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Study the physiological growth parameters and affected by post-emergence herbicidal application on soybean [*Glycine max* (L.) Merrill] crop

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Abstract
An experiment conducted at Research Farm, Eklavya University, Damoh, Madhya Pradesh in *Kharif* session 2021-22. The treatments of foliar application of weedicide/herbicide in different doses significantly influenced LAI, LAD, CGR and RGR. A progressive pattern of increase in LAI was noted up to 60 DAS and decreased at 75 DAS. Treatment continued to produce significantly highest LAI T_{14} (1.425 days) at 30 days, T_{14} (2.795 days) at 45 days, T_{14} (4.468 days) at 60 days and T_{14} (3.602 days) at 75 days. A slower rate of CGR was recorded during 45-60 DAS then again increase in rate of CGR during 60-75 was noted. Treatment sustained to produce significantly highest CGR T_{14} (0.00107 days) at 30-45 days, T_{14} (0.00166 days) at 45-60 days, T_{14} (0.00314 days) at 60-75 days and T_{13} noted minimum CGR at all growth stages.

Keywords: Leaf area index (LAI), leaf area duration (LAD), relative growth rate (RAG), crop growth rate (CGR)

1. Introduction
In India, soybean [*Glycine max* (L.) Merrill] is quickly taking over as the most significant oil seed crop. It is a legume crop that is a member of the subfamily Papilionaceae of the family Leguminosae or Fabaceae. In India as well as the rest of the globe, soybean is known as the "Golden Bean," "Miracle Crop," or "Yellow Jewel" oil seed crop that offers affordable and wholesome food. A substantial and affordable source of protein for animal feeds and many prepared foods is fat-free soybean meal. The most significant oilseed crop in the world is soybean.

It is used as an oil seed crop, livestock and aquaculture feed, a healthy source of protein for people, and a feedstock for biofuels (Masuda and Goldsmith 2009) [6]. In India, soybeans are grown on 12.032 million hectares, with an average yield of 1079 kg per hectare and an annual production of 12.98 million tonnes. Madhya Pradesh is the largest state in terms of both size (56.69 lakh hectares) and production (60.25 lakh million tonnes), with an average productivity of 1086 kg ha^{-1} (SOPA, 2016) [10]. The world top oilseed is soybean, which has recently gained prominence in India (Mahna, 2005) [5]. 35–40% protein, 19% oil, 35% carbohydrate (17% of which is dietary fibre), 5% minerals, and several other ingredients, including vitamins, make up the chemical composition of soybean (Liu, 1997) [4]. The region most favourable agro-climatic conditions promote the growth of weeds, which significantly lower crop production. Weeds compete with crops for moisture, nutrients and sunlight, which has a negative impact on crop growth and yield qualities (Muniappa *et al.*, 1975) [8]. About 8% of soybeans are seed coat or hull, 90% are cotyledons, and 2% are hypocotyls axis or germ. The term "poor man meat" refers to soybeans because of their high protein content. Due to their high bioavailability, they are also a good source of calcium, iron, zinc, potassium, magnesium, folate and the B vitamins (thiamine, riboflavin, and niacin).

2. Materials and Methods
The experimental material for this study consisted of design Randomized Block Design (RBD), replications 3, treatments 14.

Treatment details

Treatment	Doses (g *a.i.*/hac)
T_1-Pendimethalin	750
T_2-Metribuzin	300
T_3-Imazethapyr	80
T_4-Chlorimuron	4
T_5-Fenoxaprop-p-ethyl	70
T_6-Pendimethalin + Fenoxaprop-p-ethyl	750 + 70
T_7-Metribuzin + Fenoxaprop-p-ethyl	300 + 70
T_8-Imazethapyr + Fenoxaprop-p-ethyl	80 + 70
T_9-Chlorimuron + Fenoxaprop-p-ethyl	4 + 70
T_{10}-Pendimethalin+ HW (Hand Weeding) 30 DAS	750
T_{11}-Metribuzin + HW (Hand Weeding) 30 DAS	300
T_{12}-Pendimethalin + Imazethapyr	750 + 80
T_{13}-Unweeded check (No weed control)	-
T_{14}-Weed free check	-

2.1 Factors for growth

2.1.1 Leaf Area Index (LAI)

As determined by the criteria of the LAI, the ratio of the leaf surface (on one side only) to the ground area occupied by the plant or crop stand Gardner *et al*. (1985).

$$LAI = \frac{\text{Total leaf area}}{\text{Land area}} \quad LAI = \frac{(LA_2 + LA_1)}{2/p}$$

Where, LA_1 and LA_2 represent leaf area during two consecutive intervals and 'P' ground area.

