



## Effect of different weed control treatments on growth and yield of wheat

Rajat Sharda<sup>1</sup>, Asma Fayaz<sup>2</sup>

<sup>1</sup>M.sc Agronomy student, UIAS, Chandigarh University, Gharuan, Punjab, India

<sup>2</sup>Assistant Professor, UIAS, Chandigarh University, Gharuan Punjab, India

### Abstract

A field experiment on “Integrated weed management in irrigated wheat (*Triticum aestivum* L.)” was conducted at Chandigarh University, Gharuan (Mohali) during rabi 2020-21 to investigate the effects of different levels of Farmyard manure on yield of wheat varieties. The soil of experimental field was clayey loam and neutral in reaction. The soil was low in organic carbon and available nitrogen and medium in available potassium and phosphorous. The experiment was laid out in randomized block design with eleven treatments, (T<sub>1</sub>) control, (T<sub>2</sub>) one interculture at 30 DAS, (T<sub>3</sub>) isoproturon @ 0.75 kg a.i. ha<sup>-1</sup> at 30 DAS+ one interculture at 50 DAS. (T<sub>4</sub>) isoproturon @ 0.75 kg a.i. ha<sup>-1</sup> + 2, 4-D @ 500 ml ha<sup>-1</sup> at 30 DAS. (T<sub>5</sub>) Sencor @ 250 g ha<sup>-1</sup> at 30 DAS. (T<sub>6</sub>) isoproturon @ 0.75 kg a.i. ha<sup>-1</sup>+ 2,4-D @ 500 ml ha<sup>-1</sup> at 30 DAS + one interculture operation at 50 DAS with medium cultivar. (T<sub>7</sub>) Sencor @ 250 g ha<sup>-1</sup> at 30 DAS + one interculture at 50 DAS. (T<sub>8</sub>) Pumasuper @ 800 ml ha<sup>-1</sup>. (T<sub>9</sub>) Pumasuper @ 800 ml ha<sup>-1</sup> at 30 DAS + one interculture at 50 DAS. (T<sub>10</sub>) FIRBS with 3 rows. (T<sub>11</sub>) FIRBS with 3 rows + one interculture operation with medium cultivar. A significant improvement in growth and yield attributing characters were recorded with the application of Sencor @ 250 g ha<sup>-1</sup> at 30 DAS + one interculture at 50 DAS over the rest of the treatments. Isoproturon @ 0.75 kg a.i. ha<sup>-1</sup> + 2,4-D @ 500 ml ha<sup>-1</sup> at 30 DAS + one interculture operation at 50 DAS with medium cultivar was next in superiority and produced higher grain yield than rest of the treatments. FIRBS with 3 rows + one interculture at 30 DAS and FIRBS with 3 rows alone did not prove effective in controlling weeds as compared to chemical weed management method alone or in integration with interculture at 50 DAS.

**Keywords:** Integrated weed management, herbicides, interculture operations, wheat

### Introduction

Wheat (*Triticum aestivum* L.) is one of the main cereal crops in world. It is widely cultivated, produced and used throughout the world. Of all the grain crops, wheat is the most popular staple food for human consumption. It is cultivated over an area of about 29.14 (2019-20) million per hectares with an annual production of 2646.7 million tonnes (acc. to FAO) throughout the world. The predominant wheat producing countries in the world are China, India, Russia, USA, Canada. Main wheat growing states of India are Punjab, Haryana, Uttar Pradesh, Rajasthan, Madhya Pradesh. In india area under wheat cultivation is 29.58(2019-20) million hectares with an annual production and yield of 99.70 million tonnes and 3371 kg/ha respectively (Directorate of Economics and Statistics). In Punjab, Wheat is grown on area of 35.20 lakh ha (2019-20) with production of 182.62 lakh tonnes and average yield of 51.88 quintals per ha (Acc. to PAU, Ludhiana). Weeds are considered one of the destructive disasters for agricultural production due to their competition with main crop for nutrition and other components such as light, moisture and space. The loss of productivity depends on the type and density of weeds. Weeds not only reduce the yield but also make the harvesting operation difficult. Weeds alone causes 30-35% reduction in grain yield of wheat (Singh *et al*, 2010) [11]. It depends upon the magnitude, nature and duration of weeds. Therefore for sustaining food grain production to feed ever increasing population and ensuring food security, effective weed management is essential. The objective of weed control is to create those conditions which are not favourable for weeds and which are conducive for growth

