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Effect of Different Weed Management Practices on Growth and Yield of Cabbage (*Brassica oleracea* var. *capitata* L.)

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

As cabbage is cultivated with wide spacing, it is prone to profuse weed infestations, resulting in reduced crop yields and subsequent significant economic losses. A field experiment comparing different weed management treatments namely T_1 (two hand weedings), T_2 (paddy straw mulch), T_3 (pre-emergent application of oxyfluorfen @ 1 kg *a.i.*/ha), T_4 (PE application of pendimethalin @ 1.5 kg *a.i.*/ha), T_5 (PE application of pendimethalin @ 1 kg *a.i.*/ha + HW at 35 days after transplanting), T_6 (PE application of oxyfluorfen @ 1 kg *a.i.*/ha + HW at 35 DAT), T_7 (weed-free) and T_8 (weedy check) was conducted to evaluate their efficacy on growth, yield and economics of cabbage (*Brassica oleracea* var. *capitata* L.). The results revealed that the maximum value of plant height, number of unwrapped leaves, fresh weight of heads, dry weight of wrapped leaves and yield per

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hectare was obtained in plots under treatment T_7 (weed free). Similarly, in terms of weed parameters minimum weed count, weed dry weight, weed index and maximum weed control efficiency were observed in treatment T_7 (weed free). Maximum net return and benefit: cost ratio was observed under the treatment T_5 (PE application of pendimethalin @ 1 kg *a.i.*/ha + one HW at 35 DAT), making it an economically practical option for controlling weeds in cabbage.

Keywords: Cabbage; herbicides; pendimethalin; weed index; yield.

1. INTRODUCTION

Cabbage (*Brassica oleracea* var. *capitata* L.), is one of the most important members of the Cole group of vegetables belonging to the family Brassicaceae. In India, it was grown on 0.42 million hectares with a production of 9.825 million tonnes. Major cabbage-producing states in India include West Bengal, Odisha, Madhya Pradesh and Gujrat [1].

Farmers can face a substantial yield and economic loss due to weeds in cabbage if not controlled in timely manner. Weeds can reduce cabbage yields by up to 94.59 per cent [2]. They not only reduce the yield by increasing crop competition but also by acting as a host for pathogens and insects. Farmers typically have multiple options for weed control and their decision on which method to use is heavily influenced by economic factors [3]. Weeds can be controlled by traditional cultural practices like hand weeding and use of mulching. Hand weeding is an effective approach for maintaining weed population but it often becomes impractical and uneconomical due to high labour costs and availability in time. Herbicides provide good weed control in the early season by inhibiting and slowing down their growth but due to the widespread use of herbicides, the ensuing environmental pollution and its damaging effects in soil, water and the environment have been on the rise [4]. Herbicide reliance may be reduced by combining it with other approaches. Therefore, it becomes important to develop an integrated approach that not only effectively manages the weeds to reduce the yield and economic losses but also establishes a sustainable agriculture approach by mitigating environmental risks.

2. MATERIALS AND METHODS

A field experiment was conducted during *Rabi* 2021-22 at the agriculture research farm of Abhilashi University at Mandi (H.P.) to find the effect of various weed management treatments on growth and yield of cabbage. The soil of the experimental field was low in available nitrogen, medium in available phosphorus and potassium content. RBD design was laid out in 3 replications with the combination of 8 treatments namely, T_1 (HW respectively at 25 and 45 DAT), T_2 (paddy straw mulch), T_3 (PE application of oxyfluorfen @ 1 kg *a.i.*/ha), T_4 (PE application of pendimethalin @ 1.5 kg *a.i.*/ha), T_5 (PE application of pendimethalin @ 1 kg *a.i.*/ha + HW at 35 DAT), T_6 (PE application of oxyfluorfen @ 1 kg *a.i.*/ha + HW at 35 DAT), T_7 (weed-free) and T_8 (weedy check). Plot size was 3 m × 2 m. Fertilizers were applied as per recommended dose. Thirty days old seedlings were transplanted at a distance of 60 cm × 45 cm followed by irrigation. Gap filling was carried out ten days after transplantation in order to maintain the plant population. The required amount of herbicide treatment wise was applied using 750 litres volume of water per hectare with the help of a knapsack sprayer. The required chemical was calculated using the formula:

$$\text{Chemical required} = \frac{a.i./\text{ha}}{\text{EC\%}} \times 100$$

Pre-emergence herbicides oxyfluorfen and pendimethalin were sprayed uniformly one day after transplanting the cabbage seedlings. Mulching was done by spreading a uniform layer of paddy straw. Hand weeding operations were carried out as per the treatment. Observations were made on five pre-tagged plants from each plot. The observations were recorded for growth and yield parameters *viz.,* plant height, number of unwrapped leaves per plant, fresh weight of heads, dry weight of wrapped leaves (heads) and yield per hectare. Weed parameters recorded were weed count, weed dry weight, weed control efficiency and weed index. For the assessment of dry weight, weeds within 0.25 m^2 area were uprooted, cleaned and dried in hot air oven at a temperature of 80°C until constant weight is achieved. Weed control efficiency (WCE) was recorded as per the formula suggested by Mani et al. [5] and weed index (WI) was derived using the formula suggested by Gill and Kumar [6].

