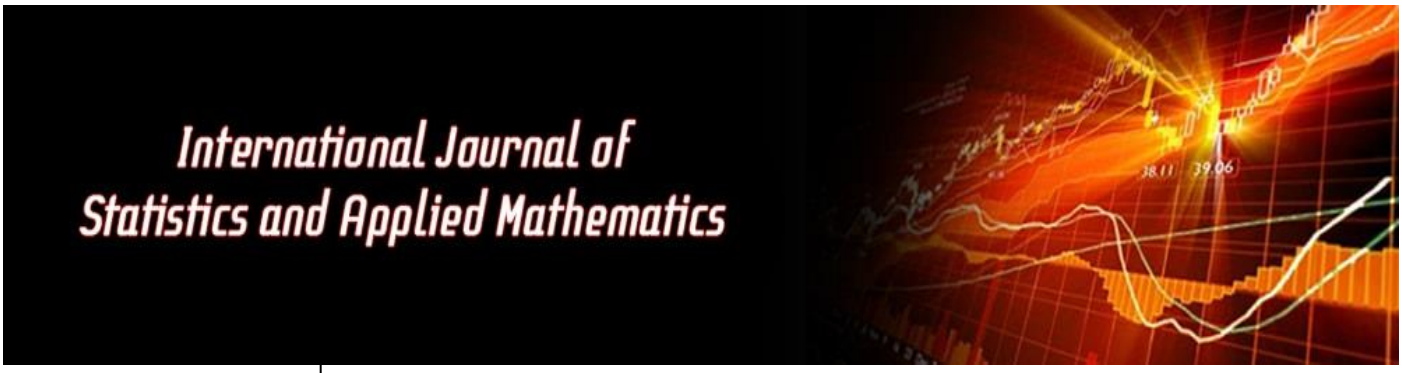

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Efficacy of herbicides along with bio-stimulant on weed occurrence and economics of soybean [*Glycine max* (L.) Merrill] under *vertisoles* of Chhattisgarh

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Abstract
A field experiment on effect of weed management on production and economics of soybean [*Glycine max* (L.) Merrill] was laid out during the *kharif* season of 2019-20 in *Vertisols* at Instructional cum Research farm of IGKV, Raipur, and Chhattisgarh. The oilseed crop known as soybean, also known as the "miracle crop of the 20th century," is very significant. With a protein concentration of about 40%, it offers an economical supply of vegetable oil and protein. Macarena is a bio-stimulant and it increases the metabolism of the plant and supplements plant with glycine and antioxidants of natural origin. This bio-stimulant relieves abiotic stress and in turn increases the soybean yield. *Echinochloa colonum, Cyperus rotundus, Parthenium hysterophorus* L., *Digera arvensis, Celosia argentea,* and *Alternanthera spp.* and some other weeds were dominant in the investigation and were observed throughout the crop growth period. The lowest weed density and weed dry matter generation were achieved with the combination of two hand weedings at 20 and 40 days after planting (T_6), followed by the application of Sodium Acifluarfan (16.5%) + Clodinafoppropargyl (8% EC) at a rate of 1000 MI/ha + Macarena at 625 ml/ha (T_1). The weedy check treatment had the maximum weed density and weed dry matter production (T_7). Weed control efficiency was found highest in two hand weeding at 20 and 40 DAS (T_6) and lowest in weedy check (T_7). The least amount of weed density and dry matter production compared to other treatments was produced by the treatment that included two rounds of hand weeding at 20 and 40 days after sowing (T_6), followed by the application of Sodium Acifluarfan (16.5%) + Clodinafoppropargyl (8% EC) at a rate of 1000 MI/ha + Macarena at 625 ml/ha (T_1). The treatment with no weed management (T_7), on the other hand, had the highest weed density and dry matter production. In conclusion, the experiment showed that the most efficient way to decrease total and species-specific weed density, weed dry matter accumulation, and overall weed control efficacy was to undertake two hand weeding sessions at 20 and 40 days following sowing (T_6). Yet when it comes to chemical weed control, the maximum yields and most favourable economic conditions were obtained when Sodium Acifluarfan (16.5%) + Clodinafop Propargyl (8% EC) at a Rate of 1000 ml/ha + Macarena at 625 ml/ha (T_1) were applied.