of plants. Cultural practices of weed control includes crop rotation, crop selection, selection of variety, spacing, rate of fertilizer and application of methods. Among all these, crop rotation is an important method in an integrated weed management programme. Crops which may be rotated with wheat are potato, onion, winter maize, mustard (Singh, 2007) [7]. Manual weed control method is considered as the best and sustainable option for management of weeds. It includes removal of weeds by various means of tools and implements, hand weeding. Mechanical weeding done twice at 15 and 30 DAS was found most effective in reducing dry matter accumulation of weeds in wheat. Hand weeding remarkably reduced the intensity of perennial grasses and sedges in wheat (Pandey *et al*, 2005) [12]. Hand weeding done twice at 35 and 55 DAS was effective to reduce the density and dry weight of wheat. But increasing costs and shortage of labour have forced farmers to adopt some other alternative methods of weed control. Weed management with herbicides is very easy and most successful method of weed control (Moss *et al.*, 2019) [1]. Herbicides have played an important role in modern agriculture for weed management (Kraehmer *et al.*, 2019). Acc. to Brar and Walia (2009) [8] mesosulfuron+iodosulfuron, sulfosulfuron and clodinafop fb 2, 4-D were effective against *Phalaris minor* and broad leaf weeds. Kanoja and Nepalia (2006) noticed that the uptake of nitrogen by broad leaf weeds was minimum, when 2, 4-D(ester) at 400 g+ isoproturon @750 g ha<sup>-1</sup> mixture was applied to control weeds. They also recorded that the 2, 4-D (ester) at 400 g+ isoproturon at 750 g ha<sup>-1</sup> treatment, which is better in managing the weeds provides more congenial environment to wheat crop for

higher utilization of nutrients. However, using identical herbicide continuously leads to building up of resistance and tolerance in weeds. So integration of herbicides with other weed control methods attributes to efficient and prolonged weed control. So integrated weed management is a concept that combines weed control principles, practices, strategies to maintain the health of plants by reducing damage due to weeds. (Patil and Dhonde, 2009) [8] reported that weed intensity and dry matter of weeds at harvest was significantly lower in weed free, pendimethalin pre emergence @ 1.0 kg/ha + hand weeding was maximum in weed free check. According to (Rathi *et al.*, 2008) integration of isoproturon @ 0.75 kg/ha + 2,4-D @ 0.5 kg/ha with one interculture at 30 DAS was the best treatment in terms of reducing weed population and dry weight at different stage of crop growth. An integrated approach, where herbicides play an important role is the only way for effective weed control method. Use of weed free seed, use of well rotten FYM, method of sowing, seed rate, sowing time, amount of fertilizer application, proper herbicide selection, proper dose, time and method of herbicide application, mechanical weeding, crop rotations are the key components of integrated weed management. Pandey *et al.* (2001) [13] reported that weed biomass was significantly lower in hand weeding treatment than isoproturon @ 0.75 kg ha<sup>-1</sup> and 2,4-D @ 0.40 kg ha<sup>-1</sup> alone but at harvest weed population was less in isoproturon and 2,4-D treated plots. Higher weed population in hand weeding plot was due to regrowth of surviving weeds and reemergence of weed population with new flushes was recorded. They also observed, minimum nutrient removed by weeds and highest grain yield in hand weeding.

