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Weed Flora and Yield of Sunflower (*Helianthus annus* L.) as Influenced by Pre- and Post-Emergences Application of Herbicides

P. N. Chirde, S. S. Thakare, P. V. Shingrup, J. P. Deshmukh and V. M. Bhale

Department of Agronomy, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra 444104

*Corresponding Author E-mail: pvshingrup@gmail.com

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ABSTRACT

A field experiment was conducted to study the efficacy of pre- and post-emergence herbicides and their combination to control the weed in soybean during summer season of the year 2014. Among the various herbicidal treatments Fluazifop-p-butyl @ 0.125 kg a.i./ha + Quizalofop ethyl @ 0.075 Kg a.i./ha (Tank mix) recorded lowest weed density (36.05/m^2), dry matter (30.59 g/m^2), weed index (10.78 %) and maximum weed control efficiency (64.38 %) at harvest. It also found superior in respect of yield attributes and highest seed yield (1101 kg/ha). Maximum gross monetary return (37102 Rs. /ha) and net monetary return (21000 Rs. /ha) and B:C ratio (2.30) were recorded in Fluazifop-p-butyl @ 0.125 kg a.i./ha + Quizalofop ethyl @ 0.075 Kg a.i./ha (Tank mix).

Key words: *Herbicides, Sunflower, Seed Yield, Summer*

INTRODUCTION

Sunflower (*Helianthus annus* L.) is an important oil seed in India and it rank third after soybean and groundnut as a source of edible oil. The productivity of sunflower has been often deflated due to an array of biotic and abiotic factor. Weed completion is one of the major biotic constraints in realizing higher sunflower productivity in irrigated condition due to wider spacing. Weed growth reduced the seed yield of sunflower upto an extent of 55%[10]. Further, non-availability of labour and high rate of wages during peak periods of agricultural operations increased hiring charges of bullock drawn intercultural implements. Pre and post emergence herbicides may be viable option to control the weeds right from sowing to harvesting of sunflower crop. In order to increase the productivity of sunflower and reduce the cost of cultivation, the use of pre and post emergence herbicides may be the useful option in weed management. Therefore, present study was undertaken to evaluate the effective and chemical weed management for sunflower.

MATERIAL AND METHODS

An field experiment was conducted at farm of Agronomy Department, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola during the summer season of 2014. The soil of experiment field was characterized as clay loam in texture, having slightly alkaline pH (7.8), moderate organic carbon status (0.40%), low nitrogen content (224.27 kg/ha), medium available phosphorus content (17.86 kg/ha) and high potassium status (384.25 kg/ha).

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The experiment was laid out in randomized block design with seven treatment replicated thrice.

The treatment comprised of Weed free (T_1), Weedy check (T_2), Mahna-04 @ 2.5 kg/ha PE (T_3), Pendimethalin 1.0 Kg a.i./ha PE (T_4), Fluazifop-p- butyl @ 0.125 kg a.i/ha PoE 15 DAS (T_5), Quizalofop ethyl @ 0.075 kg a.i./ha PoE 15 DAS (T_6) and Fluazifop-p-butyl @ 0.125 kg a.i/ha + Quizalofop ethyl @0.075 kg a.i/ha PoE 15 DAS (Tank Mix) (T_7). The gross and net plot size were 3.6 m x 4.2 m and 2.4 m x3.6 m. Sunflower (TAS-82) was sown on 24th February 2014 at 60 x 30 cm spacing with 60:60:00 NPK kg/ha. The crop was harvested on 28th May 2014. Randomly five observations of crop and weed parameters were recorded at 20 DAT, 40 DAT, 60 DAT, 80 DAT and at harvest. Weed density and dry weight were recorded with a quadrate 1 m^2. Weed biomass (g/m^2), Weed control efficiency (%) and Weed index were calculated as per standard formula given by Gautam *et al*[3]., and Gill and Vijaykumar[5]. The data yield, yield attributes were statistically analyzed at 5% level of significance. In case of observation on weeds, normality of distribution was not seen and hence, the values were subjected to square root transformation $\sqrt{x+0.5}$ prior to statistical analysis to normalize their distribution.

RESULTS AND DISCUSSION

Weed flora

In the experiment field, predominant weed flora was *Chenopodium album*, *Portulaca oleracea*, *Tridax procumbens*, *Lagasca mollis*, *Euphorbia hirta, Euphorbia geniculata, Alternanathera triandra, Parthenium hysterophorus, Digera arvensis, Argemone Mexicana, Phyllanthus niruri* among the dicot weed and *Cynodon dactylon, Cyperus rotundus, Eleusine indica* among the monocot.

