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Effect of herbicides on growth, yield and economics in soybean (*Glycine max* L.)

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Abstract
An experiment entitled "Effect of Herbicides on Growth, Yield and Economics in Soybean (*Glycine max* L.)" was conducted in *Kharif* season 2015 at research farm of BRAUSS, MHOW, (M.P.). The soil of the experimental field was medium black in texture, neutral in reaction (pH 7.60) with normal EC (0.45 dS/m) and medium organic carbon contents (0.72%) and analysing low in available N (270 kg/ha), medium in available P (6.9 kg/ha) and high in available K (382 kg/ha) contents. Due to dominance of montmorillonite clay content it has high capacity to swell and shrink and high CEC. A field experiment was consisted of 9 treatments replicated four times in randomized block design (RBD). As per treatment, the seed of soybean *cv.* JS 335 was sown in all the treatments consisting with pre and post emergence herbicides. The maximum number of pods (30.90) and seed weight (11.10 g) was recorded under treatment T_9-weed free plot followed by T_4-fenoxaprop-p-ethyl, which gave the value of 27.60 pods/plant and 11.0 g seed index. The lowest number of pods (26.60) and seed index (9.20) was recorded under treatment T_8-control. The highest grain and stover yield (14.33 and 15.52 q/ha) was recorded under treatment T_9-weed free plot followed by (14.0 and 14.73 q/ha) under treatment T_4-fenoxaprop-p-ethyl 9% EC while lowest grain and stover yield (9.14 and 11.38 q/ha) was obtained under treatment T_8 (control). The highest net return (Rs.32796/ha) was obtained under the treatment T_9 (weed free situation) closely followed by T_4 fenoxaprop-p-ethyl 9% EC (Rs.32359/ha) while the lowest net return (Rs.18284/ha) was received under the treatment T_8 (control). The highest benefit: cost ratio (2.30) was obtained under the treatment T_4-Fenoxaprop-p-ethyl 9% EC closely followed by T_3 -Chlolrimuron-ethyl 25% WP (2.29) and T_9 (weed free situation) (2.20) while the lowest benefit:cost ratio (1.45) was received under the treatment T_8 (control).

Keywords: Soybean, pre and post emergence herbicide, yield and economics

Introduction
Soybean (*Glycine max* (L) Merrill) is established as one of the major monsoon season field crops in Malwa plateau of Madhya Pradesh. It has become a economical crop because of comparatively good economic return/unit area obtained by the farmers from its improvement in the living condition of farmers. Indian soybean holds on an average 37-41% protein, 17-21% oil, 25-30% carbohydrate, 4-5% ash, 4-5% crude fibre and 2% phospholipids, Hence, it is called ‘’meat of the field’. It has recorded biological value of 2.5 and 3.5 PER (protein efficiency ratio) when it is used as raw and processed respectively. However, its productivity in the State id 1102 kg ha-1 which is very low as compared to the global productivity of 2206 kg/ ha (Anonymous, 2014) [1].

Among the causes of low productivity, weeds are the major problems causing about 37% yield reduction. Weed control is indispensable in modern crop management because weeds cause competitional stresses for light, moisture, space, nutrients and may have some allelopathic as well, resulting in poor crop growth especially during the 40 days after sowing and thereby yields are reduced markedly (Tiwari *et al.*, 1997) [18]. Complete mechanical and/or manual weeding may not be possible and cost effective during the critical period of crop weed competition for obvious reasons.

Pre and post-emergence herbicides are considered almost synonymous with modern weed science technology, as they gave a new direction to the formers to get the maximum yield potential of the crop at lower cost of production. Areas where farmers are progressive and have greater managerial ability, with scarcity of labour, chemical weed control has emerged out as one of the important factors in increasing the yield of crop. The medium to deep *Vertisol* soils

in Malwa plateau in monsoon season at times lose their workability due to rains and mechanical weeding in standing crop becomes almost impossible. Under such situations, the chemical weed control seems to be the best option to overcome the weed competition and get higher yield.