Prior to performing statistical analysis, the density of weeds and weed dry weight data underwent a square root ($\sqrt{x+0.5}$) transformation to enhance the homogeneity of variance for ANOVA. The economics was worked out on the basis of prevailing market prices.

3. RESULTS AND DISCUSSION

3.1 Growth and Yield Parameters

The data presented in Table 1 reveals that except for plant height at 30 DAT all the growth parameters were significantly affected by different weed control treatments. Significantly taller plants and the maximum number of leaves were recorded in treatment T_7 (weed free) followed by treatment T_6 (PE application of oxyfluorfen @ 1 kg *a.i.*/ha + one HW at 35 DAT) while minimum values of these parameters were recorded under treatment T_8 (weedy check). The increase in growth parameters in case of treatment T_7 (weed free) could be due to the absence of weeds during the crop growth period while on the other hand weeds reduced the plant growth in treatment T_8 (weedy check) due to the increase in crop weed competition for nutrients, sunlight exposer and water. The findings are in conformity with the results of Sen et al. [7] and Patil et al. [8].

In case of yield parameters (Table 1) such as head fresh weight, dry weight of wrapped leaves and yield per hectare different weed management treatments performed significantly better than treatment T_8 (weedy check). Highest values of these parameters were recorded under treatment T_7 (weed free) which was followed by treatment T_6 (PE application of oxyfluorfen @ 1 kg *a.i.*/ha + one HW at 35 DAT). The higher values of these parameters in these treatments might be due to the maximum availability of assimilates (light, moisture, nutrients and space) to the crop because of less crop weed competition. This resulted in an increase in the dry matter of crop and ultimately the yield. Sen et al. [7], Atal et al. [9] and Patil et al. [8] observed similar results.

3.2 Weed Studies

Remarkable influence of different weed control treatments could be observed on weed count and weed dry weight (Table 2). Treatment T_7 (weed free) recorded the minimum number of weeds and dry weight of weeds, followed by treatment T_6 (PE application of oxyfluorfen @ 1 kg *a.i.*/ha + one HW at 35 DAT). This might be due to the fact that in weedy check plots, weeds were present throughout the crop growing season and also dry weight of weeds was taken at the end, which let weeds to occupy a good amount of space and obtain good growth, ultimately leading to increased dry matter accumulation. Previous workers, Kumar et al. [10], Sen et al. [7], Kaur et al. [11] and Patil et al. [8] reported similar results. Maximum weed control efficiency was recorded in treatment T_7 (weed free) followed by treatment T_6 (PE application of oxyfluorfen @ 1 kg *a.i.*/ha + one HW at 35 DAT). Minimum value of this parameter was recorded under treatment T_8 (weedy check). From the results, it is evident that treatments that control weeds effectively consequently resulted in a higher percentage of weed control efficiency. Findings are in similarity to the results of Kumar et al. [12], Sen *et al.* [7] and Patil et al. [8]. In terms of weed index lowest values were obtained under treatment T_7 (weed free) followed by treatment T_6 (PE application of oxyfluorfen @ 1 kg *a.i.*/ha + one HW at 35 DAT). The minimum weed index was recorded under treatment T_7 (weed free) followed by treatment T_6 (PE application of oxyfluorfen @ 1 kg *a.i.*/ha + one HW at 35 DAT). Reason for the low weed index in these treatments might be due to the lower impact of weeds on yields. Similar results have been reported by Sen et al. [7] and Patil et al. [8].

3.3 Economics

The success of any practice hinges on its financial viability. To assess the economic benefits of different treatments, the marketable yield of the crop was converted as monetary returns. The highest net income and benefit: cost ratio (Table 2) was obtained under treatment T_5 (PE application of pendimethalin @ 1 kg *a.i.*/ha + one HW at 35 DAT). Lowest net income and B: C ratio was obtained from treatment T_8 (weedy check). Though the weed free treatment resulted in better weed control and higher head yield, the net return and B: C ratio were still low due to the higher cost involved for human labour and the high cost of cultivation. Several workers have reported similar findings [7,13,8].

Table 1. Effect of different weed management practices on growth and yield parameters in cabbage

Treatments	Plant height (cm)			Number of unwrapped leaves	Fresh weight of heads (g)	Dry weight of wrapped leaves (g)	Yield per hectare (q)
	30 DAT	60 DAT	At harvest				
T_1	11.60	18.78	22.08	12.60	429.87	35.00	136.19
T_2	11.03	18.38	21.79	12.27	376.62	31.03	117.17
T_3	12.43	20.14	24.82	13.93	484.66	40.05	155.73
T_4	12.90	19.86	24.41	13.40	470.06	37.63	148.84
T_5	12.86	20.95	25.57	14.20	491.98	38.83	172.18
T_6	13.16	21.92	26.23	14.87	499.34	40.64	174.73
T_7	13.22	22.36	27.34	15.47	522.97	42.61	188.63
T_8	10.58	16.75	18.82	10.27	287.55	23.29	71.23
SE(m) ±	0.71	0.85	0.89	0.66	18.03	1.77	5.51
CD at 5%	NS	2.62	2.81	2.02	55. 22	5.42	16.88