Weed density

The weed density/m^2 at harvest stage was significantly lowest in Weed free. Among the herbicidal treatment application of Fluazifop-p- butyl @ 0.125 kg a.i./ha + Quizalofop ethyl @ 0.075 Kg a.i./ha (Tank mix) showed its superiority in lowering down the weed population over Quizalofop ethyl @ 0.075 kg a.i./ha, Fluazifop-p-butyl @ 0.125 kg a.i./ha, Pendimethalin @ 1 kg a.i./ha, Mahna-04 @ 2.5 kg/ha, among these treatments, Quizalofop ethyl @ 0.075 kg a.i./ha, Fluazifop-p-butyl @ 0.125 kg a.i./ha and Pendimethalin @ 1 kg a.i./ha were found statistically comparable with each other. The treatment weedy check recorded maximum number of total weeds at the harvest stages of crop. These might be due to application of post emergences herbicides Fluazifop-p- butyl or Quizalofop ethyl was found to be more effective in controlling late coming weeds due to inhibition of acetyl co-enzyme, A carboxylase, a key enzyme responsible for synthesis of fatty acid in plants. These results are in agreement with the results reported by Christos A. Damalas[2] and Parmar *et al*[8].

Weed dry weight

There was no weed dry matter due to absence of weed in the weed free treatment. The different herbicidal treatment applied, in which tank mix application of Fluazifop-p- butyl @ 0.125 kg a.i./ha + Quizalofop ethyl @ 0.075 Kg a.i./ha recorded significantly minimum weed dry weight and it was followed by pendimethalin @ 1kg a.i./ha, Quizalofop ethyl @ 0.075 kg a.i./ha, Fluazifop-p-butyl @ 0.125 kg a.i./ha but these were statistically at par with each other. This might be due to combination of both herbicides that have longer effect on controlling weed population and brought significant reduction in weed dry matter as compared to weedy check. These results are in agreement with the results reported by Nayak *et al*[7]., Smita Prachand[9].

Weed control efficiency (WCE)

The weed free treatment was found significantly superior by recording 100% weed control efficiency. Among the various herbicidal treatments Fluazifop-p-butyl @ 0.125 kg a.i./ha + Quizalofop ethyl @ 0.075 Kg a.i./ha (Tank mix) recorded maximum weed control efficiency at harvest (64.36%) followed by treatments Fluazifop-p-butyl @

0.125 kg a.i./ha (57.88%), Quizalofop ethyl @ 0.075 kg a.i./ha (57.09%), Pendimethalin 1.0 kg a.i./ha (56.83%). This might be due to combination of both herbicides that have longer effect on controlling weeds population and thereby increasing weed control efficiency. These results are in agreement to the finding of Ghosh[4], Nayak *et al*[7]., Kurchania *et al*[6]. and Channappagoudar, B. B. *et al*[1].

Weed index (WI)

Among the weed management practices treatment tank mix application of herbicide Fluazifop-p- butyl @ 0.125 kg a.i./ha + Quizalofop ethyl @ 0.075 kg a.i./ha recorded minimum weed index (10.78 %). It was followed by Pendimethalin @ 1 kg a.i./ha (17.50%), Quizalofop ethyl @ 0.075 kg a.i./ha (24.80%), Fluazifop-p-butyl @ 0.125 kg a.i./ha (25.93%), Mahna-04 @ 2.5 kg/ha (35.81%). The weed free treatment recorded the lowest weed index (0%), indicating that there was no reduction in seed yield in this treatment due to less weed infestation. The highest weed index (60.37%) was recorded in weedy check as result of uncontrolled weed growth which leads to higher competition with the crop.

Yield attributes and yield studies

All weed management practices significantly improved the growth, yield components and yield of sunflower over weedy check. Growth parameters *viz*., plant height, dry matter production and yield component *viz.*, number of seed/head, filled seeds/head and test weight (1000 seed wt.) were significantly higher in weed free treatment but statistically at par with treatment Fluazifop-p-butyl @ 0.125 kg a.i./ha + Quizalofop ethyl @ 0.075 Kg a.i./ha (Tank mix) which followed by Pendimethalin @ 1 kg a.i./ha, Quizalofop ethyl @ 0.075 kg a.i./ha and Fluazifop-p-butyl @ 0.125 kg a.i./ha. This might be due to weed free environment especially at critical period of crop-weed competition growth, which might have resulted in increased production.

The highest seed yield of sunflower (1234 kg/ha) was recorded significantly in weed free treatment and it was at par with tank mix application treatment Fluazifop-p-butyl @ 0.125 kg a.i./ha + Quizalofop ethyl @ 0.075 Kg a.i./ha (1101 kg/ha) and the subsequent higher values of seed yield was recorded in Pendimethalin 1 kg a.i./ha (960 kg/ha), Quizalofop ethyl @ 0.075 kg a.i./ha (928 kg/ha), Fluazifop-p-butyl @ 0.125 kg a.i./ha (914 kg/ha). This might be due to vigorous growth of crop due to availability of sufficient nutrient, space, moisture and presences of minimum weed densities because of higher weed control efficiency, which would compete for the same. This leads to higher plant height, dry matter accumulation and finally increased seed yield. The lowest sunflower seed yield (489 kg/ha) was recorded in weedy check, this might be due to presence of more weeds which interfered growth and development of crop and compete for nutrients, moisture, light and space. Similar results reported by Channappagoudar B.B *et al*[1]., and Yantang[11].