Keywords: Weed management, bio-stimulant and herbicides

1. Introduction
Soybean is one of the most important oilseed crops in the world and it is also known as wonder crop of the 20th century. The soybean is a great source of protein and oil, with about 40-45% protein and 18-22% oil. Additionally, it contains plenty of essential vitamins and minerals, and has a beneficial mix of amino acids. Soybean has a protein quality that matches that of meat, eggs, and milk products. Moreover, it is an excellent source of iron and vitamin C. Soybean builds up the soil fertility by fixing atmospheric nitrogen through the root nodules, and also through leaf fall on the ground on maturity. It is able to leave residual nitrogen effect for succeeding crop equivalent to 35-40 kg N ha^{-1}. Soybean can tolerate mild drought as well as floods. This characteristic has made soybean to fit well in sustainable agriculture. World soybean production is 333.67 million tonnes from a total area of 120.50 million hectares. India ranks fourth in area with 11.34 million hectares (28.02 million acres) accounting for 9.41% of the world area and fifth in production with 11.22 million tonnes

(Soyabean Outlook, October 2021, Agricultural Market Intelligence Centre, PJTSAU).

Soybean is mainly grown during *kharif* season in sandy loam to clay loam soils in Chhattisgarh. In these soils, by virtue of their water holding capacity, do not turn up in working condition, hindering timely weeding and inter culture operation. Weed competition, which begins with crop germination and continues until maturity, can have a considerable impact on soybean, which is very sensitive to it. 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. The critical period of crop weed competition in soybean is reported to be first 45 DAS (Panneerselvam and Lourduraj, 2000) [11]. Weed infestation during early stages in soybean is one of the major factors for loss in yield. The yield loss due to weed infestation in soybean was to the tune of 20-77 per cent (Kurchania *et al*., 2001) [7].

Wide spectrum new herbicides are required to control majority of weed flora in soybean crop. Mostly the farmer's use pre-plant incorporated and pre-emergence herbicides for weed control in soybean, but their efficacy are reduced by various climatic and edaphic factors. Hand weeding is a traditional and effective method of weed control, but untimely and continuous rains as well as unavailability of labour at peak time are main limitations of manual weeding. Maximizing yields during the crop season can be achieved by selecting the most effective weed management measures that are economically feasible. The only alternative that needs to be explored is the use of post- emergence herbicides. The screening of such herbicides in soybean reveals their efficiency against either monocotyledonous or dicotyledonous weeds. Hence, their mixtures may broaden the window of weed management by broad-spectrum weed control (Bineet *et al*. 2001) [2].

2. Materials and Methods

The experiment was conducted at the Instructional Cum Research Farm of the IGKV in Raipur, which is situated at an altitude of 290.2 m above mean sea level and at latitudes 21º4' N and 81º35' E. The sub-humid to semi-arid climate of the area receives its rainfall from the south-west monsoon. Based on an average of 80 years, there are 1326 mm of rain each year. The test soil belongs to the Vertisols family and has a pH of 7.1, which is neutral. Seven treatments were included in the trial, which was set up using a randomised block design (RBD) with three repetitions. Table 1 lists the specifics of the procedures.

Table 1: Treatment details

T_1	Sodium Acifluarfan (16.5%) + Clodinafoppropargyl (8% EC) @ 1000 MI/ha + Macarena @ 625 ml/ha
T_2	Imazethapyr 10 SL@ 1000 ml/+ Macarena @ 625 ml/ha
T_3	Fluazifop-p-butyl 13.4 EC @ 2000 ml/ha + Macarena @ 625 ml/ha
T_4	Propaquizafop 2.5% EC + Imazethapyr 3.7% ME @ 2000 ml/ha + Macarena @ 625 ml/ha
T_5	Macarena @ 625 ml/ha
T_6	Two hand weeding at 20 and 40 Das
T_7	Weedy check