2.1.2 Leaf Area Duration (LAD)

The duration of leaf area or leafiness during the growing season of the crop reflects its size and persistence. It is associated with yield and indicates the strength of the seasonal integral of light interaction. This is how LAD was calculated: (Watson, 1952).

$$LAD = \frac{(LA_2 + LA_1)}{2} X (t_2 - t_1) (cm^2. days)$$

Where, LA_1 and LA_2 represent the leaf area at two successive time intervals (t_1 and t_2).

2.1.3 Crop Growth Rate (CGR)

According to Watson (1952), the daily increase in plant biomass is referred to as the crop growth rate, productivity rate, or rate of dry matter production. It was calculated using the following formula, which was recommended.

$$CGR = \frac{W_2 - W_1}{p\,(t_2 - t_1)} \quad (g\ cm^{-2}\ day^{-1})$$

Where, p = ground area (m^2); W_1 = dry weight per unit area at t_1; W_2 = dry weight per unit area at t_2; t_1 = first sampling; t_2 = second sampling

2.1.4 Relative Growth Rate (RGR)

The dry weight increase over time compared to initial weight is expressed by the relative growth rate. In real-world circumstances, measurements taken at t_1 and t_2 are used to calculate the mean relative growth rate. It was determined using the formula provided by (Watson, 1952).

$$RGR = \frac{Ln\ W_2 - Ln\ W_1}{t_2 - t_1} \quad (g\ g^{-1}\ day^{-1})$$

W_1& W_2 are dry weight of plants at two successive intervals t_1 and t_2, Ln - Natural log.

3. Result and Discussion

3.1 Leaf area index (LAI)

LAI was considerably influenced by the treatments of foliar spray of weedicide/herbicide in various concentrations. At 30 DAS, T_{14} (1.425) was expressly highlighted to have larger LAI levels than the rest, followed by T_{10} (1.368), albeit there was a considerable difference between the two. T_{13} (0.932) contains the minimum. The T_{14} (2.795) greatly outperformed the LAI at 45 DAS, followed by the T_{11} (2.618). The notably lowest value (2.280) was noted in T_{13}. The results showed that treatments T_{14} (4.468) had the greater LAI at 60 DAS. The lowest magnitudes for this feature were found in treatment T_{13} (4.045), on the other hand. The findings showed that treatment T_{14} (3.602) had the highest LAI at 75 DAS, while being on par with T_{11} (3.540). The lowest LAI was reported by Treatment T_{13} (3.075). A plant with optimum LAI and NAR may must higher biological yield as well as seed yield (Mondal *et al.*, 2007). According to Chandraker *et al.* (2016), as plant population density grows, the leaf area index (LAI) increases while the leaf weight per plant falls. Herbicides also boosted significant physiological characteristics as leaf area, LAD, RGR, CGR and NAR, according to Amaregouda *et al.* (2013) [1] research. In contrast, weed competition decreased all of these factors.

3.2 Leaf area duration (LAD cm^2.days)

Different foliar weedicide/herbicide treatment concentrations have an impact on LAD at various crop growth stages. The results showed that at 30-45 DAS, T_{14} had the significantly greatest LAD (9585.98), followed by T_{10} (9465.12), while T_{13} had the significantly lowest 7320.65 value. The significant highest LAD for the treatment T_{14} at 45–60 DAS was 16492.28, followed by T_{10} (16336.06). T_{13} had the significant lowest value, which were 14343.72. At 60–75 DAS, the data showed that treatment T_{14} (18318.50) indicated the greatest LAD, followed by treatment T_{11} (18252.98), and that T_{13} (16218.09) indicated the significant minimal LAD. The application of post emergence herbicide's imazethapyr 200 g *a.i.* ha^{-1}, Chlorimuron 9.37 g *a.i.* ha^{-1} can directly or indirectly influence the physiological activities in plant growth and development such as two hand weeding at 20 and 40 DAS, have been reported to modulate the growth, production and quality of soybean seed Shiraiwa *et al.*, (2004).