### Material and method

The investigation was conducted at the experimental farm of Chandigarh University, Gharuan Mohali which is located at 30.7691 °N latitude and 76.5759 °E longitude at an altitude of 296.86 meters above the mean sea level. The climate is sub tropical type characterized by very hot summers and severe winters. The average annual precipitation over past twenty five years is 792 mm and more than 80 per cent of precipitation is received during south west monsoon. During crop growth period (5<sup>th</sup> Dec- 28<sup>th</sup> April) wettest month was January. The mean maximum and minimum temperature for entire crop growth period of wheat crop was 38.83° C and 3.59 °C, respectively. The mean monthly meteorological data collected for the cropping season during experimental period recorded at the meteorological observatory at division of agronomy, Chandigarh University, Gharuan (Mohali). There were 11 treatments which are: Treatment (T<sub>1</sub>) control, (T<sub>2</sub>) one interculture at 30 DAS, (T<sub>3</sub>) isoproturon @ 0.75 kg a.i. ha<sup>-1</sup> at 30 DAS+ one interculture at 50 DAS. (T<sub>4</sub>) isoproturon @ 0.75 kg a.i. ha<sup>-1</sup> + 2,4-D @ 500 ml ha<sup>-1</sup> at 30 DAS. (T<sub>5</sub>) Sencor @ 250 g ha<sup>-1</sup> at 30 DAS. (T<sub>6</sub>) isoproturon @ 0.75 kg a.i. ha<sup>-1</sup>+ 2,4-D @ 500 ml ha<sup>-1</sup> at 30 DAS + one interculture operation at 50 DAS with medium cultivar. (T<sub>7</sub>) Sencor @ 250 g ha<sup>-1</sup> at 30 DAS + one interculture at 50 DAS. (T<sub>8</sub>) Pumasuper @ 800 ml ha<sup>-1</sup>. (T<sub>9</sub>) Pumasuper @ 800 ml ha<sup>-1</sup> at 30 DAS + one interculture at 50 DAS. (T<sub>10</sub>) FIRBS with 3 rows. (T<sub>11</sub>) FIRBS with 3 rows + one interculture operation with medium cultivar. The soil of the field experiment was sandy loam in texture. The design of experiment was Randomized block design (RBD) with three replications. Certified seed of wheat variety UNNAT

PBW 343 was used in the experiment. Average plant height of this variety is 100 cm. It is a gene introgressed rust resistant version of mega variety PBW 343. It takes near about 155 to mature. All necessary management practices were carried out as per standard recommendation for wheat crop. All vegetative and reproductive parameters were recorded. Plant height (cm), total dry matter accumulation, number of tillers m<sup>-2</sup>, leaf area index were measured. Data on different yield parameters such as ear length, were measured with measuring scale and counted total grains ear<sup>-1</sup> and finally grain yield (q ha<sup>-1</sup>), straw yield (q ha<sup>-1</sup>) and biological yield (q ha<sup>-1</sup>) were weighed with electric balance. The crop was harvested manually at full maturity. The harvested crop of the plot was banded separately, tagged properly and then threshed. The weight of grains and straw weight were recorded after sun drying with electric balance. The data was analysed statistically using the analysis of variance (ANOVA) technique with the help of MSTAT-C (Gomez and Gomez, 1984) and Microsoft Excel programme, and mean difference were adjusted by Duncan's Multiple Range Test (DMRT)

## Results and Discussions

### Growth attributes

Plant height (cm) and number of tillers m<sup>-2</sup> were influenced by different weed control treatments. The highest value of plant height (cm) and number of tillers m<sup>-2</sup> were recorded with the treatment Sencor @ 250 g ha<sup>-1</sup> + one interculture at 50 DAS (T<sub>7</sub>) followed by treatment isoproturon @ 0.75 kg a.i. ha<sup>-1</sup> + 2,4-D @ 500 ml ha<sup>-1</sup> at 30 DAS + one interculture operation at 50 DAS with medium cultivar (T<sub>6</sub>). The increased plant height (cm) and number of tillers m<sup>-2</sup> in these treatments may be due to intercultivation of chemicals with inter culture operations which decreased the population of weeds in these treatments resulting in maximum utilization of moisture and nutrients by the crops. These results are in line with the previous findings of Ahmad *et al.*, (1989) who reported that water shower after spray application of Arelon @ 1.5 kg ha<sup>-1</sup> proved to be beneficial by producing more productive tillers and increased plant height. Lowest number of tillers m<sup>-2</sup> and ear length (cm) was recorded with the treatments control (T<sub>1</sub>) and Furrow irrigation raised bed system (T<sub>10</sub>). It is due to effective weeding at proper time resulting in less competition of weeds with wheat for growth factors. Acc. to Patil *et al.*, 2018 integration of isoproturon @ 0.75 kg/ha + 2,4-D @ 0.5 kg/ha with one interculture at 30 DAS gave highest plant height. Lowest values of plant height (cm) and number of tillers m<sup>-2</sup> was recorded with the treatments control (T<sub>1</sub>) and furrow irrigated raised bed system (T<sub>10</sub>). It may be due to less weed control efficiency and more competition with weeds for nutrients and water.

