

Original Research Article

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Effect of Integrated Weed Management on Weed Dynamics of Soyabean [*Glycine max* (L.) Merill] under Junagadh, India

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A field experiment was carried out during kharif 2009-2010 at instructional farm, Junagadh Agricultural University, Junagadh to evaluate the suitable integrated weed management (IWM) practices for soybean. Result indicated that main weed flora was *Cyperus rotundus* L. integration of and its weed infestation was maximum from sowing to the harvesting of soybean. Integration of herbicides like Pendimethalin @ 0.750 kg ha⁻¹ pre-emergence + 1HW and IC at 20 DAS recorded significant reducing in weed dry matter and higher weed control efficiency resulting in higher yield.

Introduction

Soybean (*Glycine max*, L. Merill) is the most important leguminous crop rich in protein (40-42%) and other nutrients like calcium, vitamin A and thiamine. Because of its high nutritive value and myriad forms of uses, it is recognized as Golden bean and ranked third in India after rapeseed-mustard and groundnut. In India, soybean area was 64.97 lakh hectares, production 78.63 lakh tonnes with an average productivity, 1210 kg ha⁻¹. Statewise Madhay Pradesh ranks first in area and production of soybean. In Gujarat, the area under soybean was 14,000ha and productivity was 714 kg ha⁻¹ with total production of 10,000 MT (Anon, 2003-2004). Weed flush come at same time in almost all the kharif crops, which also restrict the

availability of manpower for weeding operation in this crop. The untimely and poor weed management adversely affects proper growth and yield of soybean. Weed management through herbicidal application remains the only viable option under these situations. Application of pre-emergence for effective weed control in soybean is required to be used within very short period (2-3 DAS) of time after sowing. In monsoon season, if rain captures this critical period of application then pre-emergence herbicide cannot be used effectively to control the weed in soybean.

Integration of weed control methods are effective and workable practice that may be used ecologically and economically viable to farmers. Unavailability of adequate labour during peak period of weeding and difficult in

use of mechanical weeding in heavy soil as well as receiving heavy rains create problem for effective weed management in soybean crop (Nainwal *et al.*, 2010). Under such condition, hand hoeing and weed control through herbicides remains the choice for controlling of weeds. Therefore integrated approach of mechanical, cultural and chemical control may be more feasible.

Materials and Methods

A field experiment was conducted during kharif seasons of 2009-2010 at instructional farm, Junagadh Agricultural University, Junagadh. On medium black soil with 0.83 percent organic carbon (Wakley and Black method), 227.5 kg ha⁻¹ available nitrogen, 38 kg ha⁻¹ available phosphorus (Olsen's method), 28405 kg ha⁻¹ (Flame photometer method) and soil pH 7.9 (Richard). The experiment consisting of ten treatments as detail in Table 2. Was laid out in randomized block design with three replications. Gujarat soybean-1 was planted on 7 July 2009. The plot size was 6m×3.6m. All recommended package and practices were adopted to raise the experimental crop. Pre-emergence herbicides (Pendimethalin, and Metribuzin) were applied immediately after sowing and post emergence herbicides (Quizalofop) was applied at 20 DAS, hoeing at 20 DAS and 40 DAS with the help of hand hoe. Manual weeding was done at 20 DAS and 40 DAS with the help of khurpee. Plant protection measures as recommended were adopted for raising the experimental crop.

Weed density were recorded at 20, 40, 60 DAS and at harvest stage by quadrat randomly placed at five place in each plot to count the weed species in each plot. The percentage composition of weed flora was estimated from weedy check plot. The weed biomass from different plot under all the treatments was recorded at 20, 40, 60 DAS

and at harvest. The weeds were first sun dried and there after kept in paperbags and dried in oven at 60°C for 48 hr and dry weight was recorded till constant weight was archived. The weed control efficiency was calculated on the basic of reduction in dry matter production of weeds in treated plots in comparison with weedy check and expressed in percentage as suggested by Mani *et al.*, (1973).

$$WCE = \frac{DWC - DWT}{DWC} \times 100$$

Where, WCE, DWC and DWT are the weed control efficiency, dry weight of weeds in control and treated plots, respectively. The data obtained on various observations were calculated and subjected to their analysis by using analysis of variance (ANOVA) and the treatment was tested by F test (Panse and Sukhatme, 1985).