Material and methods

The experiment was conducted on the Research Farm of BRAUSS Mhow in Rehati Hoshangabad, (M.P.). The topography of the experimental area are fairly leveled and proper drainage was provided. The plots were protected as not to allow the free flowing of surface runoff water, affecting the individual plot treatments. The meteorological data showed that the total rainfall received during the crop growth period was 588 mm. The maximum temperature varied from 25.7-32.6°c and the minimum temperature varied from 14.1-23.2°c. The total number of rainy days was 28. Soil temperatures varied from 21.0-27.2°c.

The soil of the experimental field has been grouped under medium black (*Vertisols*) belonging to fine montmorillonite hypertharmic family predominantly clay textural class. For fertility status of the experimental area, the soil samples were collected randomly with the help of soil augar before sowing from the experimental field and representative composite sample was made for the mechanical and chemical analysis.

Chemical analysis of experimental soil

Analysis	Quantity	Category	Method adopted
Soil pH	7.6	Slightly	Glass electrode method (pH meter) (Jackson, 1967) [6]
Electrical conductivity (dSm^{-1})	0.45	Normal	Conductivity meter at 25°C (Jackson, 1967) [6]
Organic carbon (%)	0.72	Medium	Walkley and Black's rapid titration method
Available nitrogen (kg/ha)	270	Medium	Alkaline permanganate method (Jackson, 1967) [6]
Available phosphorus (kg/ha)	6.9	Low	Olsen's (Jackson, 1967) [6]
Available potash (kg/ha)	382	Medium	Flame photometer (Jackson, 1967) [6]

The experiment consisting of nine treatments and four replications with randomized block design was laid out in the experiment. Alachlor, Pendimethalin are the herbicides, which were used as pre emergence. These were sprayed immediately after the sowing of soybean crop. Chlorimuron ethyl, fenoxoprop ethyl, Chlorimuron ethyl + fenoxoprop ethyl, quizaifop ethyl, and imazethapyr were used as post emergence herbicide. These were sprayed at 15-25 days after planting as per herbicide. The herbicides spray mixture was added with 1 ml per litre of gum as stickers. The following observations were recorded under the study:

Number of pods per plant

Number of pods counted on 10 already tagged sample plants per plot and mean was calculated,

Seed Index (g)

100 grains was counted from the seed sample taken from finally cleaned produce of each plot for recording test weight. The weight of 100-seed was recorded on a electrical balance.

Seed yield (q/ha)

The seed yield per net plot was recorded after drying the seed it is also known as economical yield. The plot yield was later on converted in to quintal per hectare by multiplying it by conversion factor.

Stover yield (q/ha)

The stover yield per plot was obtained by subtracting grain yield (economical yield) from biological yield (bundle weight) in each plot. This was later on converted in to q/ha.

Harvest index

It is the ratio of economic yield to the biological yield. In case of legumes, it is the ratio of grains to the total dry matter and expressed in percentage as follows:

$$\text{Harvest index (\%)} = \frac{\text{Economic yield (grain yield)}}{\text{Biological yield}} \times 100$$

Economics

Economic analysis of input and yields made. Cost of labour, fertilizer, herbicide and insecticide and other inputs required during growing of the crop were noted and gross profit, net profit and cost: benefit ratio of each treatment were noted and gross profit, net profit and cost: benefit ratio of each treatment were calculated on the basis of the prevailing market rates of the items of inputs and the price of the commodity produced.

Results and discussion

Growth parameters

Plant height (mm)

Data revealed that average plant height increased progressively with increase in the age of the crop till 75 DAS. The plant gained height at increased rate between 30 to 45 DAS and relatively slower rate between 60 and 75 DAS.

