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**MR Kadivar**
Department of Agronomy, College of Agriculture, Junagadh Agricultural University, Junagadh, Gujarat, India

**BS Gohil**
Department of Agronomy, College of Agriculture, Junagadh Agricultural University, Junagadh, Gujarat, India

**BP Solanki**
Department of Agronomy, College of Agriculture, Junagadh Agricultural University, Junagadh, Gujarat, India

**KB Sangani**
Department of Agronomy, College of Agriculture, Junagadh Agricultural University, Junagadh, Gujarat, India

**Corresponding Author:**
**MR Kadivar**
Department of Agronomy, College of Agriculture, Junagadh Agricultural University, Junagadh, Gujarat, India

# Effect of weed management on growth, yield and quality of summer soybean

**MR Kadivar, BS Gohil, BP Solanki and KB Sangani**

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**Abstract**
A trial entitled "Effect of plant extracts, straw mulch and herbicides on weed growth and yield of summer soybean" was carried out in the Weed Control Research Farm, Junagadh Agricultural University, Junagadh, on medium black calcareous soil during the summer season of 2023. The 12-treatments experiment was set up in a randomized block design with three replications. The results revealed that next to weed free treatment, pendimethalin 900 g/ha as pre-emergence fb IC & HW at 30 DAS ($T_8$) or pre-mix pendimethalin 30% + imazethapyr 2% EC 750+50 g/ha as PE fb pre-mix fluazifop-p-butyl 11.1% + fomesafen 11.1% SL 125+125 g/ha at 30 DAS ($T_{10}$) enhanced growth parameters *viz*., plant height, number of branches per plant at harvest; yield attributes *viz*., number of pods per plant, seed index and ultimately gave higher seed and stover yields. Also gave significantly higher gross and net returns as well as BCR.

**Keywords:** Plant extracts, straw mulch, herbicides, soybean, yield, economics

## Introduction
Soybean (*Glycine max* L. Merrill) is a legume cum oilseed crop. It belongs to family Fabaceae and sub-family Faboideae. It is a tremendously resilient crop performing well under a wide range of geographical conditions and even under water stress conditions. It has high yield potential, wider adaptability, short duration and very high nutritional value having a vast multiplicity of uses as food as well as industrial products (Tripathi and Misra, 2005) [16]. It gives profitable returns under minimum agricultural inputs and management practices hence fits well in various cropping systems/rotations. It provides 40% protein and 20% edible oil, besides minerals and vitamins. Soybean is rich in polyunsaturated fatty acids (linoleic and oleic acid) along with a good amount of minerals (Ca, P, Mg, Fe and K) and vitamins especially B-complex and tocopherols (Devi *et al*., 2012) [3]. Another significance of this crop is in its ability to fix atmospheric nitrogen. Due to its various uses, it is called as "Golden gift" of nature to humanity. The total production of soybean in the world is estimated around 385.524 million tonnes during 2021-22. Five major producing countries (Brazil, USA, Argentina, China and India) account for more than 89.76% of global soybean production (Anon., 2022) [2].
Weed management is of great prominence for obtaining high soybean yields. Weed species is a severe problem for the soybean crops and its control is needed especially in infested sides. Heavy infestation of weeds with grasses, broad-leaved and sedges poses a big task for soybean production. Initial slow growth of this crop coupled with little lateral spread increase opportunity for weeds to easily occupy vacant spaces between rows and other serious competition with crop. Simultaneous emergence and rapid growth of weed species caused severe crop-weed competition and reduce crop yields to extent of 30-80% depending on weed flora and density (Kurchania *et al*., 2001) [7]. In soybean crop, first 20 to 45 days after sowing is considered the most critical period of weed competition and at that time, weeds are to be kept under control for optimum yield (Sharma, 2007) [14]. The intensity of weeds in early and later stage can be controlled by suitable combination of physical, chemical, cultural, mechanically, and possibly biological weed control techniques to achieve maximum yield. Development of integrated weed management that is economically viable as well as ecologically safe is of at most important to control the weed effectively and improve productivity.