### Grain yield, straw yield and harvest index

Grain yield, straw yield of wheat was influenced significantly by weed control measures. It indicates that controlling weeds resulted in significant increase in grain yield compared to control. Highest grain and straw yield was recorded with the treatment Sencor @ 250 g ha<sup>-1</sup> + one interculture at 50 DAS (T<sub>7</sub>) followed by treatment isoproturon @ 0.75 kg a.i. ha<sup>-1</sup> + 2,4-D @ 500 ml ha<sup>-1</sup> at 30 DAS + one inter culture operation at 50 DAS with medium cultivar (T<sub>6</sub>). The increase in grain and straw yield under these treatments may be due to the combined effect of herbicides and interculture operations performed at 50

days after sowing. Similar results were obtained by Chandra *et al.*, (2018) [4]. Griffin *et al.*, (1983) [9] found that sencor applied as post emergence @ 0.284-0.425 kg ha<sup>-1</sup> gave both herbicides and interculture operations. Furrow irrigated raised bed system + one interculture at 30 days after sowing produced lesser grain yield due to poor weed control efficiency as compared to higher yielding treatments. However, it produced more grain yield over one interculture at 30 days after sowing (T<sub>2</sub>), Furrow irrigated raised bed system with 3 rows (T<sub>10</sub>) and control (T<sub>1</sub>). It might be due to combined effect of furrow irrigated raised bed system with 3 rows and inter culture operations which could have controlled *Phalaris minor* and broad leaved weeds. Similar results were obtained by Riaz *et al.*, (2006) [5] who reported that minimum grain and straw yield was recorded with the treatment control where no weed control treatment was

applied. Among various weed control treatments highest percentage of harvest index was recorded with the treatment sencor @ 250 g ha<sup>-1</sup> + one interculture at 50 DAS (T<sub>7</sub>). The increase in harvest index may be due to suppression of weed growth resulting in more availability of more plant nutrients to wheat crop which favoured utilization of photo synthates for better grain yield formation. Similar results were obtained by Riaz *et al.*, (2006) [5] who reported that higher value of harvest index (35%) was recorded with the treatment where interculture operations were done with the application of herbicides i.e. where chemical weeding at 2-3 leaf stage of weed with a follow up of hand weeding after 50 days of crop sowing were applied. Least value of harvest index was recorded with the treatment control (T<sub>1</sub>). It may be due to its less weed control efficiency due to unavailability of any weed control treatment.