It is evident from the data presented in Table 1, that two pre-emergence herbicide treatment *i.e.* alachlor 50 EC @ 2 litre a.i./ha (T_1) and pendimethalin 30 EC @ 750 ml a.i./ha (T_2) and post emergence herbicide *i.e* quizalofop-ethyl 5% EC @ 50 ml a.i./ha (T_6) and Imazethapyr 5% SL @ 75 mI a.i./ha (T_7) gave relatively shorter plant height at all the stages of crop growth as compared to that in treatment T_9 (weed free). Maximum plant height of 574 mm at harvest was recorded in treatment of weed free condition (T_9) and closely followed by T_4 (Fenoxaprop-p-ethyl) 564 mm, T_5 (Chlorimuron-ethyl + Fenoxaprop-p-ethyl) 562 mm and T_3 (Chlorimuron-ethyl) 561 mm, suggesting that these chemicals could be used for weed control in soybean.

Table 1: Average plant height as influenced by different treatments at successive stages of plant growth

Tr. No.	Treatments	Plant height (mm)				
		30 DAS	45 DAS	60 DAS	75 DAS	At harvest
T_1	Alachlor 50 EC, 2.0 kg/ha (Pre.eme.)	118	375	533	531	525
T_2	Pendimethalin 30 EC, 750 g/ha (Pre.eme.)	119	373	527	532	531
T_3	Chlorimuron-ethyl 25% WP, 9.37 g/ha, post eme. (20 DAS)	150	377	566	574	561
T_4	Fenoxaprop-p-ethyl 9% EC, 67.5 g/ha post eme.(20 DAS)	156	392	587	590	564
T_5	Chlorimuron ethyl + Fenoxaprop-ethyl, 9.37 g/ha + 67.5 g/ha, post eme.	156	381	585	581	562
T_6	Quizalafop-p-ethyl 5% EC, 50 g/ha, post eme. (15 DAS)	114	368	493	493	512
T_7	Imazethapyr 5% EC, 50 g/ha, post eme. (25 DAS)	112	360	483	486	521
T_8	Control (unweeded)	90.6	323	461	466	496
T_9	Weed free	161	415	598	601	574
	SEm	10	11.7	21.7	18.9	11.2
	CD at 5%	29.3	34.4	63.5	55.3	32.7

Number of branches per plant

The average number of branches/plant increased with the increase in the age of the crop. The maximum number of branches/plant was recorded in the treatment T_9 (weed free plot) at all the stages of crop growth followed by T_4 - fenoxaprop-ethyl 9% EC, which was applied as post-emergence herbicide at 20 DAS. It was significant to record that the values of number of branches/plant (3.38 and 3.12) were almost same at 75 DAS and at harvest, since no branching function took place after 75 DAS. The treatment T_6 (quizalofop-p-ethyl 5% EC) and T_7 (Imazethapyr 5% SL) were almost similar in influencing the number of branches/plant at all stages of plant growth.

Table 2: Effect of different treatments on average number of branches per plant

Tr. No	Treatments	Average number of branches/plant				
		30 DAS	45 DAS	60 DAS	75 DAS	At harvest
T_1	Alachlor 50 EC, 2.0 kg/ha (Pre.eme.)	0.70	1.60	2.25	2.28	2.24
T_2	Pendimethalin 30 EC, 750 g/ha (Pre.eme.)	0.73	1.48	2.10	2.10	2.03
T_3	Chlorimuron-ethyl 25% WP, 9.37 g/ha, post eme. (20 DAS)	0.90	1.69	2.80	2.80	2.78
T_4	Fenoxaprop-p-ethyl 9% EC, 67.5 g/ha post eme.(20 DAS)	1.01	2.04	3.10	3.13	3.12
T_5	Chlorimuron ethyl + Fenoxaprop-ethyl, 9.37 g/ha + 67.5 g/ha, post eme.	1.01	1.80	2.91	2.93	2.90
T_6	Quizalafop-p-ethyl 5% EC, 50 g/ha, post eme. (15 DAS)	0.41	1.29	1.87	1.87	1.88
T_7	Imazethapyr 5% EC, 50 g/ha, post eme. (25 DAS)	0.37	1.15	1.72	1.72	1.72
T_8	Control (unweeded)	0.33	0.91	1.31	1.33	1.34
T_9	Weed free	1.21	2.11	3.28	3.38	3.38
	SEm	0.14	0.11	0.18	0.21	0.20
	CD at 5%	0.42	0.34	0.54	0.62	0.58

Dry weight of soybean/plant

Data showed that the dry weight per plant gradually increased with the age of the crop till maturity. The rate of dry matter accumulation was maximum between 60-75 and 75 DAS to harvest and thus followed a normal growth pattern. At the age of 45 DAS also, the dry matter accumulation per plant showed significant effects.