## Materials and Methods

In Junagadh, the experiment was conducted during the 2023 summer season at the Weed Control Research Farm. Throughout the crop growth and development period, the mean maximum and lowest temperatures varied from 31.2 to 40.6 °C and 13.8 to 27.7 °C, respectively. Fourteen treatments were arranged in an RBD design with three replications for the experiment. The experimental plot's soil had a clayey texture, a high level of organic carbon (0.81%), and an alkaline pH of 8.31 with an EC of 0.45 dS $m^{-1}$. The soil exhibited a medium level of accessible nitrogen (386.00 kg $ha^{-1}$), along with high levels of available phosphorus (84.12 kg $ha^{-1}$) and potassium (230.00 kg $ha^{-1}$).

The soybean (*cv*. GJS-3) was sown on 24th February, 2023 at 45 cm x 10 cm using for sowing in nursery for raising the seedlings with seed rate of 60 kg $ha^{-1}$and harvested on 23 May 2023. The onion was fertilized with 30-60-00 NPK kg $ha^{-1}$along with FYM 10 t $ha^{-1}$. Plant extracts and herbicides were sprayed according to treatments using a hand (knapsack) sprayer with a flat fan nozzle and a spray capacity of 500 L/ha. The data were statistically examined using the proper analysis of variance, following the guidelines provided by Gomez and Gomez (1984) [6]. The important difference (CD) values/DNMRT were computed for every F value that was determined to be significant at the 5% level of probability in order to compare the treatment means.

The plant extracts were prepared by following method. First washed the plant with the distilled water and chopped it into 2 cm pieces then shade dried them at normal temperature for 10 days. After drying the plant, grinded it to fine powder. Used this powder in 1:10 ratio with water and soaked it overnight after that filtered it with whatman filter paper No. 1 then boiled the extract until it become half of its original volume (Geethika *et al*., 2020) [4].

## Results and Discussion

### A. Effect on growth and yield attributes

An appraisal of data Table 1 on growth and yield attributing parameters showed that noticeably higher values of the growth and yield attributing characteristics, *viz*., plant height, number of branches per plant, number of pods per plant and 100-seed weight, were observed under the weed free check ($T_{11}$), followed by pendimethalin 900 g/ha as pre-emergence *fb* IC & HW at 30 DAS ($T_8$), pre-mix pendimethalin 30% + imazethapyr 2% EC 750+50 g/ha as PE *fb* pre-mix fluazifop-p-butyl 11.1% + fomesafen 11.1% SL 125+125 g/ha at 30 DAS ($T_{10}$). It might be due efficient control of weeds by combination of hand weeding with pre-emergence herbicide or combination of pre-emergence and pre-mix post-emergence herbicides as evidenced by less number of weeds and dry weight of weeds resulted in better growth parameters and in turn increased the yield attributes. These results are nearly identical to those of Shaktawat *et al.* (2017) [13], Samudre *et al*. (2019) [11] and Rupareliya *et al.* (2020) [10].

**Table 1:** Effect of diverse weed management treatments on plant height, no. of branches/plant, no. of pods/plant and 100-seed weight (g)

