***Original Research Article***

**Weed-Crop Competition and Its Effect on the Productivity of Gobhi Sarson (Brassica napus L.)**

**ABSTRACT:** A field experiment was conducted during the Rabi season of session 2023-24 at the Agricultural Research Farm, School of Agricultural Sciences and Technology, RIMT University, Mandi Gobindgarh, Punjab, to study the “Crop weed competition in Gobhi sarson (Brassica napus L.)”. The experiment was laid out in Randomized Block Design (RBD) with eight treatments in three replications. The weed control treatments comprised a weedy check throughout, weed-free throughout, weed-free for 20, 40, and 60 days, and a weedy check for 20, 40, and 60 days. The highest weed density (67.67 plants/m²) and weed dry weight (79.33 g/m²) were recorded in the weedy check throughout, whereas the weedy check at 20 days recorded the minimum (23.33 plants/m² and 32.33 g/m², respectively). Weedy check treatments recorded higher weed density and weed dry weight. Weed-free treatments have a lower weed index, and weedy check treatments have a higher weed index. The highest seed yield (20.37 q/ha) was recorded in weed-free throughout, which was significantly higher than weed-free for 60 days (19.80 q/ha) but was at par with the rest of the treatments. A similar trend was also observed in growth parameters and yield attributes.

***Keywords:*** G*obhi sarson, crop weed competition, growth, yield attributes and yield.*

**1. INTRODUCTION**

Oilseed crops are the second major group among agricultural crops after cereals in India. Oilseed Brassica shares 24.4% of the area and 26.8% of the production of total oilseeds in the country [4]. Oil and fat play a significant role in the human dietary system as well as the economy of the people. Oil seeds are beneficial for human health due to their high levels of amino acids, proteins, and fat reserves [1]. The oil cakes are used as cattle feed and manure [10]. In India oilseed crops are grown in an area of 30.24 million ha with a production of 41.36 million tonnes and a productivity of 1368 kg/ha [2]. Rapeseed is a member of the Brassica family, which evolved to be one of the most significant oilseed crops in the world. Rapeseed-mustard oil is the major source of vegetable oil for cooking in India and the third major source in the world after soybean and oil palm, and the second largest source of protein meal in the world [6].

Rapeseed is an important source of vegetable oil and biofuel for the world [19]. In India, the total area under rapeseed & mustard cultivation was 8.85 million ha, while total production was 12 million tonnes, and productivity was 1428 kg/ha. In Punjab rapeseed-mustard is grown on 0.54 lakh hectares with a production of 0.87 lakh tonnes and a productivity of 1604 kg/ha [2]. The major rapeseed-mustard growing states are Rajasthan, Madhya Pradesh, Uttar Pradesh, Punjab, Haryana, and Gujarat, which contribute more than 86% of the total cropped area.

Weed competition in Gobhi sarson is more serious in the early stage because crop growth during the winter rabi season remains slow during the first 4-6 weeks after sowing, and during the later stage, it grows vigorously and suppresses the effects on weeds. Among the various factors responsible for low productivity of Gobhi sarson, weed control is one of the most important constraints. As this crop is grown in poor soils with poor crop management practices, weed infestation is one of the major causes of low productivity. The reduction in crop yield has a direct correlation with weed competition. Gobhi sarson suffers more from weed competition in the early growth stage for light, water, and nutrients, including CO₂ [14]. Heavy weed growth is a major recognised bottleneck in realising the yield potential of Gobhi sarson. Weeds appear to be the most serious menace in crop production due to their extensive losses.

Yield losses due to weeds varied from 25% to 45% depending on the type of weed flora and their intensity, stages, nature, and duration of crop-weed competition [16]. The critical period of weed control (CPWC) is the main component of combined weed management practices. The CPWC is a period of the crop growth cycle during which weeds must be managed properly to avoid losses in yield [8]. The critical period of weed competition in mustard is 15-40% to a total failure yield [15], depending on weed flora and its intensity, stage, nature, and duration of the crop-weed competition. Weeds, being injurious, harmful, or poisonous, are a constant source of trouble for the successful growth and development of the crops that compete with crops for space and plant nutrients and other environmental requirements and consequently interfere with the normal growth of crops [18]. Weeds also pose a severe problem for crop husbandry, reducing the soil fertility and moisture, acting as alternate hosts for insects & pests, and developing a potential threat to succeeding crops.

**2. MATERIALS AND METHODS**

***2.1 Experimental site:*** A field experiment was laid out during *rabi* 2023-24 at the Agriculture Research Farm, RIMT University, Mandi Gobindgarh, Punjab. The experimental site (Mandi Gobindgarh) is situated in Punjab at 30.6642**º** N latitude and 76.2914º E longitude at an altitude of 268 meters. The soil of the experimental field was sandy loam in texture with pH 8.4. It was moderately fertile, being moderate in available organic carbon (0.38%) and low in available nitrogen 144.6 kg/ha) and medium in available phosphorus (17.3 kg/ha) and high in available potassium (168 kg/ha).