Table 2. Effect of different weed management practices on weed parameters and economics in cabbage

Treatments	Weed count/0.25 m^2			Dry weight of weeds (g/0.25 m^2)	WCE (%)	WI (%)	Net return (₹/ha)	B: C ratio
	25 DAT	60 DAT	At harvest					
T_1	3.25 (9.66)	3.59 (12.00)	4.78 (22.00)	8.81 (76.72)	56.14	27.94	108375	1.13
T_2	1.98 (3.00)	3.44 (11.00)	5.19 (26.00)	9.25 (84.75)	51.56	37.95	81229	0.86
T_3	1.71 (2.00)	2.88 (7.33)	3.95 (14.66)	5.12 (25.27)	85.64	17.37	137625	1.43
T_4	1.82 (2.33)	2.99 (8.00)	4.35 (18.00)	6.06 (35.90)	79.61	21.03	139310	1.66
T_5	1.82 (2.33)	2.06 (3.33)	3.55 (11.66)	4.53 (19.62)	88.83	8.73	167197	1.84
T_6	1.60 (1.66)	1.90 (2.66)	3.20 (9.33)	3.84 (13.92)	92.15	7.06	157986	1.52
T_7	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	1.00 (0.00)	100	0.00	154538	1.20
T_8	3.64 (12.33)	5.16 (25.66)	6.80 (45.33)	13.29 (175.86)	0.00	62.48	27190	0.34
SE(m) ±	0.15	0.15	0.11	0.20	-	-	-	-
CD at 5%	0.46	0.48	0.34	0.63	-	-	-	-

Data in parentheses was subjected to square root transformation

4. CONCLUSION

From the study it may be concluded that keeping field weed free was effective for controlling weeds and getting higher yields but due to higher labour requirements and higher costs involved this method could not be considered. As the benefit: cost ratio was recorded higher under treatment T_5 (PE application of pendimethalin @ 1 kg *a.i.*/ha + one HW at 35 DAT) it can be considered for controlling weeds in cabbage.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Anonymous. Department of Agriculture and Farmers Welfare, horticulture statistics; 2022. Available:https://agricoop.nic.in/en/StatHortEst
2. Akshatha V, Prameela KP, Narayankutty C, Menon MV. Weed management in cabbage (*Brassica oleraceae* var. *capitata* L.). Journal of Tropical Agriculture. 2018;56(2):187-190.
3. Singh M, Kaul A, Pandey V, Bimbraw AS. Weed management in vegetable crops to reduce the yield losses. International Journal of Current Microbiology and Applied Sciences. 2019;8(7):1241-1258.
4. Ustuner T, Sakran A, Almhemed K. Effect of herbicides on living organisms in the ecosystem and available alternative control methods. Int. J. Sci. Res. Publ. 2020;10:633-641.
5. Mani VS, Mala ML, Gautam KC, Bhagavandas. Weed killing chemicals in potato cultivation. Indian Farming. 1973; 23:17-18.
6. Gill GS, Kumar V. Weed index, a new method for reporting weed control trials. Indian Journal of Agronomy. 1969;4:96-98.
7. Sen S, Sharma RK, Kushwah SS, Dubey R. Effect of different weed management practices on growth and yield of cauliflower (*Brassica oleracea* var. *botrytis* L.). Ann. Plant Soil Res. 2018;20:63-68.
8. Patil AG, Patil SV, Farooq Md, Singh VP, Mangesh. Evaluation of different weed management practices on growth and yield of cabbage (*Brassica oleracea* var. *capitata*.). The Pharma Innovation Journal. 2022;11(9):2718-2722.
9. Atal MK, Verma RB, Singh VK, Haque MM, Kumar A, Singh SN. Effect of intercropping and weed management practices on growth and yield of cabbage (*Brassica oleracea* var. *capitata*). The Pharma Innovation Journal. 2021;10(8): 1719-1724.
10. Kumar A, Manuja S, Singh J, Chaudhary DR. Integrated weed management in cauliflower (*Brassica oleracea* var. *botrytis*) under dry temperate climate of western Himalayas. Journal of Crop and Weed. 2015;11(2):168-171.
11. Kaur P, Kaur A, Dhillon NS. Impact of integrated weed management on growth and yield of cauliflower (*Brassica oleracea* var. *botrytis*). Journal of Pharmacognosy and Phytochemistry 2021;10(1):243-246
12. Kumar JS, Reddy KC, Rajkumar BV, Rao AM. Integrated weed management in cabbage. Annals of Plant and Soil Research. 2014;16(2):175-176.
13. Gupta RK, Bharti R, Shah MH, Pramanik K. Weed management in transplanted onion (*Allium cepa* L.) through early post-emergence herbicides. Plant Archives. 2020;20(2):6919-6924.

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