| Treatments | Plant height (cm) | No. of branches/plant | No. of pods/plant | 100-seed weight (g) |
|---|---|---|---|---|
| T1: *Parthenium* extract 20 L/ha at 15 and 30 DAS | $35.87^{cde}$ | $3.53^{cd}$ | $33.93^{bc}$ | $8.58^{cd}$ |
| T2: *Eucalyptus* leaves extract 20 L/ha at 15 and 30 DAS | $34.20^{de}$ | $3.52^{cd}$ | $33.60^{c}$ | $8.57^{cd}$ |
| T3: Sorghum extract 20 L/ha at 15 and 30 DAS | $38.73^{bcd}$ | $3.70^{bcd}$ | $38.33^{ab}$ | $9.86^{b}$ |
| T4: Sunflower extract 20 L/ha at 15 and 30 DAS | $33.33^{ef}$ | $3.38^{d}$ | $27.33^{d}$ | $9.47^{bc}$ |
| T5: Mix weed flora extract 20 L/ha at 15 and 30 DAS | $36.97^{cde}$ | $3.63^{bcd}$ | $34.53^{bc}$ | $9.73^{bc}$ |
| T6: Wheat straw extract 20 L/ha at 15 and 30 DAS | $33.57^{e}$ | $3.50^{cd}$ | $28.80^{d}$ | $9.47^{bc}$ |
| T7: Wheat straw mulch 5 t/ha at 15 DAS | $39.67^{abc}$ | $3.73^{bcd}$ | $38.53^{ab}$ | $9.85^{b}$ |
| T8: Pendimethalin 900 g/ha as pre-emergence fb IC & HW at 30 DAS | $43.50^{ab}$ | $3.93^{ab}$ | $41.70^{a}$ | $9.98^{ab}$ |
| T9: Pre-mix fluazifop-p-butyl 11.1% + fomesafen 11.1% SL 125+125 g/ha as PoE at 20 DAS | $39.87^{abc}$ | $3.78^{abc}$ | $39.53^{a}$ | $9.83^{b}$ |
| $T_{10}$: Pre-mix pendimethalin 30% + imazethapyr 2% EC 750+50 g/ha as PE fb pre-mix fluazifop-p-butyl 11.1% + fomesafen 11.1% SL 125+125 g/ha at 30 DAS | $43.07^{ab}$ | $3.90^{ab}$ | $40.60^{a}$ | $9.97^{ab}$ |
| $T_{11}$: Weed free check | $44.17^{a}$ | $4.10^{a}$ | $42.80^{a}$ | $11.07^{a}$ |
| $T_{12}$: Unweeded check | $28.40^{f}$ | $2.87^{e}$ | $25.43^{d}$ | $7.66^{d}$ |
| S.Em.± | 1.71 | 0.12 | 1.60 | 0.40 |
| C.D. at 5% | 5.03 | 0.34 | 4.69 | 1.17 |
| C.V.% | 7.89 | 5.50 | 7.82 | 7.25 |

PE: pre-emergence, PoE: post-emergence, HW: Hand weeding, IC: Inter-culturing DAS: Days after sowing

### B. Effect on yield

A data narrated in Table 2 showed revealed that many weed control techniques had a substantial impact on the yields of seed and stover but not significant effect on harvest index. Notably, there were increased yields of soybean seed and stover were seen with the weed-free check ($T_{12}$), followed by pendimethalin 900 g/ha as pre-emergence *fb* IC & HW at 30 DAS ($T_8$) and pre-mix pendimethalin 30% + imazethapyr 2% EC 750+50 g/ha as PE *fb* pre-mix fluazifop-p-butyl 11.1% + fomesafen 11.1% SL 125+125 g/ha at 30 DAS ($T_{10}$). The higher seed and stover yields under these treatments could be ascribed to better control of weeds might have favoured higher uptake of nutrients and water. The current results are in similar proximity to those that have been documented with other weed control methods by Ahirwar *et al.* (2018) [1], Susmitha *et al.* (2019) [15] and Ghosh and Pramanik (2020) [5].

