kg ha^{-1}, Pendimethalin 0.5 kg ha^{-1} + hoeing at 30 DAS, Mulching sunflower stalks @ 10 t ha^{-1}, Pendimethalin 0.5 kg ha^{-1} + mulching sunflower stalks @ 5 t ha^{-1} and Hoeing at 20 & 30 DAS) under three graded levels of fertilizers (100, 75 or 50% of recommended NPK) were tested in a split plot design keeping the fertilizer levels in main plots and weed control treatments in sub plots. Half the nitrogen and full phosphorus and potassium were supplied at sowing and remaining nitrogen was applied at 30 days after sowing (DAS). Pendimethalin was applied one day after sowing as per the treatments. The sunflower stalks along with dried leaves of previous season crop were chopped to a length of 8-10 cm and applied to plots in between the crop rows, as per the treatments after the emergence of seedlings (7 DAS).

Observations on plant height, Leaf Area Index (LAI) and Dry Matter Production (DMP)

Table 1. Influence of weed control treatments and nutrient levels on growth components of sunflower

Weed control treatments	Nutrient levels*	Plant height (cm) at harvest				Leaf area index at flowering				DMP at harvest(g plant^{-1})			
		100%	75%	50%	Mean	100%	75%	50%	Mean	100%	75%	50%	Mean
Weedy check		109.9	106.6	92.2	102.9	1.46	1.40	1.16	1.34	53.1	46.1	33.7	45.0
Pendimethalin 1 kg ha^{-1}		127.1	124.9	112.0	121.3	2.14	2.11	1.60	1.95	81.0	75.7	56.9	71.2
Pendimethalin 0.5 kg ha^{-1} + hoeing at 30 DAS		131.6	128.9	115.0	125.2	2.17	2.16	1.64	1.99	83.4	77.3	58.4	73.1
Mulching sunflower stalks @ 10 t ha^{-1}		90.0	79.7	60.3	76.7	0.42	0.39	0.28	0.36	29.9	25.8	14.3	23.4
Pendimethalin 0.5 kg ha^{-1} + Mulching sunflower stalks @ 5 t ha^{-1}		103.3	99.4	88.4	97.0	1.45	1.39	1.14	1.33	51.8	47.3	31.9	43.7
Hoeing at 20 & 30 DAS		125.1	122.4	109.4	119.0	2.11	2.07	1.59	1.92	74.3	68.6	50.5	64.5
Mean		114.5	110.3	96.2		1.63	1.59	1.23		62.2	57.1	40.9	
		S.Em	C.D (P=0.05)			S.Em	C.D.(P=0.05)			S.Ed	C.D.(P=0.05)		
For nutrient levels		0.8	3.2			0.004	0.02			0.22	0.86		
For weed control treatments		0.9	2.4			0.007	0.02			0.29	0.77		
For WCT at same nutrient level		1.5	4.2			0.012	0.03			0.48	1.33		
For nutrient levels at same or different WCT		1.6	5.0			0.011	0.03			0.49	1.47		

*Recommended (100%) NPK is 37.5:50.0:37.5 kg ha^{-1} DAS: Days After Sowing DMP=Dry Matter Production WCT: Weed Control Treatment

Table 2. Yield of sunflower as influenced by weed control treatments and nutrient levels

Weed control treatments	Nutrient levels*	Seed yield (q ha^{-1})				Stalk yield (q ha^{-1})				Oil yield (q ha^{-1})			
		100%	75%	50%	Mean	100%	75%	50%	Mean	100%	75%	50%	Mean
Weedy check		8.61	7.78	5.22	7.20	1027	9.29	6.48	8.68	2.68	2.43	1.62	2.24
Pendimethalin 1 kg ha^{-1}		17.61	16.08	13.69	15079	18.67	17.74	14.31	16.91	5.49	4.86	4.16	4.84
Pendimethalin 0.5 kg ha^{-1} + hoeing at 30 DAS		19.53	17.36	14.03	16.97	20.47	19.31	15.02	18.27	6.39	5.68	4.38	5.48
Mulching sunflower stalks @ 10 t ha^{-1}		1.72	1.45	0.97	1.38	2.92	2.38	1.55	2.28	0.53	0.44	0.33	0.43
Pendimethalin 0.5 kg ha^{-1} + Mulching sunflower stalks @ 5 t ha^{-1}		7.08	6.42	4.62	6.04	8.11	7.41	5.64	7.05	2.32	2.01	1.45	1.93
Hoeing at 20 & 30 DAS		16.39	15.08	12.36	14.61	17.74	17.01	13.77	16.17	5.07	4.79	3.79	4.55
Mean		11.82	10.69	8.48		13.03	12.19	9.46		3.75	3.37	2.62	
		S.Em	C.D (P=0.05)			S.Em	C.D.(P=0.05)			S.Ed	C.D.(P=0.05)		
For nutrient levels		0.14	0.55			0.11	0.44			0.04	0.16		
For WCT at same nutrient level		0.16	0.45			0.15	0.42			0.08	0.23		
For nutrient levels at same or different WCT		0.29	0.9			0.26	0.78			0.14	0.39		

