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Weed Dynamics, Growth, Yield and Correlation Study as Affected by Weed Control Methods in Soybean [*Glycine max* (L.) Merril.]

Sheela Barla[1], K.K. Binjha[1], R.R. Upasani[1]

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ABSTRACT

Background: Soybean being a rainy season crops, is heavily infested with weeds thus ultimately affect the crop yield and economic return.

Methods: Field experiment was conducted at Birsa Agricultural University, Ranchi during rainy season of 2019 and 2020 under randomized block design replicated thrice with eight different weed control methods *viz.*, imazathapyr 75 g/ha at 20 days after sowing (DAS), imazathapyr 35% + imazamox 35% ready mix (RM) 75 g/ha at 20 DAS, quizalofop ethyl 50 g/ha at 20 DAS, sodium acifluorfen 16.5% + clodinafop propargyl 8% (RM) 125 g/ha at 20 DAS, imazathapyr 2% + pendimethalin 30% (RM) 1 kg/ha at 20 DAS, hand weeding at 20 and 40 DAS, weed free (three hand weeding at 20, 40 and 60 DAS) and weedy check.

Result: Among herbicides, application of quizalofop ethyl 50 g/ha recorded higher growth and yield attributes of soybean due to reduced weed density and weed dry matter which resulted in higher weed control efficiency, weed management index, agronomic management index, thereby recorded maximum soybean yield (2065 kg/ha), net return (` 54,743/ha) and B:C ratio (2.50). The soybean yield was negatively correlated with weed dry matter particularly with grassy as well as total weed dry matter while plant dry matter accumulation was strongly correlated with soybean yield.

Key words: Correlation, Economics, Plant dry matter, Weed control efficiency, Weed density, Weed dry matter.

INTRODUCTION

Soybean [*Glycine max* (L.) Merril.] is one of the important oilseed crops of the leguminaceae family having subfamily papilionaceae and genus Glycine. It has revolutionized the agricultural economy with its immense potential for oil, fuel and numerous industrial products (Patel *et al.,* 2016) and it is also rich and is cheapest source of high quality protein (40-42%), therefore called as “poor man’s meat”. Besides, it is second only to groundnut in terms of oil content among food legumes. It is also rich in other nutrients like calcium and iron. Presently, globally soybean is cultivated in 127.60 million ha with annual production of 364.07 million tons (Bagale, 2021). India ranks fourth in area with 11.40 million hectares accounting for 9.12% of the world area with production of 13.78 million tons (Anonymous, 2021). So far as productivity of soybean in Jharkhand is concerned, it is very low *i.e.* (931 kg/ha (Anonymous, 2018) as compared to other states like Himachal Pradesh (1533 kg/ha), Madhya Pradesh (1062 kg/ha), Maharashtra (1012 kg/ha) Rajasthan (1207 kg/ha) and Telengana (1625 kg/ha). Among various constraints in soybean production, weeds are considered as most serious problem. Being a rainy season crop, it is heavily infested with diversified population of weeds. The weeds compete for light, nutrient, moisture and space against the soybean crop, thus affecting the crop yield. The loss of soybean yield due to weed ranges from 40 to 85 percent (Jha *et al.*, 1993). Uncontrolled weeds not only reduce soybean yields through their competition for light, nutrients and moisture, but they can also severely reduce harvest efficiency. Among various methods, the chemical method of weed control is considered to be cheap and effective provided suitable herbicides with judicious application techniques are followed. Success of chemical method of weed control depends on type of weeds present as well as compatibility of herbicides with crops. Several factors need to be considered including weed species, rotational crops and cost before implementing a weed management plan for soybeans. Imazathapyr is generally applied as pre plant incorporation, pre emergence or as post-emergence herbicide. The compound controls weeds by inhibiting the synthesis of branched-chain aliphatic amino acids resulting in disruption in protein synthesis. While quizalafop ethyl acts by inhibiting the enzyme Acetyl Coenzyme Carboxylase (ACCase) in susceptible species (Suzuki *et al.,* 1991). Sodium acifluorfen is a selective post emergence herbicide. The primary target site appears to be

[1]Department of Agronomy, Birsa Agricultural University, Ranchi-834 006, Jharkhand, India.