The experiment was laid out in Randomized block design (RBD) with eight treatments and three replications. The treatment comprised of T1-weedy check throughout, T2-weed free throughout, T3- weed free up to 20 days, T4-weed free up to 40 days, T5- weed free up to 60 days, T6-weedy check up to 20 days, T7-weedy check up to 40 days, and T8-weedy check up to 60 days. The cultivar ADV. 405 was sown with seed rate of 3.75 kg/ha at row to row spacing was 45 cm, plant to plant spacing was 10 cm and the net plot was 4 m × 3.15 m² and the recommended dose of fertilizer like Nitrogen (225 kg/ha), Phosphorus (187 kg/ha) was applied under experimental field. However, half dose of nitrogen through urea and full dose of Phosphorus by single super phosphate respectively were applied as basal. Remaining quantity of nitrogen was applied in two equal split. The observations recorded on weed density and weed dry weight were taken from randomly selected four spots by using 0.5 m² iron quadrate from net plot area. The weed data were subjected to square root transformation before analysis. The observations were recorded per the random 5 plants selected within each net plot. Parameters for growth include plant population, plant height, number of branches/plant and chlorophyll content, yield attributes and yield *viz.,* siliquae/plant, seeds/siliqua, siliqua length, test weight, seed yield, stover yield, harvest index, net return and benefit cost ratio.

**3. RESULTS AND DISCUSSION**

**3.1 *Weed parameters***

Different weed management practices significantly influenced the weed density and dry weight of weed at 60 DAS (Table 1). However, besides weed check throughout (T1), the highest weed density (67.67 plants/m²) and dry weight (79.33 g/m²) was recorded. Minimum weed density (23.33 plants/m²) and dry weight (32.33 g/m²) was recorded in weedy check up to 20 days (T6). The higher weed density and dry weight in weedy check and lower in weed free treatments were reported [18]. Higher weed index was recorded in treatment T1-weedy check throughout (45.16%) and lowest in weed free throughout (0%) (T2). This result confirms the Patel *et al.* [12] and Raj *et al.* [13].

**3.2. *Growth parameters***

The data on growth parameters of Gobhi sarson *viz.,* Plant population (m²), plant height (cm), number of branches/plant at harvest and chlorophyll content (mg/plant) at 100 days after sowing, as influenced by weed management treatments are shown in Table 2. The result showed that weed free throughout (T2) recorded the highest plant population (19.51m²) plant height (173.00cm), number of branches/plant (16.00) and chlorophyll content (55.66 mg/plant), which was statistically at par with weed free up to 60 days (T5). The minimum plant population (14.71m²), plant height (140.33 cm), number of branches/plant (8.66) and chlorophyll content (48.66 mg/plant) were recorded in weedy check throughout (T1) similar finding were observed by Singh *et al*. [17] and Jangir *et al*. [7].

**3.3. *Yield Attributes***

The results in (Table 3) contained data on yield qualities that were influenced by weed management treatments. Siliquae/plant (382.66), seeds/siliqua (26.00), siliqua length (6.53 cm) and test weight (4.41 g) were recorded to be the highest in weed free throughout (T2) which was statistically at par with weed free up to 60 days (T5) the lowest number of siliquae/plant (326.33), number of seeds/siliqua (16.66), siliqua length (5.13 cm) and test weight (3.37 g). The result agreed with the findings of Degra *et al*. [5] and Kumar *et al.* [9].

**3.4. *Yield***

The maximum seed yield (20.37 q/ha), stover yield (60.00 q/ha) and harvest index (24.18%) (Table 4) were recorded by weed free throughout (T2) in which was found by similar with weed free up to 60 days (T5). Meanwhile, the lowest seed yield (11.17 q/ha), stover yield (48.23) and harvest index (14.38%) were recorded in weedy check throughout (T1). Higher seed yield in weed free treatments could be ascribed to better control of weeds which favoured higher uptake of nutrients and water resulting optimum growth characters. Similar finding was also reported by Bamboriya *et al.* [3] and Raj *et al.* [13].

**3.5. *Economics***

Economics analysis showed that the weed management treatments weed free up to 60 days (T5) resulted in significantly higher net return (Rs.77068.67) and benefit cost ratio (3.58) than other weed free and weedy check treatments. The minimum net return (Rs.33448.00) and benefit cost ratio (2.25) was recorded under weedy check throughout (T1) (Table 4). These finding are in agreement by Mukherjee *et al.* [11].