Using a seed rate of 75 kg ha-1 and a spacing of 30 10 cm, the soybean variety "JS 97-52" was manually seeded. Before planting, seeds were treated with Bavistin at a rate of 2 g per kg of seeds, followed by seed inoculation with Rhizobium japonicum at a rate of 4 g per kg of seeds, to protect the crop from diseases transmitted through the soil and seeds. As a base dose, urea, single super phosphate, and muriate of potash were used to apply the appropriate amount of fertiliser. At 20 DAS, all chemicals were sprayed as post-emergence. Sodium Aciflorfan + Clodinofop (Kover), Imazethapyr (Pursuit 10SL), Fluazifop-p-butyl (Fusilade), Propaquizafop, and Macarena, a bio-stimulant that boosts the plant's metabolism and supplements it with glycine and antioxidants from natural sources, were among the herbicides also used in accordance with the treatments. At 20 and 40 DAS, the treatment T6 underwent two hand weeding's. At 30, 60, 90, and harvest, the weed flora in the experimental fields was noted from each plot in each replication by randomly placing a quadrate (1x1 m2) at three different locations in plot 1. After harvesting and threshing the crop, the seed and stover yield was measured from the net plot area. The cost of cultivating each type of treatment was computed independently, and the personnel costs and mechanical power requirements for various tasks including clearing the field, planting, and harvesting were estimated based on local market rates. The data from the experiment were statistically examined using the F-test, and critical difference (CD) values at P=0.05 were used to determine the significance of mean differences between treatments. The benefit cost (B: C) ratio was derived by dividing the cost of cultivation by net return.

3. Results and Discussion

3.1 Studies on weed

3.1.1Weed flora composition

Echinochloa colonum, Cyperus rotundus, Parthenium hysterophorus L., *Digera arvensis, Celosia argentea,* and *Alternanthera spp.* are the predominant weed species were observed in the experimental field which are displayed in Table 4.8. *Alternanthera spp.* was the most prevalent weed species discovered in the experimental followed by *Parthenium hysterophorus* L. and *Celosia argentea* (Table 2).

3.1.2 Total and species wise weed density (No.m^{-2})

Total weed density of *Echinochloa colonum, Cyperus rotundus, Parthenium hysterophorus* L, *Digera arvensis, Celosia argentea*, and *Alternanthera spp.* were recorded at 30, 60 and 90 DAS. Throughoutall stages of observations, the overall weed density as well as the weed density of the species were impact significantly by various weed management treatments.

At all stages of observations, minimum weed density was observed under two hand weeding at 20 and 40 DAS (T_6) which was at par with Sodium Acifluarfan (16.5%) + Clodinafoppropargyl (8% EC) @ 1000 ml/ha + Macarena @ 625ml/ha (T_1), and the maximum weed density was recorded under weedy check (T_7). At 60 and 90 DAS, the significantly minimum total and species wise weed density was observed under two hand weeding at 20 and 40 DAS (T_6). And the maximum total and species wise weed density was recorded under weedy check (T_7). The performing of hand weeding twice at 20 and 40 DAS (T_7), which was significantly effective for weed control over other treatments, while, it was less effective under weedy check (T_7) as compared to others treatments. The outcomes of this study similar with the results Hassan and Khan (2007) [12] and Singh *et al.* (2011) [10].

Total and species wise dry matter accumulation of weeds (g m^{-2})

The higher amount of dry matter accumulation of weeds denotes the more competition there is between the crop and

the weeds. The reduction of crop yield was directly linked to the dry matter accumulation of weeds rather than density of weeds along. The total dry matter accumulation of weeds at various time intervals is showed in Table 6 to 8.

The various weed management treatments at 30, 60 and 90 DAS showed a significant impact on the amount of total weed dry matter accumulation. The treatment showed significantly higher amount of dry matter accumulation of weed species such as *Echinochloa colonum, Cyperus rotundus, Parthenium hysterophorus L., Digera arvensis, Celosia argentea, and Alternanthera spp.* as compared to the weedy check (T_7). The treatment involving manual weeding at 20 and 40 days after sowing (T_6) resulted in the lowest weed dry matter accumulation at 30, 60, and 90 days after sowing (DAS). However, this treatment showed similar results to the application of Sodium Acifluarfan (16.5%) + Clodinafoppropargyl (8% EC) at a rate of 1000ml/ha + Macarena at a rate of 625ml/ha (T_1), as well as Fluazifop-p-butyl 13.4 EC at a rate of 2000ml/ha + Macarena at a rate of 625ml/ha (T_3). The weedy check (T_7) showed the highest amount of dry matter accumulation among the weeds.