Corresponding Author: R.R. Upasani, Department of Agronomy, Birsa Agricultural University, Ranchi-834 006, Jharkhand, India. Email: upasani.ravikant@gmail.com

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protoporphyrinogen oxidase (protox), an enzyme involved with the biosynthesis of chlorophyll that is necessary for plants to carry out photosynthesis. The leaves of susceptible plants become chlorotic and then desiccated. Pendimithalin controls weeds by inhibiting the microtubule formation in cells causing interruption of cell division. Clodinafop-p-propargyl is absorbed by grassy leaves and rapidly move to the growing points of leaves and stems interfering with the production of fatty acids, needed for plant growth and development in susceptible grassy weeds. Considering the above facts, a field experiment was conducted with objectives to find out the effect of weed control methods on growth, yield attributes and yield of soybean.

MATERIALS AND METHODS

Field experiment was conducted to study the efficacy of weed control methods on weed dynamics and productivity of soybean at Birsa Agricultural University, Ranchi (Jharkhand) during *Kharif* season of 2019 and 2020 on sandy loam soil, moderately acidic in nature (pH 5.4), EC (0.17 dSm^{-1}) having organic carbon (4.2 g/kg), available nitrogen (160 kg/ha), phosphorus (19 kg/ha) and potassium (146 kg/ha). The experiment was laid out in randomized block design with eight treatments replicated thrice. The treatments comprised of imazathapyr 75 g /ha at 20 DAS (T_1), imazathapyr 35% + imazamox 35% Ready Mix (RM) 75 g/ha at 20 DAS (T_2), quizalofop-p- ethyl 50 g/ha at 20 DAS (T_3), sodium acifluorfen 16.5% + clodinafop propargyl 8% (RM) 125 g/ha at 20 DAS (T_4), imazathapyr 2% + pendimethalin 30% (RM) 1000 g/ha at 20 DAS (T_5), hand weeding at 20 and 40 DAS (T_6), weed free (three hand weeding at 20, 40 and 60 DAS) (T_7) and weedy check (T_8). The experiment was sown on 27th and 25th June and was harvested on 30th October and 3rd November during 2019 and 2020, respectively. The density and dry matter of weeds in each plot were studied at 30 and 60 DAS. To observe the weed density, a rectangular iron frame, the quadrate, measuring 25 × 25 cm was placed randomly at two places inside of each plot. Grassy, broad leaved and sedges weeds within the quadrate were counted, cut from the base of stem separately and sun dried to remove any excess moisture present on the surface of weeds then oven dried at 60°C±5°C. As the sedges weeds were not found at 60 DAS, they were not considered for that period. After complete oven drying the dry weight was recorded on electronic balance and converted into g/m^2. Density and dry matter of weeds was subjected to square root transformation *i.e.* $\sqrt{(X + 0.5)}$ prior to statistical analysis for test of significance. Different weed indices were calculated by using following formula as suggested by Barla and Upasani, (2022).

Weed management index (WMI)

$$WMI = [(YT-YC)/YC] / [(WC-WT)/WC]$$

Where,
YT= Yield of treated plot.
YC= Yield of control (weedy check) plot.
WC= Weed dry weight in control (weedy check) plot.
WT= Weed dry weight in treated plot.

Agronomic management index (AMI)

$$AMI = [(YT-YC)/YC] - [(WC-WT/WC)]/ (WC-WT)/WC)$$

Where,
YT = Yield of treated plot.
YC= Yield of control (weedy check) plot.
WC= Weed dry weight in control (weedy check) plot.
WT= Weed dry weight in treated plot.

Weed persistence index (WPI)

$$WPI = (WT/WC) \times (WPC/WPT)$$

Where,
WT= Weed dry weight in treated plot.
WC= Weed dry weight in control (weedy check) plot.
WPC= Weed population in control (weedy check) plot.
WPT= Weed dry weight in treated plot.

RESULTS AND DISCUSSION

Weed flora

The experimental field was infested with all three categories of weed species in weedy check throughout the crop growth period in soybean crop. Altogether there were eight species of weeds namely *Dactyloctenium aegyptium, Echinochloa colona, Eleusin indica* and *Digitaria sanguinalis* among grassy weeds, *Stellaria media, Commelina benghalensis* and *Phyllanthus niuri* among broad leaved and *Cyperus rotundus* among sedges weeds were dominant.