**Table 1: Impact of crop weed competition on weed density, weed dry weight at 60 DAS and weed index of Gobhi sarson.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Treatments** | **Weed density at 60 DAS (plants/m²)** | **Weed dry weight at 60 DAS (g/m²)** | **Weed index (%)** |
| T₁ :Weedy check throughout | 8.25 (67.67) | 8.93 (79.33) | 45.16 |
| T₂ :Weed free throughout | 0.70 (0.0) | 0.70 (0.00) | 0.0 |
| T₃ :Weed free up to 20 days | 6.15 (37.33) | 7.24 (52.00) | 18.65 |
| T₄ :Weed free up to 40 days | 5.52 (30.00) | 6.89 (47.00) | 8.54 |
| T₅ :Weed free up to 60 days | 5.30 (27.67) | 6.46 (41.33) | 2.79 |
| T₆ :Weedy check up to 20 days | 4.88 (23.33) | 5.72 (32.33) | 23.56 |
| T₇ :Weedy check up to 40 days | 6.36 (40.00) | 7.62 (57.67) | 28.96 |
| T₈ :Weedy check up to 60 days | 6.59 (43.00) | 7.79 (60.00) | 32.40 |
| SEm (±) | 1.91 | 2.43 | - |
| C.D. (p₌0.05) | 5.80 | 7.37 | - |

**Table 2: Impact of crop weed competition on plant population, plant height, number of branches/plant at harvest and chlorophyll content after sowing of Gobhi sarson.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Treatments** | **Plant population at harvest (m²)** | **Plant height (cm) at harvest** | **Number of****branches/plant****at harvest** | **Chlorophyll content (mg/plant)** |
| T₁ :Weedy check throughout | 14.71 | 140.33 | 8.66 | 48.66 |
| T₂ :Weed free throughout | 19.51 | 173.00 | 16.00 | 55.66 |
| T₃ :Weed free up to 20 days | 18.21 | 155.00 | 11.66 | 51.66 |
| T₄ :Weed free up to 40 days | 18.76 | 164.66 | 12.00 | 52.33 |
| T₅ :Weed free up to 60 days | 19.46 | 169.66 | 13.83 | 53.00 |
| T₆ :Weedy check up to 20 days | 17.05 | 151.33 | 10.66 | 50.33 |
| T₇ :Weedy check up to 40 days | 16.56 | 148.00 | 9.66 | 49.66 |
| T₈ :Weedy check up to 60 days | 15.14 | 144.66 | 9.33 | 49.00 |
| SEm (±) | 0.57 | 1.23 | 0.73 |  1.25 |
| C.D. (p₌0.05) | 1.72 | 3.77 | 2.24 | 3.85 |

**Table 3: Impact of crop weed competition on siliquae/plant, seeds/siliqua, siliqua length and test weight of Gobhi sarson.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Treatments** | **Siliquae/plant** | **Seeds/siliqua** | **Siliqua length (cm)** | **Test weight (g)** |
| T₁ :Weedy check throughout | 326.33 | 16.66 | 5.13 | 3.37 |
| T₂ :Weed free throughout | 382.66 | 26.00 | 6.53 | 4.41 |
| T₃ :Weed free up to 20 days | 363.66 | 21.33 | 6.03 | 3.94 |
| T₄ :Weed free up to 40 days | 370.00 | 23.00 | 6.20 | 4.19 |
| T₅ :Weed free up to 60 days | 377.66 | 24.66 | 6.36 | 4.35 |
| T₆ :Weedy check up to 20 days | 350.33 | 20.66 | 5.80 | 3.76 |
| T₇ :Weedy check up to 40 days | 342.00 | 20.00 | 5.60 | 3.64 |
| T₈ :Weedy check up to 60 days | 339.00 | 17.66 | 5.46 | 3.49 |
| SEm (±) | 1.80 | 0.54 | 0.06 | 0.01 |
| C.D. (p₌0.05) | 5.51 | 1.67 | 0.21 | 0.03 |

**Table 4: Impact of crop weed competition on seed yield, stover yield harvest index, net return and benefit cost ratio of Gobhi sarson.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Treatments** | **Seed yield (q/ha)** | **Stover yield (q/ha)** | **Harvest index (%)** | **Net Return****(RS)** | **B : C Ratio** |
| T₁ :Weedy check throughout | 11.17 | 48.23 | 14.38 | 33448.00 | 2.25 |
| T₂ :Weed free throughout | 20.37 | 60.00 | 24.18 | 74130.00 | 3.07 |
| T₃ :Weed free up to 20 days | 16.57 | 54.50 | 20.99 | 60608.00 | 3.10 |
| T₄ :Weed free up to 40 days | 18.63 | 55.16 | 21.52 | 71268.00 | 3.43 |
| T₅ :Weed free up to 60 days | 19.80 | 58.70 | 22.91 | 77068.67 | 3.58 |
| T₆ :Weedy check up to 20 days | 15.57 | 53.56 | 20.19 | 53708.00 | 2.77 |
| T₇ :Weedy check up to 40 days | 14.47 | 51.53 | 18.26 | 49768.00 | 2.76 |
| T₈ :Weedy check up to 60 days | 13.77 | 49.50 | 16.07 | 46988.00 | 2.72 |
| SEm (±) | 0.28 | 0.46 | 0.45 | 1533.22 | 0.05 |
| C.D. (p₌0.05) | 0.86 | 1.40 | 1.38 | 4649.85 | 0.14 |