Results and Discussion

Weed flora

Among the different weed species in the experimental field, most dominant weeds were *Cyperus rotundus* found at all the stage of study. Other dicot weeds were *Digera arvensis* Forsk, *Phyllanthus niruri* L., *Commelina benghalensis* L., *Physalis minima*, *Portulaca oleracea* L., *Leucas aspera* Sperny, *Tridex procumbens* L., *Indigofera glandulosa* and *Euphorbia hirta*. Dicot weeds dominated over monocot weeds throughout the crop season. Among various narrow leaf weeds, density of *Cyperus rotundus* is high. Dominance of these weeds in soyabean field during kharif season has also been reported by Balyan and Malik (2003).

Weed density

Integrated weed management practices had a remarkable effect on weed density (Table 1).

Maximum density of weeds was observed through the investigation period under unweed control plot. The minimum numbers of weed were recorded at 40 DAS under treatment T₉ (weed free). The minimum numbers of weeds was obtained under treatment T₉ (weed free) at 20, 40, 60 DAS and at harvest (Table 1) this was evident due to practically least weed emergence after cultural operations. The minimum weed population recorded under these treatments was due to efficiency of herbicides to control weeds at early stage and later on through weeding and intercultural operation done at 20,40 DAS cause the least emergence of weeds and hence, minimum weed population. In addition to this dense crop might have smoothening effect on weeds. These findings corroborate the result reported by Suzuki *et al.*, (1991), Chavan *et al.*, (2000), Nayak *et al.*, (2000), Sonawane and Sabale (2003) and Singh *et al.*, (2004).

Weed dry matter production

Weed dry matter production is presented in Table 3. The treatment T₉ (weed free)

produced lower dry weight of weeds at harvest (Table 4.12) followed by the treatment T₂ (Pendimethalin @ 0.750 kg ha⁻¹ as pre-emergence+ 1HW and IC at 20 DAS) that was 94 kg ha⁻¹ due to frequent hand weeding and inter culturing. Owing to fact that hand weeding and interculturing cause a substantial reduction in weed density hence, recorded the lowest dry weight of weeds. The lethal effect of chemicals at early stage of crop growth controlled the weeds and at later resulting a significant reduction in weed population which was responsible for the lower dry weight of weeds with these treatments. Integration of one hand weeding and interculturing along with herbicide application caused a substantial reduction in dry weight of weeds over herbicide application alone.

In addition to this, dense canopy restricted the weed growth and thereby lower dry weight of weeds under these treatments. The findings are in conformity with those reported by Chavan *et al.*, (2002), Bhattacharya (2002) Bhan and Kewat (2002) Sonwane and Sable (2003), and Idapuganti *et al.*, (2005).

Table.1 Important weed flora observed in the experimental field

Sr no	Local name	English name	Scientific name
Monocot weeds			
1	Chidho	Purple nustedges	<i>Cyperus rotundus</i>
2	Dharo	Bermuda grass	<i>Cyperus docctylon L.Pers</i>
3	Kariyu	Singal grass	<i>Brachiaria spp.</i>
4	samo	Samo grass	<i>Echinochloa colonum L.Beauv.</i>
Dicot weeds			
5	Kanjero	Kundra	<i>Digera arvensis</i> Forsk
6	Bhoi-amli	Hazardana	<i>Phyllanthus niruri L.</i>
7	Shemul	Dayflower	<i>Commelina benghalensis L.</i>
8	Popti	Sun berry	<i>Physalis minima</i>
9	Luni	Purslane	<i>Portulaca oleracea L.</i>
10	Kubi	Maldoda	<i>Leucas aspera sperny</i>
11	Akadandi	Tridex	<i>Tridex procumbens L.</i>
12	Vekariyo	Wild indigo	<i>Indigofera glandulosa</i>
13	Dudheli	Garden spurge	<i>Euphorbia hirta</i>

Table.2 Total weed density (No. m⁻²) at different time interval as affected by integrated weed management practices in soybean