Weed density and weed dry weight

Post emergence application of quizalofop 50 g /ha) at (T_3) recorded 100 per cent control of grassy weeds as well as total weeds density to the extent of 60.12 and 73.54 per cent, compared to weedy check at 30 and 60 DAS respectively (Table 1). It appeared that application of quizalofop-p-ethyl had an edge over other herbicides in controlling grassy weeds effectively. The efficacy of quizalofop-p-ethyl in controlling grassy weeds can be understood with its mode of action as its post emergence application inhibited amino acid synthesis in grassy weeds which ultimately withered them although latter on grassy weeds appeared but they may not be competitive enough to affect crop growth as it crossed the critical period of weed competition. Yadav *et al.* (2017) also suggested effective control of grassy weeds due to post emergence application of quizalofop-p-ethyl in soybean crop.

Plant dry matter accumulation

Plant dry matter increased as the growth progressed and the maximum dry matter was attained at harvest (Table 2). The trend of mean dry matter accumulation by leaves was 21.66 and 50.09 g/m^2 at 30 and 60 DAS respectively thereafter the leaves started drying and remained inactive in photosynthesizing. Similarly, the mean dry matter accumulation by stem was 4.73, 72.36, 153.85 and 212.66

Table 1: Weed density and weed dry weight as influenced by weed control methods (mean of 2019 and 2020).

Treatment	Weed density (No./m²)							Weed dry weight (g /m²)						
	30 DAS				60 DAS			30 DAS				60 DAS		
	Grassy	BL	Sedges	Total	Grassy	BL	Total	Grassy	BL	Sedges	Total	Grassy	BL	Total
T_1 Imazathapyr (75 g/ha)	23.28	28.35	19.75	41.84	10.63	11.54	15.72	9.91	7.95	2.61	13.05	8.42	9.60	12.82
at 20 DAS	(555.89)	(818.01)	(402.99)	(1776.9)	(113.2)	(133.33)	(246.53)	(100.8)	(63.36)	(6.69)	(170.85)	(73.59)	(91.89)	(165.48)
T_2 Imazathapyr + imazamox	24.78	25.40	17.34	39.60	16.39	6.90	17.81	10.23	8.58	3.35	13.75	11.62	4.31	12.39
(75 g a.i /ha) at 20 DAS	(622.91)	(645.89)	(302.99)	(1571.8)	(268.64)	(48)	(316.64)	(105.58)	(73.69)	(11.03)	(190.29)	(139.9)	(18.82)	(158.72)
T_3 Quizalofop-p-ethyl	0.71	32.49	16.34	36.39	0.71	24.11	24.11	0.71	9.67	3.99	10.45	0.71	10.68	10.68
(50 g/ha) at 20 DAS	(0)	(1079.25)	(270.67)	(1349.9)	(0)	(581.33)	(581.33)	(0)	(93.41)	(15.75)	(109.16)	(0)	(114.87)	(114.87)
T_4 Sodium acifluor + clodinafop	16.94	25.55	22.43	38.26	8.37	14.79	16.99	7.46	6.50	6.35	11.81	7.64	5.16	9.34
(125 g a.i/ha) at 20 DAS	(290.32)	(669.71)	(508.51)	(1468.5)	(69.79)	(218.67)	(288.45)	(55.37)	(45.15)	(39.93)	(140.44)	(57.84)	(30.7)	(88.54)
T_5 Imazathapyr + pendimethalin	18.96	29.63	14.91	38.26	7.29	10.43	12.89	7.88	8.45	4.27	12.31	9.37	9.36	13.42
(1000 g/ha) at 20 DAS	(360.55)	(898.59)	(226.35)	(1485.5)	(55.2)	(113.33)	(168.53)	(62.24)	(71.03)	(17.98)	(151.25)	(88.52)	(91.65)	(180.17)
T_6 Hand weeding at	8.22	13.58	10.05	18.85	4.37	11.33	12.37	1.56	1.87	2.12	3.17	1.21	3.58	3.74
20 and 40 DAS	(74.03)	(185.52)	(105.12)	(364.67)	(25.47)	(129.33)	(154.8)	(1.95)	(3.2)	(4.56)	(9.71)	(1.47)	(12.76)	(14.23)
T_7 Weed free	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.93	0.71
	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0.47)	(0.00)
T_8 Weedy check	29.51	43.87	24.00	58.19	24.81	30.01	38.97	13.75	12.66	7.84	20.25	14.38	12.92	19.33
	(871.62)	(1928.07)	(586.29)	(3386)	(617.2)	(901.33)	(1518.5)	(189.9)	(161.59)	(61.14)	(412.63)	(209.2)	(167.2)	(376.4)
SEm (±)	1.60	1.74	1.67	2.38	0.91	4.80	0.64	0.62	0.71	0.36	0.58	0.82	2.51	0.60
LSD (P=0.05)	4.84	5.28	5.09	7.21	2.77	14.56	1.94	1.88	2.14	1.08	1.76	2.50	7.61	1.83