* Recommended (100%) NPK is 37.5:50.0:37.5 kg ha^{-1} DAS : Days After Sowing WCT : Weed Control Treatment

were recorded. Seed and stalk yields were also recorded. The oil content was analyzed and oil yield was also estimated.

Results and Discussion

Effect on growth

The DMP per plant (Table 1) was significantly higher (62.2 g) in 100% recommended nutrient level as compared to 75% (57.1 g) or 50% (40.96g) nutrient levels due to taller and thicker plants with more number of leaves. The LAI was also maximum in 100% nutrient level owing to more number of leaves and larger size of leaves. Similarly application of 100% of nutrients resulted in maximum plant height. This corroborates with the findings of Sankpal and Mahale (1991).

Among the weed control treatments pre-emergence application of pendimethalin 0.5 kg ha^{-1} + hoeing at 30 DAS recorded the highest DMP (73.1 g $plant^{-1}$) followed by pendimethalin 1 kg ha^{-1} (71.2 g $plant^{-1}$). The higher DMP in these treatments were due to higher LAI and higher plant height (Table 1), which inturn was due to better control of weeds. Similar results were also obtained by Bhosle *et al.* (1992). In mulching sunflower stalks @ 10 t ha^{-1}, the DMP was significantly lower (23.4 g $plant^{-1}$) than weedy check (45.0 g $plant^{-1}$). This is attributed to the reason that mulching could not control the weeds. Further, it served as initial inoculum of Alternaria leaf spot disease and resulted in severe disease intensity. Similarly in pendimethalin 0.5 kg ha^{-1} + mulching sunflower stalks @ 5 t ha^{-1} also, the DMP was lower (43.7 g $plant^{-1}$) than weedy check owing to higher disease intensity.

Effect on yield

The seed, stalk and oil yields were higher at 100% nutrient level (11.82, 13.03 and 3.75 q ha^{-1}, respectively) as compared to 75 % or 50% nutrient levels (Table 2) due to higher magnitude of yield components such as greater size of head and higher 100-seed weight. A significant positive correlation was observed between seed yield and oil yield (r=0.996*). The increase in yield with increase in amount of nitrogen and phosphorus applied was also reported by Chaniara *et al.* (1989).

All weed control treatments, except mulching sunflower stalks, registered higher seed, stalk and oil yields as compared to weedy check (Table 2). The increased seed (14.61 to 16.97 q ha^{-1}), stalk (16.17 to 18.27 q ha^{-1}) and oil (4.55 to 5.48 q ha^{-1}) yields were due to effective control of weeds which resulted in better use of soil nutrients and moisture by sunflower. This was evident from the significant negative correlation observed between seed yield and weed dry weight (r= -0.764*). Pendimethalin 0.5 kg ha^{-1} + hoeing at 30 DAS was found to be superior method of weed control as it registered the highest seed, stalk and oil yields. Also, the same treatment registered higher seed , stalk and oil yields than pendimethalin 1 kg ha^{-1}, due to higher weed control efficiency and other benefits of hoeing such as increased infiltration, improved aeration and enhanced microbial activity. Girijesh and Patil (1989) and Reddy *et al.* (1992) are also on similar opinion.

Mulching sunflower stalks @ 10 t ha^{-1} or pendimethalin 0.5 kg ha^{-1} + mulching sunflower stalks @ 5 t ha^{-1} recorded lower yield than weedy check. The lower yield in mulched plots is attributed to the reduction in plant stand and to the reduction in the magnitude of growth and yield components, which intern are due to higher incidence of leaf spot disease and poor control of weeds. From the findings, it is evident that it may not be feasible to control weeds in sunflower using sunflower stalks as mulch, either alone or in combination with pendimethalin.

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