Treatment T_9 (weed free) had highest values (20.60 g) with respect to dry weight/plant compared to all the treatments at all growth stages, suggesting that the weed free situation improves the quantity the biomass of the crop. However, this treatment (T_9) was statistically at par with T_4, fenoxaprop-p-ethyl (19.70) at harvest where as minimum dry weight (13.20 g) was recorded in T_8 (control) at harvest which was almost at par with T_7-Imazethapyr 5% SL (14.90 g) and T_6-quizalofop-ethyl 5% EC (15.10 g).

Table 3: Average dry weight of soybean plants as influenced by different treatments.

Tr. No	Treatments	Dry weight of soybean plant (g)				
		30 DAS	45 DAS	60 DAS	75 DAS	At harvest
T_1	Alachlor 50 EC, 2.0 kg/ha (Pre.eme.)	2.67	6.85	11.10	12.12	18.10
T_2	Pendimethalin 30 EC, 750 g/ha (Pre.eme.)	2.71	6.61	10.60	12.40	17.30
T_3	Chlorimuron-ethyl 25% WP, 9.37 g/ha, post eme. (20 DAS)	3.64	7.10	11.90	15.10	18.30
T_4	Fenoxaprop-p-ethyl 9% EC, 67.5 g/ha post eme.(20 DAS)	3.80	7.81	13.20	16.00	19.70
T_5	Chlorimuron ethyl + Fenoxaprop-ethyl, 9.37 g/ha + 67.5 g/ha, post eme.	3.71	7.31	12.00	15.90	19.30
T_6	Quizalafop-p-ethyl 5% EC, 50 g/ha, post eme. (15 DAS)	1.98	6.31	9.10	12.20	15.10
T_7	Imazethapyr 5% EC, 50 g/ha, post eme. (25 DAS)	1.95	6.01	9.33	11.80	14.90
T_8	Control (unweeded)	1.82	5.61	8.21	10.10	13.20
T_9	Weed free	3.93	7.97	13.90	17.30	20.60
	SEm	0.33	0.33	0.73	0.92	0.87
	CD at 5%	0.99	0.96	2.12	2.69	2.54

Leaf area index

The total area accumulated by the soybean plant per unit of the ground area in which the crop was grown was recorded under each treatment at 30, 45, 60 and 75 DAS. The leaf area index was significantly affected by different treatments at all the periods of growth that is 30, 60 and 75 DAS. The highest

values (8.25) of LAI recorded in the treatment T_9 (weed free plot) at all the growth stages, which was significantly superior to the LAI recorded under each treatment at 30 DAS except T_4 and T_5 at 45 DAS, T_3, at 60 and 75 DAS while minimum LAI recorded under T_8 (control) at all the stages of growth.

Table 4: Leaf area index as influenced by different treatments

Tr. No	Treatments	Leaf area index			
		30 DAS	45 DAS	60 DAS	75 DAS
T_1	Alachlor 50 EC, 2.0 kg/ha (Pre.eme.)	3.16	3.77	4.54	6.43
T_2	Pendimethalin 30 EC, 750 g/ha (Pre.eme.)	3.10	3.80	4.60	6.30
T_3	Chlorimuron-ethyl 25% WP, 9.37 g/ha, post eme. (20 DAS)	3.15	4.10	5.05	7.10
T_4	Fenoxaprop-p-ethyl 9% EC, 67.5 g/ha post eme.(20 DAS)	3.40	4.48	5.51	7.65
T_5	Chlorimuron ethyl + Fenoxaprop-ethyl, 9.37 g/ha + 67.5 g/ha, post eme.	3.70	4.40	5.35	7.42
T_6	Quizalafop-p-ethyl 5% EC, 50 g/ha, post eme. (15 DAS)	2.92	3.55	4.21	5.85
T_7	Imazethapyr 5% EC, 50 g/ha, post eme. (25 DAS)	2.50	3.25	3.80	5.35
T_8	Control (unweeded)	2.18	2.79	3.61	5.21
T_9	Weed free	3.19	4.79	6.04	8.25
	SEm	0.16	0.19	0.35	0.41
	CD at 5%	0.45	0.57	1.02	1.19