g/m^2 at 30, 60, 90 and 120 DAS respectively; pod was 230.72, 370.22 and 472.36 at 60, 90 and 120 DAS, while, dry matter accumulation by total plants were 26.39, 353.17, 524.07 and 685.03 g/m^2 at 30, 60, 90 and 120 DAS respectively. This indicated that the photosynthates synthesized in leaves were gradually translocated to the stem and then stored in pods as the days progressed towards maturity.

The dry matter accumulation by different plant parts (Table 2) like leaf, stem and pod remained unaffected by different weed control methods, however, application of imazathapyr + pendimethalin (1000 g/ha) at 20 DAS (T_5) being similar to rest of the treatments except imazathapyr (75 g/ha) at 20 DAS (T_1) recorded significantly higher total plant dry matter to the extent of 92.56, 93.32 per cent compared to weedy check at 90 and 120 DAS, respectively. Weedy check (T_8) recorded the lowest total plant dry matter accumulation at all the stages of growth. This might be due to severe competition of weeds which restricted the crop for proper growth and development, limiting the dry matter accumulation. Similar findings were also confirmed by Singh *et al.* (2020) who suggested that crop dry matter accumulation was increased appreciably due to the different treatments as compared to the weedy check as all the growth stages of crop. Dry matter recorded at 30th day stage of the crop growth was not affected significantly due to different weed control treatments as at early stage there was not much competition between crop and weed plants. But plant dry matter accumulation was influenced to a greater extent at 90 and 120 DAS as imazathapyr+ pendimethalin (1000 g/ha) at 20 DAS (T_5) being similar to rest of the treatments recorded 93.12 and 93.32 per cent higher plant dry matter respectively compared to that recorded under weedy check (T_8).

Yield attributes

Soybean yield attributes were greatly reduced in the untreated control (T_8) where full-season weed interference occurred. Application of quizalofop-p-ethyl (50 g /ha) at 20 DAS remaining similar to rest of the herbicide application recorded 91.67 per cent higher number of pods per plant as compared to that recorded under weedy check. This might be due to the effective growth and development of soybean crops under a reduced weed environment during the critical period of crop growth which might have resulted in a maximum number of pods per plant. Yadav *et al.* (2017) have also reported higher number of pods per plant owing to application of quizalofop-p-ethyl.

Seed yield

The season-long weed infestation in the untreated control (T_8) reduced soybean seed yield by 57.27 compared with the weed-free control. Yadav *et al.* (2017) have also reported 37-54 per cent reduction in soybean yield in weedy plots compared to weed free. Hand weeding at 20 and 40 DAS recorded significantly higher soybean seed yield to the extent of 118.94 per cent compared to weedy check. Among herbicides, application of quizalofop-p-ethyl (50 g/ha) at 20 DAS recorded significantly higher soybean seed yield over

Table 2: Dry matter accumulation by soybean plant parts as influenced by different herbicides (mean of 2019 and 2020).

Treatment	Plant dry matter (g/m^2)											
	30 DAS			60 DAS			90 DAS			120 DAS		
	Leaf	Stem	Total	Leaf	Stem	Pod	Total	Stem	Pod	Total	Stem	Pod	Total
T_1	18.52	3.55	22.07	40.35	53.90	203.92	298.17	111.15	326.94	438.09	153.74	416.30	570.04
T_2	20.00	4.35	24.35	46.20	66.62	227.64	340.45	142.24	365.26	507.50	196.64	465.94	662.58
T_3	19.26	3.81	23.07	42.62	58.11	303.07	403.80	122.20	487.17	609.37	169.22	623.87	793.09
T_4	24.08	5.59	29.67	57.18	85.34	262.81	405.33	180.26	422.09	602.35	249.27	539.56	788.83
T_5	25.26	5.33	30.60	57.56	81.66	290.38	429.60	174.93	466.65	641.59	241.77	597.28	839.05
T_6	26.92	5.99	32.92	62.90	91.84	185.08	339.82	197.36	296.48	493.84	272.90	376.81	649.71
T_7	26.26	5.77	32.02	60.88	88.23	235.29	384.39	189.10	377.61	566.71	261.00	481.91	742.91
T_8	12.95	3.48	16.44	33.01	53.24	137.53	223.78	113.55	219.63	333.18	156.79	277.23	434.02
Mean values	21.66	4.73	26.39	50.09	72.37	230.72	353.17	153.85	370.23	524.08	212.67	472.36	685.04
SEm (±)	2.50	0.58	3.03	5.80	8.89	30.92	32.78	19.62	49.50	51.60	27.12	65.09	68.08
LSD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	156.51	NS	NS	206.49

