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

**ABSTRACT:** Gobhi sarson suffer more from weed competition in early growth stage for light, water and nutrient including CO2.Heavy weed growth is a major recognized bottleneck in realizing the yield potential of Gobhi sarson. Weeds appear to be most serious menace in crop production due to their extensive losses.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. The experiment was laid out in Randomized Block Design (RBD) with eight treatments in three replications. The weed control treatments comprised of weedy check throughout, weed free throughout, weed free for 20, 40 and 60 days and 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 weedy check throughout, whereas, weedy check at 20 days recorded minimum (23.33 plants/m² and 32.33 g/m² respectively). Weedy check treatments recorded higher weed density, weed dry weight. Weed free treatments are lower weed index and weedy check treatments are 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 rest of the treatments. 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 form the second major group among agricultural crops in India, after cereals. Oilseed Brassica accounts for 24.4% of the area and 26.8% of the production of total oilseeds in the country” [4]. “Oils and fats play a significant role in the human dietary system as well as in the economy. Oilseeds are beneficial for human health due to their high levels of amino acids, proteins, and fat reserves” [1]. “The oil cake is used as cattle feed and manure [10]. In India, oilseed crops are grown on 30.24 million hectares, with a production of 41.36 million tonnes and a productivity of 1368 kg/ha” [2].Rapeseed, a member of the Brassica family, has become 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-largest source globally, after soybean and oil palm. It is also the second-largest source of protein meal worldwide [6].

“Rapeseed is an important source of vegetable oil and bio fuel of the world” [19]. “In India 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 are grown a 0.54 lakh hectare with production of 0.87 lakh tonnes and productivity of 1604 kg/ha” [2]. “The major rapeseed-mustard growing states are Rajasthan, Madhya Pradesh, Uttar Pradesh, Punjab, Haryana and Gujarat contributes more than 86% of total cropped area. Weed competition in Gobhi sarson is more serious in early stage because crop growth during winter *rabi* season remains slow during the first 4-6 weeks after sowing and during later stage its grows vigorously and suppressing effects on weeds. The various factor 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. Weeds compete with mustard crops for light, moisture, nutrients, and space, leading to significant yield reductions. The critical period of weed competition in mustard is 15–40 days after sowing (DAS), during which uncontrolled weed growth can cause yield losses of 25–45%”: [19]. Gobhi sarson suffer more from weed competition in early growth stage for light, water and nutrient including CO2 [14]. “Heavy weed growth is a major recognized bottleneck in realizing the yield potential of Gobhi sarson. Weeds appear to be most serious menace in crop production due to their extensive losses. Yield losses due to weeds varied from 25-45% 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 avoided 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; 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 which 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 severe problem for crop husbandry, reducing the soil fertility and moisture, act as alternate host for insect & pest and develop 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 45cm, plant to plant spacing was 10cm 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.*[14].

**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 byPatel *et al* [13], 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.* [14].

**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 Gobhisarson.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **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.

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