**Table 1:** Periodic plant height (cm) of Wheat as affected by Weed control treatments

Treatment	30 DAS	60 DAS	90 DAS	120 DAS	At Harvest
(T <sub>1</sub> ) Control	11.4	28.8	55.5	83.5	86.4
(T <sub>2</sub> ) One interculture at 30 DAS	12.5	29.9	59.4	89.4	92.4
(T <sub>3</sub> ) Isoproturon @ 0.75 kg a.i. ha <sup>-1</sup> at 30 DAS + one Interculture at 50 DAS	13.9	31.9	64.2	93.1	96
(T <sub>4</sub> ) Isoproturon @0.75 kg a.i. ha <sup>-1</sup> + 2,4-D @ 500 ml ha <sup>-1</sup> at 30 DAS	14.2	32.8	65.1	93.7	97.4
(T <sub>5</sub> ) Sencor @ 250 g ha <sup>-1</sup> at 30 DAS	14.6	33.5	66.1	95	97.8
(T <sub>6</sub> ) Isoproturon @ 0.75 kg a.i. ha <sup>-1</sup> + 2,4-D @ 500 ml ha <sup>-1</sup> at 30 DAS + one interculture operation at 50 DAS	15.2	34.4	67.8	95.4	98.5
(T <sub>7</sub> ) Sencor @ 250 g ha <sup>-1</sup> at 30 DAS + one interculture at 50 DAS	15.5	35.2	68.4	95.9	99.4
(T <sub>8</sub> ) Pumasuper @ 800 ml ha <sup>-1</sup>	12.9	30.4	60.0	91.2	94.5
(T <sub>9</sub> ) Pumasuper @ 800 ml ha <sup>-1</sup> at 30 DAS+ one interculture at 50 DAS	13.5	31.4	62.2	92.7	95.4
(T <sub>10</sub> ) FIRBS with 3 rows	12.2	29.4	58.8	87.3	90.6
(T <sub>11</sub> ) FIRBS with 3 rows+ one interculture operation with medium cultivar	13.2	30.7	61.4	92.4	94.9
SEm(±)	0.38	0.06	0.10	0.19	NS
CD (P≤0.05)	0.08	0.13	0.21	0.39	

**Table 2:** Number of tillers m<sup>-2</sup> of Wheat as affected by Weed control treatments

Treatment	30 DAS	60 DAS	90 DAS	120 DAS
(T <sub>1</sub> ) Control	195.3	309.0	401.9	284.3
(T <sub>2</sub> ) One interculture at 30 DAS	211.3	336.0	433.5	313.0
(T <sub>3</sub> ) Isoproturon @ 0.75 kg a.i. ha <sup>-1</sup> at 30 DAS + one Interculture at 50 DAS	245.1	415.9	493.2	384.1
(T <sub>4</sub> ) Isoproturon @0.75 kg a.i. ha <sup>-1</sup> + 2,4-D @ 500 ml ha <sup>-1</sup> at 30 DAS	252.8	432.6	514.3	396.4
(T <sub>5</sub> ) Sencor @ 250 g ha <sup>-1</sup> at 30 DAS	264.0	489.4	534.4	456.1
(T <sub>6</sub> ) Isoproturon @ 0.75 kg a.i. ha <sup>-1</sup> + 2,4-D @ 500 ml ha <sup>-1</sup> at 30 DAS + one interculture operation at 50 DAS	272.5	472.8	552.3	467.1
(T <sub>7</sub> ) Sencor @ 250 g ha <sup>-1</sup> at 30 DAS + one interculture at 50 DAS	285.6	510.5	569.1	485.2
(T <sub>8</sub> ) Pumasuper @ 800 ml ha <sup>-1</sup>	223.2	350.5	441.6	310.9
(T <sub>9</sub> ) Pumasuper @ 800 ml ha <sup>-1</sup> at 30 DAS+ one interculture at 50 DAS	236.6	384.7	473.3	363.7
(T <sub>10</sub> ) FIRBS with 3 rows	208.1	319.6	418.7	299.5
(T <sub>11</sub> ) FIRBS with 3 rows+ one interculture operation with medium cultivar	230.3	365.7	462.6	343.1
SEm(±)	0.91	14.5	0.71	5.92
CD (P≤0.05)	1.90	30.4	1.48	12.3

**Table 3:** Yield and harvest index of Wheat as affected by Weed control treatments

Treatment	Grain yield (q ha <sup>-1</sup> )	Straw yield (q ha <sup>-1</sup> )	Biological yield (q ha <sup>-1</sup> )	Harvest index
(T <sub>1</sub> ) Control	35.27	52.20	87.47	40.31
(T <sub>2</sub> ) One interculture at 30 DAS	38.23	54.07	92.30	41.20
(T <sub>3</sub> ) Isoproturon @ 0.75 kg a.i. ha <sup>-1</sup> at 30 DAS + one Interculture at 50 DAS	41.87	60.10	101.63	41.19
(T <sub>4</sub> ) Isoproturon @0.75 kg a.i. ha <sup>-1</sup> + 2,4-D @ 500 ml ha <sup>-1</sup> at 30 DAS	43.27	60.37	103.63	43.12
(T <sub>5</sub> ) Sencor @ 250 g ha <sup>-1</sup> at 30 DAS	45.27	61.60	106.87	42.35
(T <sub>6</sub> ) Isoproturon @ 0.75 kg a.i. ha <sup>-1</sup> + 2,4-D @ 500 ml ha <sup>-1</sup> at 30 DAS + one interculture operation at 50 DAS	46.50	63.43	109.93	42.29