**Table 2:** Effect of various weed management treatments on seed yield, stover yield and harvest index of soybean

| Treatments | Seed yield (kg/ha) | Stover yield (kg/ha) | Harvest index (%) |
|---|---|---|---|
| T1: *Parthenium* extract 20 L/ha at 15 and 30 DAS | 852$^{c}$ | 1309$^{c}$ | 39.7 |
| T2: *Eucalyptus* leaves extract 20 L/ha at 15 and 30 DAS | 818$^{c}$ | 1222$^{c}$ | 40.4 |
| T3: Sorghum extract 20 L/ha at 15 and 30 DAS | 1481$^{b}$ | 2040$^{b}$ | 42.1 |
| T4: Sunflower extract 20 L/ha at 15 and 30 DAS | 802$^{c}$ | 1204$^{c}$ | 40.0 |
| T5: Mix weed flora extract 20 L/ha at 15 and 30 DAS | 907$^{c}$ | 1460$^{c}$ | 38.4 |
| T6: Wheat straw extract 20 L/ha at 15 and 30 DAS | 787$^{c}$ | 1204$^{c}$ | 39.4 |
| T7: Wheat straw mulch 5 t/ha at 15 DAS | 1543$^{b}$ | 2160$^{b}$ | 41.6 |
| T8: Pendimethalin 900 g/ha as pre-emergence fb IC & HW at 30 DAS | 1657$^{ab}$ | 2278$^{ab}$ | 42.2 |
| T9: Pre-mix fluazifop-p-butyl 11.1% + fomesafen 11.1% SL 125+125 g/ha as PoE at 20 DAS | 1528$^{b}$ | 2210$^{ab}$ | 41.0 |
| $T_{10}$: Pre-mix pendimethalin 30% + imazethapyr 2% EC 750+50 g/ha as PE fb pre-mix fluazifop-p-butyl 11.1% + fomesafen 11.1% SL 125+125 g/ha at 30 DAS | 1648$^{ab}$ | 2330$^{ab}$ | 41.4 |
| $T_{11}$: Weed free check | 1778$^{a}$ | 2485$^{a}$ | 41.6 |
| $T_{12}$: Unweeded check | 454$^{d}$ | 901$^{d}$ | 34.2 |
| S.Em.± | 71 | 102 | 2.20 |
| C.D. at 5% | 207 | 299 | NS |
| C.V.% | 10.28 | 10.19 | 9.51 |

**C. Effect on quality**

A data narrated in Table 3 showed revealed that different treatments found non-significant on seed protein and oil content, but significant effect on oil yield. Significantly, highest oil yield was recorded under the weed free check ($T_{11}$), which was followed by pendimethalin 900 g/ha as pre-emergence *fb* IC & HW at 30 DAS ($T_8$), pre-mix pendimethalin 30% + imazethapyr 2% EC 750+50 g/ha as PE *fb* pre-mix fluazifop-p-butyl 11.1% + fomesafen 11.1% SL 125+125 g/ha at 30 DAS ($T_{10}$) and pre-mix fluazifop-p-butyl 11.1% + fomesafen 11.1% SL 125+125 g/ha as PoE at 20 DAS ($T_9$). Higher seed yield in above-mentioned treatments ultimately resulted in higher oil yield. These results are nearly identical to those of Nainwal and Saxena (2023) [8].

**Table 3:** Effect of various weed management treatments on protein content, oil content and oil yield of soybean

| Treatments | Protein content (%) | Oil content (%) | Oil yield (kg/ha) |
|---|---|---|---|
| T1: *Parthenium* extract 20 L/ha at 15 and 30 DAS | 34.1 | 19.5 | 166$^{c}$ |
| T2: *Eucalyptus* leaves extract 20 L/ha at 15 and 30 DAS | 33.9 | 19.4 | 159$^{c}$ |
| T3: Sorghum extract 20 L/ha at 15 and 30 DAS | 36.6 | 19.6 | 291$^{b}$ |
| T4: Sunflower extract 20 L/ha at 15 and 30 DAS | 33.2 | 18.8 | 151$^{c}$ |
| T5: Mix weed flora extract 20 L/ha at 15 and 30 DAS | 34.5 | 19.6 | 178$^{c}$ |
| T6: Wheat straw extract 20 L/ha at 15 and 30 DAS | 33.9 | 18.8 | 150$^{c}$ |
| T7: Wheat straw mulch 5 t/ha at 15 DAS | 35.1 | 19.6 | 303$^{b}$ |
| T8: Pendimethalin 900 g/ha as pre-emergence fb IC & HW at 30 DAS | 38.2 | 19.8 | 328$^{ab}$ |
| T9: Pre-mix fluazifop-p-butyl 11.1% + fomesafen 11.1% SL 125+125 g/ha as PoE at 20 DAS | 36.7 | 19.7 | 301$^{b}$ |
| $T_{10}$: Pre-mix pendimethalin 30% + imazethapyr 2% EC 750+50 g/ha as PE fb pre-mix fluazifop-p-butyl 11.1% + fomesafen 11.1% SL 125+125 g/ha at 30 DAS | 37.5 | 19.7 | 325$^{ab}$ |
| $T_{11}$: Weed free check | 39.0 | 19.9 | 353$^{a}$ |
| $T_{12}$: Unweeded check | 32.2 | 18.6 | 84$^{d}$ |
| S.Em.± | 1.44 | 0.72 | 15 |
| C.D. at 5% | NS | NS | 44 |
| C.V.% | 7.02 | 6.46 | 11.17 |