Yield parameters

Number of pods/plant

The increase in grain yield of soybean crop is determined by the bearing of number of pods. The number of pods per plant directly affects the number of grains per plant and ultimately the final grain yield of the crop. The highest number of pods (30.90) per plant was recorded under treatment T_9 (weed free plot) followed by 27.60 pods per plant in the treatment T4, fenoxaprop-p-ethyl 9% EC when applied as post-emergence treatment at 20 DAS. Among the different chemical herbicides used, the next treatment was T_3-chilorimuron-ethyl 25% WP, which recorded 26.60 number of pods/plant.

Seed index

Seed index is considered to be an important character, which contributes towards the yield of the crop. The highest 100 seed weight (11.10 g) was recorded under treatment T_9, weed free plot followed by T_4, fenoxaprop-p-ethyl, which gave the value of 11.00 g. The lowest seed index (9.20) was recorded under treatment T_8, control. However, the 100 seed weight under all the treatments of chemical herbicides was found quite close to each other as compared to 11.10 g under treatment T_9-weed free plot. Thus, the treatment T_9, the weed free plot and use of fenoxaprop-p-ethyl at 20 DAS proved effective.

Table 5: Number of pods/plant and seed index (g) as influenced by different treatments

Tr. No.	Treatments	Pods/ plant	Seed index
T_1	Alachlor 50 EC, 2.0 kg/ha (Pre.eme.)	24.80	10.50
T_2	Pendimethalin 30 EC, 750 g/ha (Pre.eme.)	24.80	6.30
T_3	Chlorimuron-ethyl 25% WP, 9.37 g/ha, post eme. (20 DAS)	26.60	10.60
T_4	Fenoxaprop-p-ethyl 9% EC, 67.5 g/ha post eme.(20 DAS)	27.60	11.00
T_5	Chlorimuron ethyl + Fenoxaprop-ethyl, 9.37 g/ha + 67.5 g/ha, post eme.	27.70	10.60
T_6	Quizalafop-p-ethyl 5% EC, 50 g/ha, post eme. (15 DAS)	22.90	9.73
T_7	Imazethapyr 5% EC, 50 g/ha, post eme. (25 DAS)	20.00	9.40
T_8	Control (unweeded)	17.40	9.20
T_9	Weed free	30.90	11.10
	SEm	1.53	0.28
	CD at 5%	4.48	0.83

Grain yield (q/ha)

The highest grain yield of 14.33 q/ha was recorded under treatment T_9-weed free plot followed by 14.0 q/ha under treatment T_4-fenoxaprop-p-ethyl 9% EC while lowest grain yield of 9.14 q/ha was obtained under treatment T_8 (control). Treatment T_3 and T_5 with grain yield of 13.34 and 13.62 q per hectare were recorded at par with each other. Thus all the herbicidal treatments as well as treatment T_9-weed free plot were recorded significantly superior to control (T_8) under the assessed herbicidal treatments from gain yield/ha point of view.

Stover yield (q/ha)

The highest amount of stover yield (15.52 q/ha) was recorded under T_9 -weed free plot followed by 14.73 q/ha under treatment T_4. Higher quantity of stover production naturally resulted in lower grain yield of 9.14 q/ha due to weedy condition of this treatment. T_1, T_5 and T_7 were found almost at par with each other but the T_9-weed free plot was significantly superior to these treatments as far as stover yield/ha is concerned while lowest stover yield of 11.38 q/ha was recorded under T_8-weed check.