Weed control efficiency (%)

Weed control efficiency of various weed species at 30 and 60 DAS are displayedin Table 9. The data indicated that highest weed control efficiency was recorded under weed free two hand weeding at 20 and 40 DAS (T6) followed by Sodium Acifluarfan (16.5%) + Clodinafoppropargyl (8% EC) @ 1000ml/ha + Macarena @ 625ml/ha (T_1) and Propaquizafop 2.5% EC + Imazethapyr 3.7% ME @ 2000ml/ha + Macarena @ 625ml/ha (T_4). And at 90 DAS two hand weeding at 20 and 40 DAS (T_6) recorded significantly higher weed control efficiency followed by Imazethapyr 10 SL@ 1000ml/+ Macarena @ 625ml/ha (T_2) and Sodium Acifluarfan (16.5%) + Clodinafoppropargyl (8% EC) @ 1000ml/ha + Macarena @ 625ml/ha (T_1). This reason for this could be due to reduced density and dry weight of weeds to some extent with the pre-emergence application of Pendimethalin and Sulfenotrazon. These results are similar with the findings of Sharma (2009) [9], Bhutada and Bhale (2013) [1].

Yield

Data revealed that the application of herbicides has a significant impact on the seed yield of soybean showed in (Table 9). Data showed that treatment T_1- Sodium Acifluarfan (16.5%) + Clodinafoppropargyl (8% EC) @ 1000ml/ha + Macarena @ 625ml/ha resulted in significantly higher seed and stover yield, which was at par with T_4- Propaquizafop 2.5% EC + Imazethapyr 3.7% ME @ 2000ml/ha + Macarena @ 625ml/ha and T_6- Two hand weeding at 20 and 40DAS and T_2- Imazethapyr 10 SL@ 1000ml/+ Macarena @ 625ml/ha. The lowest yield was recorded in T_7- weedy check. A non-significant variation was observed in harvest index due to application of different herbicides.

Economics

The data related to the economics of soybean cultivation such as the cost of production, gross income, net income, and benefit-cost ratio are displayed in Table 10.

The cost of cultivation varied according to types of herbicide and their combinations. The cost of cultivation per hectare was the lowest with the weedy check (T_7) at 12,685 Rs/ha-1, and it increased as the level of herbicide combinations increased, reaching 17,785 Rs/ha-1under two-hand weeding at 20 and 40 days after sowing (T_6). The gross return showed a notable increase with each rise in the level and combination of herbicides used. Nonetheless, a further increase in the combination of herbicides did not lead to a significant increase in gross return. Maximum gross return (88195 Rs/ha^{-1}) was recorded with the application of sodium Acifluarfan (16.5%) + Clodinafoppropargyl (8% EC) @ 1000ml/ha + Macarena @ 625ml/hand maximum net return (71410 Rs/ ha^{-1}) with maximum B:C ratio (5.2).

Conclusion

Combined application of two hand weeding at 20 and 40 DAS (T_6) is most suitable for the minimization of total and species wise weed density and dry matter accumulation. In term of weed control efficiency the use of two hand weeding at 20 and 40 DAS (T_6) gave significantly superior result compare to other treatments. The integration of Sodium Acifluarfan (16.5%) + Clodinafoppropargyl (8% EC) @ 1000 ml/ha + Macarena @ 625 ml/ha (T_1) recorded maximum yields as well as economics i.e. gross return (88195 Rs/ha^{-1}) and net return (71410 Rs/ ha^{-1}) with B: C ratio (5.2).