**4. CONCLUSION**

Based on the one-year study on Gobhi sarson (*Brassica napus* L.) it may be concluded that, weed management treatments significantly better with treatment weed free throughout (T2) in the terms of growth attributes, yield attributes and yield. Weed free up to 60 days (T5) found best treatment in the terms of net return and B:C ratio. The about treatment is recommended give maximum profit to the farmers.

**DISCLAIMER (ARTIFICIAL INTELLIGENCE)**

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (Chat GPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

**REFERENCES**

1. Abiodun OA. The role of oilseed crops in human diet and industrial use. In: Oilseed Crops: Yield and Adaptations Under Environmental Stress. 2017; p.249.
2. Anonymous. Ministry of Agriculture & Farmers Welfare, Govt of India. 2022-23.
3. Bamboriya SD, Kaushik MK, Bamboriya SD, Kumawat P. Effect of weed management on yield and nutrient uptake in mustard (*Brassica juncea* L.). Journal of Applied and Natural Science. 2017; 9(2):1107-11.
4. Choudhary RL, Langadi AK, Jat RS, Anupama, Singh HV, Meena MD, Dotaniya ML, Meena MK, Premi OP, Rai PK. Mitigating the moisture stress in Indian mustard (*Brassica juncea*) through polymer. Journal of Oilseed Brassica. 2019;12:21-27.
5. Degra ML, Pareek BL, Shivran RK, Jat RD. Integrated weed management in Indian mustard and its residual effects on succeeding fodder pearl millet.Indian Journal of Weed Science.2011;43(1):73-76.
6. FAOSTAT. [http://faostat.fao.org/](http://faostat.fao.org/) Accessed on 16.04.2017.
7. Jangir R, Arvadia LK, Kumar S. Growth and yield of mustard (*Brassica juncea* L.), dry weight of weeds and weed control efficiency influenced by different planting methods and weed management. International Journal of Current Microbiology and Applied Sciences. 2017;6(7):2586-93.
8. Knezevic SZ, Evans SP, Blankenship EE, Van Acker RC, Lindquist JL. Critical period for weed control: concept and data analysis. Weed Science. 2002;50(2):773-86.
9. Kumar R, Yadav SS, Singh U, Verma HP. Growth, yield, quality and energetics of mustard [*Brassica juncea* (L.) Czern & Coss] as influenced by weed management and sulphur fertilization under semi-arid condition of Rajasthan. International Journal of Bio-resource and Stress Management. 2021;12(4):255-63.
10. Kumrawat M, Yadav M. Trends in area, production and yield of mustard crop in Bharatpur region of Rajasthan. International Journal of Engineering Development and Research.2018;6(1):315-21.
11. Mukherjee D. Influence of weed and fertilizer management on yield and nutrient uptake in mustard. Indian Journal of Weed Science. 2014;46(3):251-55.
12. 12. Patel HB, Patel GN. Integrated weed management in mustard (*Brassica juncea* L.). An International e-Journal. 2013;2(3):276-82.
13. Raj P, Singh RP, Pal RK, Rajput P, Rana SS. Integrated weed management in Indian mustard (Brassica juncea L.). International Journal of Current Microbiology and Applied Sciences. 2020;10(2):271-76.
14. Rao VS. Principles of Weed Science. New Delhi, India: Oxford and IBH Publishing Co. Pvt. Ltd.; 2000. p.144.
15. Shekhawat K, Rathore SS, Premi OP, Kandpal BK, Chauhan JS. Advances in agronomic management of Indian mustard (*Brassica juncea* L.): An overview. International Journal of Agronomy. 2012;8(1):1-14.
16. 16. Singh H, Singh BP, Prasad H. Weed management in Brassica species. Indian Journal of Agronomy. 2001;46(3):533-37.
17. Singh L, Kumar S. Effect of integrated weed management on weed and growth attributing characters of mustard (*Brassica juncea* L.). Journal of Oilseed Brassica. 2020;11(1):62-68.
18. Upadhyay VB, Bharti V, Rawat A. Bio-efficacy of post-emergence herbicides in soybean. \*Indian Journal of Weed Science. 2012;44(3):261-63.
19. Zheng Q, Kede L. Worldwide rapeseed *(Brassica napus* L.) research: A bibliometric analysis. Research. 2022; 7(4):157-65.