(T <sub>7</sub> ) Sencor @ 250 g ha <sup>-1</sup> at 30 DAS + one interculture at 50 DAS	48.40	63.97	112.22	43.28
(T <sub>8</sub> ) Pumasuper @ 800 ml ha <sup>-1</sup>	39.23	54.47	93.70	41.55
(T <sub>9</sub> ) Pumasuper @ 800 ml ha <sup>-1</sup> at 30 DAS+ one interculture at 50 DAS	41.17	59.60	100.77	40.85
(T <sub>10</sub> ) FIRBS with 3 rows	36.30	53.17	89.43	40.58
(T <sub>11</sub> ) FIRBS with 3 rows+ one interculture operation with medium cultivar	40.43	55.23	95.63	42.27
SEm(±)	0.22	0.07	NS	0.20
CD (P≤0.05)	0.476	0.14		0.43

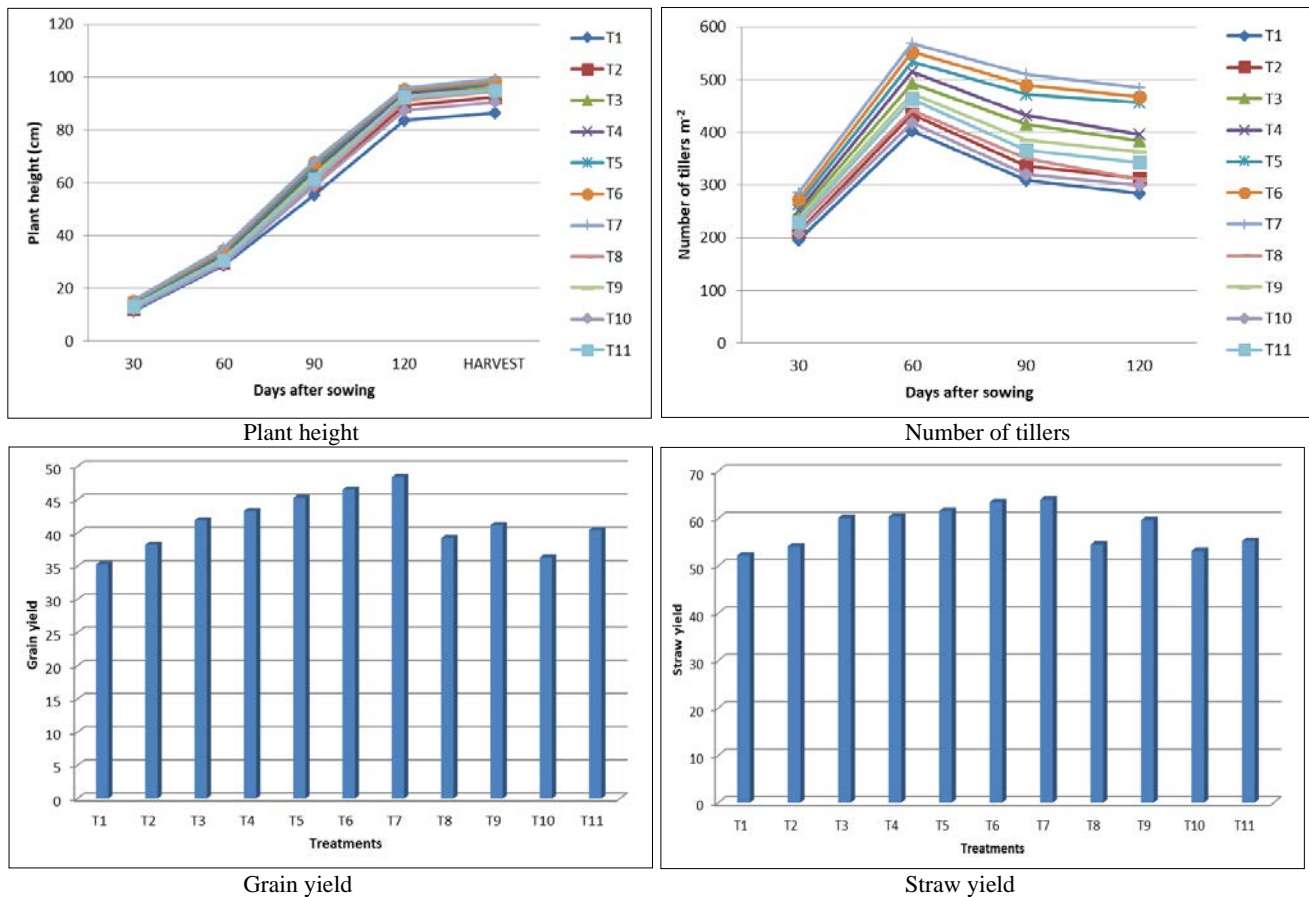


Fig 1

**Conclusion**

From the present study it may be concluded that sencor @ 250 g ha<sup>-1</sup> + one interculture at 50 DAS could be considered for obtaining higher yield of Wheat.

**References**

1. Moss S. Integrated weed management (IWM): why are farmers reluctant to adopt non-chemical alternatives to herbicides? *Pest Manag Sci*, 2019;75:1205-1211. pmid:30450751
2. Kraehmer H, Laber B, Rosinger C, Schulz A. Herbicides as weed control agents: state of the art: I. Weed control research and safener technology: the path to modern agriculture. *Plant Physiol*, 2014;166:1119-1131. pmid:25104723
3. Ahmad S, Ahmad I, Banaras M, Gill MA. Effect of row spacing and weed control on growth and yield of wheat. *J. Agriac. Res*,1984;22:113-7.
4. Chandra, Sateesh, Kumar, Sunil, Acharya, Shivasankar Kumar, et al. Effect of Different Weed Management Practices on Growth and Yield of Wheat and

- Associated Weeds. *International Journal of Current Microbiology and Applied Sciences*, 2018, 3859-3865.