Table 2: Weeds species observed in the experimental field

S No.	Scientific name	Family	Common Name
	Grasess		
1.	*Echinochloacolonum* (L.)	Poaceae	Sawa
	Sedges		
2.	*Cyperusrotundus* L.	Cyperaceae	Motha
	Broad leaf		
3.	*Partheniumhysterophorus* L.	Asteraceae	Gajarghass
4.	*Digeraarvensis*	Amaranthaceae	Amaranthace
5.	*Celosia argentea*	Amaranthaceae	Siliari
6.	*Alternantheraspp*	Amaranthaceae	Reshmkata

Table 3: Weed density in Soybean as influenced by different weed management practices

Treatment	Weed density (No.m^{-2})																				
	*E. colonum*in			*A. asessilis*			*P. hysterophorus*			*D.iarvensis*			*C. argentea*			*C. rotundus*			Total		
	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS
T_1	0.71	2.35	1.22	2.12	2.12	2.74	1.22	2.35	2.55	2.35	2.92	3.08	1.58	2.35	2.55	1.87	2.74	1.58	3.94	6.04	5.61
	(0.0)	(5.0)	(1.0)	(4.0)	(4.0)	(7.0)	(1.0)	(5.0)	(6.0)	(5.0)	(8.0)	(9.0)	(2.0)	(5.0)	(6.0)	(3.0)	(7.0)	(2.0)	(15.0)	(36.0)	(31.0)
T_2	1.58	3.24	1.58	2.35	2.35	2.55	2.55	3.94	4.06	2.12	2.74	2.92	2.35	2.74	3.08	2.12	2.12	1.22	5.15	6.96	6.52
	(2.0)	(10.0)	(2.0)	(5.0)	(5.0)	(6.0)	(6.0)	(15.0)	(16.0)	(4.0)	(7.0)	(8.0)	(5.0)	(7.0)	(9.0)	(4.0)	(4.0)	(1.0)	(26.0)	(48.0)	(42.0)
T_3	0.71	1.87	1.22	2.55	2.55	3.67	2.35	3.94	4.18	2.74	2.55	2.74	2.92	2.74	2.92	2.12	3.24	1.58	5.52	7.31	6.96
	(0.0)	(3.0)	(1.0)	(6.0)	(6.0)	(13.0)	(5.0)	(15.0)	(17.0)	(7.0)	(6.0)	(7.0)	(8.0)	(7.0)	(8.0)	(4.0)	(10.0)	(2.0)	(30.0)	(53.0)	(48.0)
T_4	0.71	1.87	1.58	2.35	2.35	2.92	2.35	2.35	2.74	2.12	2.92	3.08	1.58	3.08	3.24	2.12	2.92	1.58	4.53	6.36	6.20
	(0.0)	(3.0)	(2.0)	(5.0)	(5.0)	(8.0)	(5.0)	(5.0)	(7.0)	(4.0)	(8.0)	(9.0)	(2.0)	(9.0)	(10.0)	(4.0)	(8.0)	(2.0)	(20.0)	(40.0)	(38.0)
T_5	2.55	3.67	1.22	2.92	2.92	3.81	2.12	3.39	3.54	2.55	3.24	3.39	2.92	3.24	3.39	2.35	3.24	1.58	6.12	8.22	7.18
	(6.0)	(13.0)	(1.0)	(8.0)	(8.0)	(14.0)	(4.0)	(11.0)	(12.0)	(6.0)	(10.0)	(11.0)	(8.0)	(10.0)	(11.0)	(5.0)	(10.0)	(2.0)	(37.0)	(67.0)	(51.0)
T_6	1.58	1.58	1.22	1.58	1.58	1.58	1.87	0.71	0.71	0.71	1.22	1.58	1.58	1.22	1.58	1.22	0.71	0.71	3.24	2.35	2.74