**D. Economics**

The data in Table 4 was showed that the cultivation cost (62093 ₹/ha) and highest gross profits (120525 ₹/ha) were obtained with weed free ($T_{13}$). The higher gross returns under this treatment could be due to better seed and stover yields. The higher cost of cultivation under this treatment was owing to higher cost of manual weeding and pre-planting herbicides and its application cost. Maximum net realization of (61563 ₹/ha) and higher B:C ratio (2.21) was obtained with the application of pendimethalin 900 g/ha as pre-emergence *fb* IC & HW at 30 DAS ($T_8$). This might be due to effective and efficient control of weeds by integration of hand weeding and pre-emergence herbicide. In addition to increased seed and stover yields, the comparatively cheaper cost of herbicides when compared to hand weeding contributed to the larger advantages under these treatments. The outcomes correspond with those of Geethika *et al*. (2020) [4], Satyanarayan *et al*. (2021) [12] and Poddar *et al*. (2023) [9].

**Table 4:** Effect of distinct weed management treatments on economics of soybean

| Treatments | Gross return (₹/ha) | Cost of cultivation (₹/ha) | Net return (₹/ha) | B:C Ratio |
|---|---|---|---|---|
| T1: *Parthenium* extract 20 L/ha at 15 and 30 DAS | 57988 | 47226 | 10761 | 1.23 |
| T2: *Eucalyptus* leaves extract 20 L/ha at 15 and 30 DAS | 55608 | 47226 | 8382 | 1.18 |
| T3: Sorghum extract 20 L/ha at 15 and 30 DAS | 100377 | 47226 | 53150 | 2.13 |
| T4: Sunflower extract 20 L/ha at 15 and 30 DAS | 54568 | 47226 | 7341 | 1.16 |
| T5: Mix weed flora extract 20 L/ha at 15 and 30 DAS | 61901 | 47226 | 14675 | 1.31 |
| T6: Wheat straw extract 20 L/ha at 15 and 30 DAS | 53565 | 47226 | 6338 | 1.13 |
| T7: Wheat straw mulch 5 t/ha at 15 DAS | 104630 | 48247 | 56383 | 2.17 |
| T8: Pendimethalin 900 g/ha as pre-emergence fb IC & HW at 30 DAS | 112287 | 50724 | 61563 | 2.21 |
| T9: Pre-mix fluazifop-p-butyl 11.1% + fomesafen 11.1% SL 125+125 g/ha as PoE at 20 DAS | 103725 | 47981 | 55744 | 2.16 |
| $T_{10}$: Pre-mix pendimethalin 30% + imazethapyr 2% EC 750+50 g/ha as PE fb pre-mix fluazifop-p-butyl 11.1% + fomesafen 11.1% SL 125+125 g/ha at 30 DAS | 111790 | 51071 | 60719 | 2.19 |
| $T_{11}$: Weed free check | 120525 | 62093 | 58432 | 1.94 |
| $T_{12}$: Unweeded check | 31293 | 44603 | -13310 | 0.70 |

## Conclusion

Based on the results, it is possible to produce soybean profitably and effectively control complex weed flora with a greater yield by either application of pendimethalin 900 g/ha as pre-emergence *fb* IC & HW at 30 DAS OR pre-mix pendimethalin 30% + imazethapyr 2% EC 750+50 g/ha as PE *fb* pre-mix fluazifop-p-butyl 11.1% + fomesafen 11.1% SL 125+125 g/ha at 30 DAS.