5. Riaz, Muhammad, Malik M, Mahmood, Tahira, Jamil Muhammad. Effect of Various Weed Control Methods on Yield and Yield Components of Wheat Under Different Cropping Patterns. *International Journal of Agriculture and Biology*,2006;8:637-640.
6. Ahmad S, Cheema ZA, Mahmood A. Methods of application of herbicides in wheat. *Pakistan J. Weed Sci. Res.*, 1989;2:35-41.
7. Singh S. Role of management practices on control of isotopuron-resistant littleseed canarygrass (*Phalaris minor*) in India. *Weed tech.*,2007;21:339-346.
8. Brar AS, Walia US. Weed dynamics and wheat (*Triticum aestivum* L.) productivity as influenced by planting techniques and weed control practices. *Indian journal of weed sciences*,2009;41(3-4):161-6.
9. Griffin JL, Vialtor HP, Taylor RW, Habetz RJ. Wheat weed control test. 75<sup>th</sup> annual progress report, Rice research station, Crowley, Louisiana,1983:323-26.
10. Singh S, Malik RK, Balyan RS, Singh S. Distribution of weed flora of wheat in Haryana., *Indian j. weed sci.*,1995;27:114-121.

11. Singh G, Singh OP, Singh S, Prasad K. Weed management in late sown wheat in low land. *Indian Journal of Agronomy*, 2010;55(2):83-88.
12. Pandey IB, Kumar K. Response of wheat (*Triticum aestivum* L.) to seeding methods and weed management. *Indian Journal of Agronomy*, 2005;50(1):48-51.
13. Pandey IB, Sharma SL, Tiwari S, Bharti V. Effect of tillage and weed management on grain yield and nutrient removal by wheat and weeds. *Indian Journal of Weed Sciences*, 2001;33:107-111.
14. SK Patil, GB Suryavanshi, Dr. JB Patil, SP Kusale. Effect of integrated weed management on growth, yield and economics of wheat (*Triticum aestivum*), 2018.