	(2.0)	(2.0)	(1.0)	(2.0)	(2.0)	(2.0)	(3.0)	(0.0)	(0.0)	(0.0)	(1.0)	(2.0)	(2.0)	(1.0)	(2.0)	(1.0)	(0.0)	(0.0)	(10.0)	(5.0)	(7.0)
T_7	2.74	3.54	1.58	3.24	3.24	3.81	2.92	3.81	3.94	2.35	3.24	3.54	2.55	3.67	3.81	3.08	3.24	1.22	6.75	8.51	7.65
	(7.0)	(12.0)	(2.0)	(10.0)	(10.0)	(14.0)	(8.0)	(14.0)	(15.0)	(5.0)	(10.0)	(12.0)	(6.0)	(13.0)	(14.0)	(9.0)	(10.0)	(1.0)	(45.0)	(72.0)	(58.0)
S.Em±	0.12	0.10	0.06	0.12	0.12	0.17	0.11	0.13	0.17	0.10	0.14	0.14	0.13	0.12	0.19	0.09	0.12	0.08	0.29	0.35	0.34
CD (P=0.05)	0.34	0.30	0.17	0.35	0.35	0.50	0.32	0.39	0.51	0.29	0.41	0.43	0.39	0.36	0.59	0.27	0.35	0.23	0.85	1.05	1.01

Table 4: Weed dry matter accumulation in Soybean as influenced by different weed management practices

Treatment	Dry matter accumulation (g m^{-2}) at 30.60.90 DAS																				
	***E. colonum*in**			***A. asessilis***			***P. hysterophorus***			***D.iarvensis***			***C. argentea***			***C. rotundus***			**Total**		
T_1	0.71	1.35	1.95	1.89	1.91	4.35	1.55	2.58	4.20	1.25	1.96	3.58	1.23	2.26	3.84	1.80	2.16	2.35	3.21	4.82	8.42
	(0.00)	(1.32)	(3.32)	(3.08)	(3.15)	(18.45)	(1.90)	(6.14)	(17.12)	(1.07)	(3.33)	(12.33)	(1.01)	(4.60)	(14.22)	(2.74)	(4.18)	(5.01)	(9.80)	(22.72)	(70.45)
T_2-	2.52	3.14	2.39	1.55	2.54	4.10	1.47	2.60	4.76	1.66	1.72	2.51	1.82	2.12	3.66	1.53	2.04	1.97	4.11	5.68	8.14
	(5.87)	(9.37)	(5.21)	(1.91)	(5.97)	(16.30)	(1.66)	(6.26)	(22.12)	(2.24)	(2.47)	(5.78)	(2.83)	(4.00)	(12.87)	(1.85)	(3.65)	(3.40)	(16.36)	(31.72)	(65.68)
T_3-	0.71	2.61	2.32	1.90	2.67	5.59	2.54	2.36	5.72	2.55	2.16	4.12	1.78	2.18	4.79	2.07	2.59	2.30	4.69	5.76	10.59
	(0.00)	(6.33)	(4.88)	(3.11)	(6.64)	(30.78)	(5.95)	(5.06)	(32.23)	(6.00)	(4.18)	(16.45)	(2.68)	(4.24)	(22.45)	(3.80)	(6.21)	(4.78)	(21.54)	(32.66)	(111.57)
T_4	1.87	2.51	1.90	1.91	2.30	5.17	1.46	3.10	5.07	1.66	1.49	4.22	1.36	1.73	5.26	1.57	2.14	2.40	3.72	5.33	10.24
	(3.01)	(5.78)	(3.12)	(3.14)	(4.77)	(26.23)	(1.63)	(9.13)	(25.24)	(2.26)	(1.73)	(17.35)	(1.34)	(2.48)	(27.15)	(1.97)	(4.06)	(5.25)	(13.35)	(27.95)	(104.34)
T_5-	2.83	2.99	1.96	1.66	3.22	5.81	1.38	3.09	5.39	1.89	2.91	5.31	2.20	2.71	5.07	2.36	2.51	2.22	4.92	6.96	11.09
	(7.53)	(8.43)	(3.35)	(2.25)	(9.89)	(33.21)	(1.41)	(9.04)	(28.53)	(3.09)	(7.99)	(27.67)	(4.35)	(6.82)	(25.23)	(5.06)	(5.80)	(4.43)	(23.69)	(47.97)	(122.42)
T_6-	0.91	1.58	1.90	0.94	1.41	2.95	1.03	0.71	0.71	0.71	1.10	3.04	0.97	1.30	2.81	0.89	0.71	0.71	1.58	2.43	5.29
	(0.32)	(2.01)	(3.12)	(0.38)	(1.50)	(8.23)	(0.56)	(0.00)	(0.00)	(0.00)	(0.71)	(8.76)	(0.45)	(1.18)	(7.40)	(0.29)	(0.00)	(0.00)	(2.00)	(5.40)	(27.51)
T_7	2.74	2.85	2.20	1.80	3.08	5.88	2.08	3.46	6.42	1.86	2.60	5.82	2.17	3.28	6.46	2.34	3.80	1.90	5.12	7.68	12.55
	(7.03)	(7.63)	(4.32)	(2.74)	(8.96)	(34.12)	(3.81)	(11.50)	(40.77)	(2.97)	(6.27)	(33.32)	(4.20)	(10.25)	(41.25)	(4.96)	(13.92)	(3.12)	(25.71)	(58.53)	(156.90)
S.Em±	0.09	0.14	0.10	0.08	0.11	0.25	0.06	0.11	0.23	0.07	0.09	0.19	0.11	0.14	0.22	0.11	0.11	0.12	0.25	0.27	0.53
CD (P=0.05)	0.25	0.43	0.30	0.24	0.32	0.74	0.19	0.33	0.69	0.21	0.28	0.56	0.31	0.40	0.66	0.32	0.31	0.36	0.73	0.80	1.59