Harvest index (%)

The maximum harvest index of 49.77% was recorded under treatment T_5, in which there was a larger gap between the grain yield and stover yield per hectare. Harvest index of 48.19% was recorded in treatment T_9 (weed free plot) which was almost at par with harvest index under many other treatments. The harvest index values of the treatments of chemical herbicides ranged between 49.77% and 46.87%. The lowest harvest index (43.21%) was recorded in control plot (weedy condition).

Table 6: Mean grain yield, stover yield and harvest index as influenced by different treatments

Tr No.	Treatments	Yield (q/ha)		Harvest index (%)
		Grain	Stover	
T_1	Alachlor 50 EC, 2.0 kg/ha (Pre.eme.)	13.14	14.05	48.31
T_2	Pendimethalin 30 EC, 750 g/ha (Pre.eme.)	12.86	14.16	47.59
T_3	Chlorimuron-ethyl 25% WP, 9.37 g/ha, post eme. (20 DAS)	13.34	13.95	48.86
T_4	Fenoxaprop-p-ethyl 9% EC, 67.5 g/ha post eme.(20 DAS)	14.00	14.73	48.83
T_5	Chlorimuron ethyl + Fenoxaprop-ethyl, 9.37 g/ha + 67.5 g/ha, post eme.	13.62	13.65	49.77
T_6	Quizalafop-p-ethyl 5% EC, 50 g/ha, post eme. (15 DAS)	12.86	14.58	46.87
T_7	Imazethapyr 5% EC, 50 g/ha, post eme. (25 DAS)	12.38	13.91	47.17
T_8	Control (unweeded)	9.14	11.38	43.21
T_9	Weed free	14.33	15.52	48.19
	SEm	0.49	0.57	1.28
	CD at 5%	1.45	1.66	3.72

Economic evaluation of treatments

The highest net return (Rs. 32796/ha) was obtained under the treatment T_9 (weed free situation) closely followed by T_4 fenoxaprop-p-ethyl 9% EC (Rs. 32359/ha) while the lowest net return (Rs. 18284/ha) was received under the treatment T_8 (control). The highest benefit:cost ratio (2.30) was obtained under the treatment T_4-Fenoxaprop-p-ethyl 9% EC closely followed by T_3 -Chlolrimuron-ethyl 25% WP (2.29) and T_9 (weed free situation) (2.20) while the lowest benefit:cost ratio (1.45) was received under the treatment T_8 (control).

Treatments T_1, T_5 and T_2 were recorded the B:C ratio 2.10, 2.08 and 2.02 which were at par to T_4 -fenoxaprop-ethyl 9% EC and T_9 (weed free situation). Thus, the chemical treatment T_4-fenoxaprop-ethyl 9% EC and weed free situation treatment were found to be economically more valuable than others.

Table 7: Economic evaluation of treatments

Tr. No	Treatments	Expenditure (Rs/ha)		Tatal cost (Rs/ha)	Income (Rs/ha)		Cost: benefit ratio
		Common	Extra		Gross	Net	
T_1	Alachlor 50 EC	12550	1570	14120	43635	29565	1:2.10
T_2	Pendimethalin 30 EC	12550	1600	14150	42828	28678	1:2.02
T_3	Chlolrimuron-ethyl 25% WP	12550	900	13450	44205	30805	1:2.29
T_4	Fenoxaprop-p-ethyl 9% EC	12550	1510	14060	46419	32359	1:2.30
T_5	Chlorimuron ethyl 25% WP + Fenoxaprop-ethyl 9% EC	12550	2025	14575	44955	30380	1:2.08
T_6	Quizalofop-ethy 5% EC	12550	2100	14650	28304	13654	1:0.93

The sale rate for soybean grain and stover were Rs. 3000/q and Rs.300/q, respectively.