Table 3: Weed indices as influenced by nutrient and weed management practices (mean of 2019 and 2020).

Treatments	Weed control efficiency (%)		Weed management index (WMI)		Agronomic management index (AMI)		Weed persistence index (WPI)	
	30	60	30	60	30	60	30	60
T_1 Imazathapyr (75 g /ha) at 20 DAS	77.48	55.82	0.94	1.31	0.77	0.56	0.86	2.73
T_2 Imazathapyr + imazamox (75 g a.i /ha) at 20 DAS	81.19	58.86	0.97	1.38	0.81	0.59	0.97	2.17
T_3 Quizalofop-p-ethyl (50 g/ha) at 20DAS	84.07	69.37	1.11	1.34	0.84	0.69	0.77	1.20
T_4 Sodium acifluor + clodinafop (125 g a.i/ha at 20 DAS	81.44	76.69	0.76	0.80	0.81	0.77	0.89	1.33
T_5 Imazathapyr+ pendimethalin (1000g /ha) at 20 DAS	89.82	51.38	0.60	1.02	0.90	0.51	1.03	3.44
T_6 Hand weeding at 20 and 40 DAS	99.38	96.40	1.21	1.24	0.99	0.96	0.24	0.33
T_7 Weed free	74.49	99.84	1.80	1.35	0.74	1.00	0.00	0.00
T_8 Weedy check	0.00	0.00	0.00	0.00	0.00	0.00	0.81	2.65
SEm (±)	1.45	3.14	0.18	0.16	0.15	0.11	0.16	0.29
LSD (P=0.05)	4.40	9.53	0.52	0.46	NS	0.33	0.46	0.84

Table 4: Correlations of weed dry matter at 30 and 60 DAS and periodic plant dry matter with yield of soybean (mean of 2019 and 2020).

	GWDW 30 DAS	BLDW 30 DAS	SWDW 30 DAS	TWDW 30 DAS	GWDW 60DAS	BLWDW 60 DAS	TDW 60 DAS	Plant DW 30 DAS	Plant DW 60 DAS	Plant DW 90 DAS	Plant DW 120 DAS	Yield (Kg/ha)
GWDW 30 DAS	1											
BLDW 30 DAS	0.73	1.00										
SWDW 30 DAS	0.63	0.70	1.00									
TWDW 30 DAS	0.94	0.91	0.79	1.00								
GWDW 60DAS	0.96	0.74	0.64	0.92	1.00							
BLWDW 60 DAS	0.51	0.86	0.55	0.71	0.44	1.00						
TDW 60 DAS	0.90	0.93	0.71	0.97	0.89	0.80	1.00					
Plant DW 30 DAS	-0.73	-0.88	-0.49	-0.82	-0.64	-0.75	-0.81	1.00				
Plant DW 60 DAS	-0.75	-0.51	-0.39	-0.67	-0.64	-0.42	-0.64	0.71	1.00			
Plant DW 90 DAS	-0.73	-0.46	-0.37	-0.64	-0.62	-0.38	-0.60	0.67	1.00	1.00		
Plant DW 120 DAS	-0.74	-0.47	-0.37	-0.65	-0.62	-0.39	-0.61	0.68	1.00	1.00	1.00	
Yield (Kg/ha)	-0.86	-0.83	-0.87	-0.94	-0.85	-0.70	-0.93	0.63	0.48	0.45	0.45	1.00

GWDW = Grassy weed dry weight; BLDW = Broad leaf weed dry weight; SWDW= Sedges weed dry weight.

**Significant at 1%; *Significant at 5%; n = 11; r = 0.56 at 5%; r = 0.68 at 1%.

Table 5: Yield attributes, yield and economics of soybean as influenced by different herbicide (mean of 2019 and 2020).