Sr no.	Treatments	Total weed density no m ⁻²			
		20 DAS	40 DAS	60 DAS	At harvest
T ₁	Pendimethalin @ 1.000 kg ha ⁻¹ as pre-emergence	11.92 (46.22)	12.91 (54.41)	13.09 (56.55)	16 (84.88)
T ₂	Pendimethalin @ 0.750 kg ha ⁻¹ pre-emergence + 1 HW and IC at 20 DAS	6.18 (11.39)	7.83 (19.22)	7.87 (19.58)	9.66 (30.32)
T ₃	Quizalofop ethyl @ 0.040 kg ha ⁻¹ as post-emergence at 20 DAS	12.67 (52.41)	12.65 (53.11)	12.77 (55.61)	14.48 (69.54)
T ₄	Quizalofop ethyl @ 0.040 kg ha ⁻¹ as post-emergence at 20 DAS+1 HW and IC at 40 DAS	9.46 (29.79)	7.22 (16.24)	9.78 (30.72)	11.64 (45.21)
T ₅	Metribuzin @ 0.500 kg ha ⁻¹ as pre-emergence	11.79 (45.65)	12.53 (50.98)	14.07 (65.1)	15.98 (84.72)
T ₆	Metribuzin @ 0.500 kg ha ⁻¹ pre-emergence + 1 HW at 40 DAS	9.85 (32.25)	8.69 (23.78)	9.65 (29.72)	11.89 (46.45)
T ₇	1 HW at 20 DAS	7.45 (18.1)	9.03 (26.57)	12.15 (48.16)	13.99 (64.57)
T ₈	2 HW at 20 and 40 DAS	7.68 (19.03)	7.35 (16.76)	9.61 (29.72)	10.86 (38.79)
T ₉	Weed free	2.13 (0.00)	2.13 (0.00)	2.13 (0.00)	2.13 (0.00)
T ₁₀	Unweeded Control	15.2 (76.52)	17.66 (103.01)	18.87 (118)	22.59 (171.52)

Table.3 Effect of integrated weed management on weed dry matter, weed control efficiency

Sr. no	Treatments	Weed dry matter (Kg ha ⁻¹)	Weed control efficiency (%)
1	T ₁	19.84 (370)	70.95
2	T ₂	9.72 (94)	92.62
3	T ₃	19.65 (386)	69.70
4	T ₄	11.76 (138)	89.16
5	T ₅	20.16 (406)	68.13
6	T ₆	11.93 (142)	88.85
7	T ₇	11.89 (141)	88.93
8	T ₈	11.64 (135)	89.40
9	T ₉	0.71 (0.00)	100
10	T ₁₀	35.70 (1274)	0.00

Yield

Treatments	Yield(kg ha ⁻¹)		Weed index (%)
	Grain (kg ha ⁻¹)	Stover (kg ha ⁻¹)	
T ₁	1988	2110	13.03
T ₂	2129	2496	6.86
T ₃	1980	2110	13.38
T ₄	2050	2350	10.32
T ₅	1960	2050	14.26
T ₆	2035	2310	10.97
T ₇	2002	2210	12.46
T ₈	2100	2385	8.13
T ₉	2286	2652	0.00
T ₁₀	1120	1365	51.00

Weed control efficiency

The highest weed control efficiency 100% was registered under T₉ (weed free). The lower weed density, minimum dry weight of weeds observed under this treatment due to cultural operations carried out as and when required. The higher weed control efficiency observed under treatments T₂ (93%) complete elimination of weeds from the field since beginning and weeds those escaped from herbicidal control were removed by hand weeding and intrerculturing at 20 and 40 DAS. The combined effect of herbicide and hand weeding + interculturing ultimately resulted in minimum dry weight (Table 2) and observed that these treatments liable for higher weed control efficiency. Similar findings were reported by Jadhav (2003) and Nandurkar *et al.*, (1997).

Weed index

No weed index was recorded under treatment T₉ (weed free). Besides weed free conditions, treatments T₂ (Pendimethalin @ 0.750 kg ha⁻¹ pre-emer + 1 HW and IC at 20 DAS) and T₈ (2 HW at 20 and 40 DAS) recorded 6.86% and 8.13% lower weed index respectively. This might be due to lower dry weight of

weeds and high weed control efficiency under these treatments. Remarkable higher weed index (51%) was recorded under treatment T₁₀ (unweeded control) because of greater weed competition stress. The results are in close conformity with the results obtained by Kumarswami *et al.*, (1995).

Yield

The treatment (T₉) weed free produced 104% and 94% higher grain and stover yields respectively (Table 4) as compared to unweeded control (T₁₀). These treatments could be ascribed to better control of weeds might have favoured higher uptake of nutrients and water, which helped the plant to put optimum growth characters viz., plant height and number of branches per plant. Further, it might have enhanced photosynthetic activity and partitioning of assimilates, resulting in improved yield attributes viz., number of pods per plant and grain weight per plant by virtue of less weed count and dry weight of weeds. These growth and yield attributes evidently reflected in higher grain and stover yields under these treatments. Analogous findings have been reported by Kushwa and kushwa (2001), Jadhav (2003), Manjusha Mohod (2004),

Giriwanshi *et al.*, (2004), Umale *et al.*, (2005), and Vitalkarate *et al.*, (2006).

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