3.3 Crop growth rate (CGR g $cm^{-2}day^{-1}$)

At various phases of crop growth, CGR was affected by different soil treatments and foliar weed/herbicide applications. The results showed that treatments T_{14} (0.00107) had the highest CGR production at 30-45 DAS, on par with treatments T_{10} (0.00106). T_{13} contained the significant minimum value of 0.00084. The maximum CGR followed by the treatment T_{14} (0.00166) treatment at 45–60 DAS did not significantly differ from the treatment T_{11} (0.00162) treatment. T_{13} contained the significant minimum value of 0.00105. The findings indicated that maximum CGR was demonstrated by T_{14} (0.00314) at 60–75 DAS and did not substantially differ from the treatment T_{10} (0.00310). T_{13} has the significant lowest value (0.00217). Shiraiwa *et al.*, (2004) revealed that the yield significantly and positively correlated with crop growth rate (CGR) during the 20 days period after the beginning of seed filling (R_5), *i.e.* initial seed filling stage.

3.4 Relative growth rate (RGR g $g^{-1}day^{-1}$)

The outcomes demonstrated the considerable RGR disparities between treatments over the course of the analysis. The therapy T_{14} (0.0463) had the highest significant RGR at 30-45 DAS, followed by T_{10} (0.0460). T_{13} contained the significant minimum value (0.0402). T_{14} (0.0381) had the significantly greatest RGR at 45–60 DAS, followed by T_{10} (0.0380). T_{13} recorded the significant lowest value (0.0342). According to the findings, at 60–75 DAS, treatment T_{14} (0.0344) revealed the highest RGR, followed by treatment T_{11} (0.0341). In T_{13} (0.0301), the considerable minimum RGR was noted. The RGR data indicated that it dropped as expansion progressed, reaching its peak at 30-45 DAS. Tandale and Ubale (2007) described in RGR at 30-60 DAS showed a significant and positive correlation with seed yield.

Table 1: Effect of weedicide treatment in different doses on LAI, LAD, CGR and RGR at different growth stages

Treatments	Leaf area index				Leaf area duration (cm^2 days)			Crop growth rate (g $cm^{-2}day^{-1}$)			Relative growth rate ($g^{-1}day^{-1}$)		
	Days after sowing												
	30	45	60	75	30-45	45-60	60-75	30-45	45-60	60-75	30-45	45-60	60-75
T_1	1.135	2.448	4.327	3.345	8239.44	15432.12	17435.31	0.00104	0.00159	0.00265	0.0442	0.0371	0.0316
T_2	1.038	2.339	4.212	3.258	7889.08	15351.32	16916.29	0.00105	0.00151	0.00269	0.0425	0.0345	0.0309
T_3	1.258	2.568	4.353	3.414	9359.12	16086.09	17609.19	0.00099	0.00143	0.00304	0.0432	0.0358	0.0335
T_4	1.263	2.232	4.148	3.315	8790.32	15012.48	18156.28	0.00097	0.00149	0.00250	0.0451	0.0365	0.0322
T_5	1.286	2.578	4.254	3.454	9084.56	16134.22	17281.42	0.00103	0.00153	0.00272	0.0447	0.0352	0.0328
T_6	1.348	2.414	4.321	3.372	7587.81	15816.65	16572.36	0.00101	0.00131	0.00305	0.0449	0.0371	0.0319
T_7	1.325	2.512	4.198	3.427	8514.16	16212.95	17945.24	0.00105	0.00125	0.00298	0.0440	0.0354	0.0312
T_8	1.222	2.414	4.346	3.186	8682.71	15837.16	17635.65	0.00100	0.00157	0.00256	0.0453	0.0362	0.0310
T_9	1.115	2.311	4.238	3.438	8972.36	15981.26	17316.56	0.00098	0.00132	0.00268	0.0436	0.0355	0.0339
T_{10}	1.368	2.315	4.425	3.507	9465.12	16336.06	18251.34	0.00106	0.00160	0.00310	0.0460	0.0380	0.0340
T_{11}	1.360	2.618	4.406	3.540	9395.27	16331.06	18252.98	0.00102	0.00162	0.00308	0.0456	0.0372	0.0341
T_{12}	1.189	2.608	4.238	3.298	8813.44	16252.09	17831.32	0.00092	0.00158	0.00286	0.0418	0.0364	0.0332
T_{13}	0.932	2.280	4.045	3.075	7320.65	14343.72	16218.09	0.00084	0.00105	0.00217	0.0402	0.0342	0.0301
T_{14}	1.425	2.795	4.468	3.602	9585.98	16492.28	18318.50	0.00107	0.00166	0.00314	0.0463	0.0381	0.0344
Mean	1.23	2.46	4.28	3.37	8692.86	15829.96	17552.90	0.00100	0.00147	0.00280	0.0441	0.0362	0.0325
S.E(m)±	0.0040	0.0046	0.0033	0.0041	20.53	17.39	18.71	0.000064	0.000005	0.000008	0.00005	0.00003	0.00004
CD at 5%	0.0117	0.0135	0.01	0.01	59.68	50.55	54.39	0.00019	0.00001	0.00002	0.00014	0.00010	0.00012