## Author's contributions

Each author worked collaboratively to complete this research project. The completed work was read and approved by all writers.

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## References

1. Ahirwar SK, Ahirwar AD, Alawa SL, Deshmukh G. Effect of weed management and fertility levels on productivity and economics of soybean in central Narmada valley of Madhya Pradesh, India. Int. J Curr. Microbiol. Appl. Sci. 2018;7(2):3543-3548.
2. Anonymous. World soybean production. The Soybean Processors Association of India, Government of India. Available from: https://www.sopa.org. Accessed January 25, 2023.
3. Devi KN, Singh LNK, Singh MS, Singh SB, Singh KK. Influence of sulphur and boron fertilization on yield, quality, nutrient uptake and economics of soybean under upland conditions. J Agric. Sci. 2012;4(4):1-10.
4. Geethika NS, Subramanyam D, Reddy ST, Umamahesh V. Effect of plant extracts and rice straw mulch on weed growth and yield of groundnut. Indian J Weed Sci. 2020;52(3):292-295.
5. Ghosh P, Pramanik K. Efficacy of fomesafen against broadleaved weeds and productivity improvement in soybean. Plant Cell Biotechnol. Mol. Biol. 2020;21(11&12):53-60.
6. Gomez KA, Gomez AA. Statistical Procedures for Agricultural Research. 2nd ed. New York: John Wiley & Sons; c1984.
7. Kurchania SP, Rathi GS, Bhalla CS, Mathew R. Bio-efficacy of post emergence herbicides for weed control in soybean. Indian J Weed Sci. 2001;33:34-35.
8. Nainwal RC, Saxena SC. Effect of herbicides on plant growth and seed yield and quality of soybean (*Glycine max* L. Merr.). Environ Conserv J. 2023;24(2):77-82.
9. Poddar B, Kundu R, Bera S, Ghosh D. Complex weed flora managing efficacy of herbicides in soybean and their effect on soil properties, microorganisms and productivity of succeeding mustard. Indian J Weed Sci. 2023;55(2):181-186.
10. Rupareliya VV, Mathukia RK, Gohil BS, Javiya PP. Effect of post emergence herbicides and their mixture on growth, yield and quality of soybean. J Pharmacogn Phytochem. 2020;9(6):1161-1164.
11. Samudre SS, Chavan KA, Patil AA, Jadhav KT. Influence of different weed management practices on growth of soybean (*Glycine max* L. Merrill). J Pharmacogn Phytochem. 2019;8(1):2649-2652.
12. Satyanarayan R, Singh SP, Hansraj S, Bairwa RC, Vimal K. Weed management in groundnut. Indian J Weed Sci. 2021;53(1):111-113.
13. Shaktawat RPS, Somvanshi SPS, Singh HP, Chundawat GS, Singh D, Kulmi GS, *et al*. Assessment of weed management treatments on yield of soybean (*Glycine max* L.) and its weeds in Malwa plateau zone of Madhya Pradesh. Prog Res Int J. 2017;12(4):2622-2624.
14. Sharma R. Weed management in soybean crop. Indian Farming. 2007;57(3):31-34.
15. Susmitha M, Vijaya BR, Ramesh PV, Srinivasa RM. Efficacy of different herbicides on weed dynamics and yield attributes in kharif black gram. Int. J Curr. Microbiol. Appl. Sci. 2019;8(6):2026-2031.
16. Tripathi AK, Misra AK. Soybean-A consummate fictional food: A review. J Food Sci. Technol. 2005;42(2):111-119.