Economics of various treatments

The cost of cultivation (18,780 Rs. /ha) and gross monetary returns (41,264 Rs. /ha) were significantly higher in weed free treatment. It was followed by Fluazifop-p-butyl @ 0.125 kg a.i./ha + Quizalofop ethyl @ 0.075 Kg a.i./ha (tank mix) which recorded cost of cultivation (16,102 Rs. /ha) and gross monetary returns (37,102 Rs. /ha). While B:C ratio (2.30) was significantly higher in tank mix application of Fluazifop-p-butyl @ 0.125 kg a.i./ha + Quizalofop ethyl @ 0.075 Kg a.i./ha. The monetary returns among weed control treatment was recorded maximum (22,484 Rs. /ha) in weed free treatment followed by Fluazifop-p-butyl @ 0.125 kg a.i./ha + Quizalofop ethyl @ 0.075 Kg a.i./ha (tank mix) (21,000 Rs. /ha), Pendimethalin @ 1 kg a.i./ha (17,659 Rs. /ha), Quizalofop ethyl @ 0.075 kg a.i./ha (16,452 Rs. /ha) and Fluazifop-p-butyl @ 0.125 kg a.i./ha (15,672 Rs. /ha).

Table 1: Weed count and Weed dry matter at harvest, weed control efficiency and Weed index influenced by different weed management practices

Treatments	Dose kg a.i./ha	Time of application DAS	Weed count m^{-2} at harvest			Weed dry matter weight at harvest (g/m^2)	Weed control efficiency (%)	Weed index (%)
			Monocot	Dicot	Total			
T_1 – Weed free	-	-	1.87 (3.00)	1.58 (2.00)	2.34 (4.99)	1.43	98.33	-
T_2 – Weedy check	-	-	7.27 (52.35)	5.46 (29.31)	9.06 (81.66)	85.83	-	60.37
T_3 - Mahna -04 PE	2.5	1	5.84 (33.61)	4.70 (21.59)	7.46 (55.20)	44.55	48.09	35.81
T_4 – Pendimethalin PE	1	1	5.11 (25.61)	4.60 (20.66)	6.84 (46.27)	37.05	56.83	17.50
T_5 - Fluazifop-p- butyl	0.125	15	4.88 (23.31)	4.71 (21.68)	6.72 (45.00)	36.15	57.88	25.93
T_6 - Quizalofop ethyl	0.075	15	4.72 (21.78)	4.75 (22.06)	6.66 (43.84)	36.83	57.09	24.80
T_7 -Fluazifop-p- butyl + Quizalofop ethyl (Tank Mix)	0.125 + 0.075	15	4.11 (16.39)	4.49 (19.66)	6.05 (36.05)	30.59	64.36	10.78
S.E(m)±			0.06	0.09	0.08	1.21	-	-
C.D. at 5%			0.18	0.27	0.24	3.72	-	-

Table 2: Yield contributing characters and economics of different treatment influenced by different weed management practices

Treatments	Dose kg a.i./ha	Time of application DAS	Plant height at harvest	Dry matter production at harvest	Total no. of seeds/head	Filled seeds/head	Test weight (g)	Seed yield kg/ha	Gross monetary returns Rs./ha	Net monetary returns Rs./ha	B:C ratio
T_1 – Weed free	-	-	189.38	202.53	1395	1128	52.20	1234	41264	22484	2.20
T_2 – Weedy check	-	-	158.12	102.22	1058	673	45.90	489	16767	3387	1.25
T_3 - Mahna -04 PE	2.5	1	170.47	133.67	1148	836	48.70	792	26865	11680	1.77
T_4 - Pendimethalin PE	1	1	177.31	166.44	1256	967	50.67	960	32489	17659	2.19
T_5 - Fluazifop-p-butyl	0.125	15	173.88	148.97	1235	928	50.30	914	30987	15672	2.02
T_6 - Quizalofop ethyl	0.075	15	176.11	152.83	1230	931	50.37	928	31402	16452	2.10
T_7 -Fluazifop-p-butyl + Quizalofop ethyl (Tank Mix)	0.125 + 0.075	15	183.98	188.77	1314	1029	51.03	1101	37102	21000	2.30
S.E(m)±			2.03	6.00	43.51	33.16	1.31	45.60	1019.33	1019.33	-
C.D. at 5%			6.26	18.49	134.06	99.53	NS	137	3140.87	3140.87	-

CONCLUSION

The study revealed that the highest yield as well as economic return could be realized in sunflower with weed free condition. However, in case of area where the labour scarcity or prohibitive cost exists, the next alternative without draining either economical yield or net profit, B:C ratio, the weed management practice of Fluazifop-p-butyl @ 0.125 kg a.i./ha + Quizalofop ethyl @ 0.075 Kg a.i./ha (tank mix) can be followed.

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