4. Conclusion

Among the treated plants also expressed higher LAI (4.468), LAD (18318.50 cm^2. days), CGR (0.00314 g cm^{-2} day^{-1}) and RGR (0.0463 g g^{-1} day^{-1}).

5. References

1. Amaregouda A, Jadhav J, Chetti MB. Effect of Weedicides on Physiological parameters, Growth, Yield and Yield components of Soybean (*Glycine max*, L.) and Weed Growth. Journal of Agriculture and Allied sciences. 2013:2(4):12-15.
2. Chandraker AK, Paikra PR. Effect of integrated weed management on weed dynamics of soybean [*Glycine max* (L.) Merrill] under Chhattisgarh plain Indian J Agric. Res. 2016;49(1):53-58.
3. Gardner FP, Pearecer RB, Mitchell RL. Growth and development in physiology and crop plants. The IOWA, State Univ. Press; c1985. p. 187-208.
4. Liu K. In: Soybeans: Chemistry, Technology and Utilization. Chapman and Hall, International Thomson Publishing, Singapore; c1997. p. 532.
5. Mahna SK. Production, regional distribution of cultivars, and agricultural aspects of soybean in India. 2005 Chapter 4. D., Werner and W. E. Newton (eds.), Nitrogen Fixation in Agriculture, Forestry, Ecology, and the Environment, Springer. Printed in the Netherlands; c2005. p. 43-46.
6. Masuda T, Goldsmith PD. World Soybean production: Area harvested, yield, and long-term projections. International Food and Agribusiness Management Review. 2009;12:143-162.
7. Mondal MMA, Howlader MHK, Akter MB, Dutta RK. Evaluation of five advanced lentil mutants in relation to morpho-physiological characters and yield. Bangladesh Journal Crop Sciences. 2007;18:367-372.
8. Muniyappa TV, Ramachandraprasad TV, Kumar Rao JVD, Krishnamurthy K. Pre emergence spray of alachlor can effectively control weed in soybean. Curr. Res. 1975;4:21-23.
9. Shiraiwa T, Ueno N, Shimada S, Horie T. Correlation between Yielding Ability and Dry Matter Productivity during Initial Seed Filling Stage in Various Soybean Genotypes, Plant Production Science. 2004;7:138:138-142.
10. SOPA. The Soybean Processors Association of India; c2016. e-mail: sopa@sopa.org.
11. Tandale MD, Ubale SS. Effect of growth parameters, leaf area index, leaf area duration, crop growth rate on seed yield of soybean during Kharif season. International Journal Agricultural Sciences. 2007;3(1):119-123.
12. Watson DJ. Physiological basis of varieties in yield. Advance in Agronomy. 1952;4:101-145.