References

1. Anonymous. Soybean Processors Association of India, SOPA Souvenir. All India Conversation of Oilseed and Oil Trade and Industries, 2014, 15p.
2. Bhan M, Kewat ML. Activity and persistence of pendimethalin applied pre- emergence to soybean in Vertisol, Ann. Agri. Res., New Series. 2003; 24(4):978-982.
3. Halvankar GB, Varghese P, Taware SP, Raut VM. Effect of herbicide on weed dynamics and yield of soybean (*Glycine max* (L) Merrill). J. Maha. agril. Univ. 2005; 30(1):35-37.
4. Chetan F, Cornel C, Rusu T, Simon A. Determining influence on the cultivation technology on weeds and soybean production. Production Environment. 2015; 8:211- 215.
5. Dwivedi RK, Pandre NK, Ahirwar MK. Integrated Weed Management in Soybean through Front Line Demonstration in Farmer's Field. International Journal of Current Microbiology and Applied Sciences. 2019; 8(11):880-883.
6. Jackson ML. Soil chemical analysis Pub. Prentice Hall of India Pvt. Ltd. New Delhi, 1967.
7. Kheriya A, Jha AK, Dubey J. Effect of Chemical Weed Control on Weed Flora and Yield of Soybean. Advances in Life Sciences. 2016; 5(16).
8. Kulal DA, Dhaigude GS, Adat SS. Evaluation of efficacy of post - emergence herbicides for weed control in soybean under Marathwada region. International Journal of Agricultural Sciences. 2017; 13(1):53-55.
9. Olsen SR, Cole CV, Watanabe FS, Dean LA. Estimation of available Phosphorus in soils by extraction with sodium bicarbonate. U.S.D.A. Circ., 1954, 939.
10. Patel A, Spare N, Malgaya G. Bio-Efficacy of Post Emergence Herbicides against Weed Control in Soybean. International Journal of Current Microbiology and Applied Sciences. 2019; 8(4):1964-1974.
11. Patil AS, Bhavsar MS, Deore PS, Raut DM. Effect of Integrated Weed Management on Weed Dynamics of Soybean [*Glycine max* (L.) Merill] under Junagadh, India. International Journal of Current Microbiology and Applied Sciences. 2018; 7(1):1110-1115.
12. Piper C. Soil and plant analysis. University of Adelaide, Australia, 1950.
13. Prachand S, Kubde KJ, Bankar S. Effect of chemical weed control on weed parameters, growth, yield attributes, yield and economics in Soybean (*Glycine max*). American Eurasian Journal Agricultural and Environment Science. 2014; 14(8):698-701.
14. Sandil MK, Sharma JK, Sanodiya P, Pandey A. Bio-efficacy on tank mixed Propaquizafop and Imazethapyr against weeds in soybean. Indian Journal of Weed Science. 2015; 47(2):158-162.
15. Sharma GD, Sharma JJ, Sonisood. Evaluation of alachlor, metachlor and pendimethanlin for weed control in Rajmash (*Phaseolus valgaris* L.) in cold desert of

North Western Himalayas. Indian J. Weed Sci. 2004; 36(3-4):287-289.
16. Subbhiah BV, Asija GL. A rapid method for estimation of nitrogen in soil. Current Science. 1956; 25:259-250.
17. Thakre SS, Deshmukh JP, Shingrup PV, Pawar PM, Ghlop AN. Efficacy of different new herbicides against weed flora in soybean (*Glycine max* (L.) Merrill). Plant Archives. 2015; 15(1):217-220.
18. Tiwari JP, Kurchania SP, Paradkar NR, Bhalla SP. Varietal susceptibility and weed control efficiency of fluazifop-p-butyl in soybean (*Glycine max*). Indian J. agric. Sci. 1997; 67(4):147-149.
19. Vyas MD, Singh S, Singh PP. Weed management in soybean (*Glycine max* (L.) Merrill). Annals of Plant Protection Sci. 2000; 8(1):76-78.
20. Walkley A, Black CA. An examination of degtjareff for determining soil organic matter and a proposed modification of the chromic acid titration method. Soil Science. 1934; 37:29-38.