Table 5: Weed control efficiency and yields of Soybean as influenced by different weed management practices

Treatments	**Weed control efficiency**			**Yield**		
	30 DAS	**60 DAS**	**90 DAS**	**Seed Yield (kg ha^{-1})**	**Stover Yield (kg ha^{-1})**	**Harvest Index (%)**
T_1- Sodium Acifluarfan (16.5%) + Clodinafoppropargyl (8% EC) @ 1000ml/ha + Macarena @ 625ml/ha	60.88	59.65	55.65	1930	3870	33.28
T_2- Imazethapyr 10 SL@ 1000ml/+ Macarena @ 625ml/ha	34.70	43.53	55.82	1600	3560	31.01
T_3-Fluazifop-p-butyl 13.4 EC @ 2000ml/ha + Macarena @ 625ml/ha	19.26	41.88	26.59	1470	3410	30.12
T_4- Propaquizafop 2.5% EC + Imazethapyr 3.7% ME @ 2000ml/ha + Macarena @ 625ml/ha	47.14	49.96	30.64	1830	3860	32.16
T_5- Macarena @ 625ml/ha	5.44	17.38	19.16	1350	2920	31.62
T_6- Two hand weeding at 20 and 40 DAS	92.02	90.38	82.61	1650	3280	33.47
T_7- Weedy check	0.00	0.00	0.00	411	804	33.83
S.Em±	8.00	4.37	7.34	43	89	-
CD (P=0.05)	23.76	12.98	21.82	124	262	NS

Table 6: Economics of soybean as influenced by different weed control measures

Treatment	**Gross return (Rs/ha)**	**Cost of cultivation (Rs/ha)**	**Net returns (Rs\h)**	**B:C ratio**
T_1- Sodium Acifluarfan (16.5%) + Clodinafoppropargyl (8% EC) @ 1000ml/ha + Macarena @ 625ml/ha	88195	16785	71410	5.2
T_2- Imazethapyr 10 SL@ 1000ml/+ Macarena @ 625ml/ha	75485	16285	59200	4.6
T_3- Fluazifop-p-butyl 13.4 EC @ 2000ml/ha + Macarena @ 625ml/ha	70275	15885	54390	4.4
T_4- Propaquizafop 2.5% EC + Imazethapyr 3.7% ME @ 2000ml/ha + Macarena @ 625ml/ha	84495	16785	67710	5.0
T_5- MACARENA @ 625ml/ha	65235	15285	49950	4.2
T_6- Two hand weeding at 20 and 40DAS	78835	17785	61050	4.4
T_7- Weedy check	27892	12685	15207	2.1
SE m±	-	-	-	-
CD (P=0.05)	-	-	-	-

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