Treatment	Number of pods /plant	Number of seeds /pod	100 seeds weight (g)	Seed yield (kg/ha)	Straw yield (kg/ha)	WI (%)	Cost of cultivation (` /ha)	Gross return (` /ha)	Net return (` /ha)	B:C ratio
T_1 Imazathapyr (75 g /ha) at 20 DAS	40	1.92	11.09	1855	3396	14.86	20642	68821	48196	2.33
T_2 Imazathapyr + imazamox (75 g a.i /ha) at 20 DAS	41	2.13	10.68	1918	3067	17.88	22262	71158	48886	2.20
T_3 Quizalofop-p-ethyl (50 g/ha)at 20DAS	46	2.05	10.33	2065	2946	11.95	21857	76612	54743	2.50
T_4 Sodium acifluor + clodinafop (125 g a.i/ha) at 20 DAS	43	2.64	10.91	1730	2842	24.60	21449	64183	42733	1.99
T_5 Imazathapyr+ pendimethalin (1000 g/ha) at 20 DAS	41	2.25	11.7	1658	3183	24.03	22387	61512	39115	1.75
T_6 Hand weeding at 20 and 40 DAS	41	1.89	9.19	2347	2863	5.45	26053	87074	61013	2.34
T_7 Weed free	51	2.38	9.72	2509	2896	0.00	29749	93084	63329	2.13
T_8 Weedy check	24	1.47	9.80	1072	1570	44.59	19895	39771	19889	1.00
SEm (±)	3.73	0.14	0.56	149.49	344.58	4.77		5546.13	5546.13	0.24
LSD (P=0.05)	11.30	0.42	1.70	453.41	1045.14	NS		16821.59	16821.59	0.73

rest of the herbicide treatments. The reason for higher soybean yield achieved by application of quizalofop-p-ethyl may be due to reduced weed density and weed biomass particularly grassy weeds compounded with significantly higher number of pods per plant and also associated with satisfactory other yield attributing parameters.

Weed indices

Hand weeding performed at 20 and 40 DAS, recorded significantly higher weed control efficiency at 30 and 60 DAS (Table 3). However, among herbicides, application of imazathapyr+ pendimethalin (1000 g/ha) at 20 DAS (T_5), quizalofop-p-ethyl (50 g/ha) at 20 DAS (T_3) and sodium acifluorfen 16.5% + clodinafop propargyl 8% (RM) 125 g/ha at 20 DAS (T_4) were most effective in recording maximum weed control efficiency at 30 and 60 DAS. Maximum weed management index was recorded under hand weeding (T_6), imazathapyr + pendimethalin (1000 g/ha) at 20 DAS (T_5) and sodium acifluorfen 16.5% + clodinafop propargyl 8% (RM) 125 g/ha at 20 DAS (T_4). The maximum agronomic management index was found under hand weeding (T_6) at 60 DAS. Similar findings were also found by Kumar *et al.* (2019) who observed that better weed management indices in treatment was due to lowest weed infestation.

Correlation study

The correlation studies of various weed dry matter and periodic plant dry matter with yield of soybean (Table 4) revealed that **s**oybean yield was highly negatively correlated with weed dry matter more particularly grassy as well as total weed dry matter at 30 and 60 DAS respectively. While, plant dry weight was positively correlated with soybean yield.

Economics

Hand weeding at 20 and 40 DAS recorded 206.76 per cent higher net return compared to weedy check (Table 5). However, among herbicides, application of quizalofop-p-ethyl 50 g/ha at 20 DAS (T3) similar to rest of the herbicides recorded maximum net return to the tune of 175.24 per cent compared to weedy check and also registered maximum B:C ratio (2.50). This result is due to the efficacy of herbicides as well as the reduced cost of cultivation in proportion to increased soybean seed yield. Similar findings were also confirmed by Samant and Mishra (2014) and Pratrap *et al.* (2019).

CONCLUSION

It was concluded that among herbicides, quizalofop-p-ethyl (50 g/ha) at 20 DAS or imazathapyr + imazamox (75 g a.i /ha) at 20 DAS or imazathapyr (75 g /ha) at 20 DAS can be opted for effective weed control in soybean crop for higher yield and monetary return.

Conflict of interest

On behalf of all authors, I confirm that there are no conflicts of interest related to the manuscript. All authors declare that they have no financial, personal, or professional relationships that could be perceived as influencing the research work presented in this manuscript.

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