

Original Research Article

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## To Study the Effect of Herbicide on Growth, Yield Attributes and Yield of the Mustard Crop in Chhattisgarh Plain

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### ABSTRACT

An experiment was conducted during *Rabi* season 2018-19 at Research farm, BTC College of Agriculture and Research Station, Bilaspur to “To Study the effect of herbicide on growth, yield attributes and yield of the mustard crop in Chhattisgarh plain” The experiment was laid out in randomised block design with three replications. The soil of experimental plot has pH 6.9 in low in available nitrogen 275 kg/ha, available phosphorus 13.75 kg/ha and medium in available potash 268 kg/ha. The experiment was comprised thirteen treatment *i.e.*, T<sub>1</sub>: Quizalofop ethyl 5EC + one hand weeding. T<sub>2</sub>: Pendimethalin 30EC (PE) T<sub>3</sub>: Oxadiazon 25EC (PE). T<sub>4</sub>: Weedy check. T<sub>5</sub>: Oxadairgyl 80WP (PE). T<sub>6</sub>: Clodinofof-propagyl 15WP + one hand weeding. T<sub>7</sub>: Pendimethalin 30EC + one hand weeding. T<sub>8</sub>: Weed free. T<sub>9</sub>: Quizalofop ethyl 5EC (PoE). T<sub>10</sub>: Two hand weeding (30&60 DAS). T<sub>11</sub>: Oxadiazon 25EC + one hand weeding. T<sub>12</sub>: Clodinofof-propagyl 15WP (PoE). T<sub>13</sub>: Oxadairgyl 80WP + one hand weeding. The crop variety of mustard “Chhattisgarh sarson” was sown on 16/11/2018 and harvested on 07/03/2019. The fertilizer was applied as per the recommendation. The treatment T<sub>8</sub>: Weed free (74.67cm) recorded maximum plant height followed by treatment T<sub>10</sub>: Two hand weeding (71.00 cm) and T<sub>6</sub>: Clodinofof-propagyl 15WP + 1 Hand weeding (70.70 cm). The highest number of branches (3.91) was recorded under treatment T<sub>8</sub>: Weed free which was at par with T<sub>10</sub>: Two hand weeding (3.90). The experimental result indicated that the significantly highest seed yield was obtained with the treatment T<sub>8</sub> weed free (1460 kg /ha) followed by T<sub>10</sub>: Two hand weeding (30 & 60 DAS) (1420 kg /ha) which were in turn at par to each other the treatment T<sub>6</sub>: Clodinofof-propagyl 15WP + one hand weeding. T<sub>13</sub>: Oxadairgyl 80WP + one hand weeding and T<sub>11</sub>: Oxadiazon 25 EC + one hand weeding were at par but significantly superior to other treatments.

### Keywords

Herbicide, Mustard,  
Weed, Yield and  
Yield attributes

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### Introduction

Mustard is the 3<sup>rd</sup> most important edible oilseed crop of the world after the Soybean and palm oil. The oil % varies from 37-49 % in mustard and rapeseed. The mustard and rapeseed are used in various ways. The oil

and seed are used as condiments in the preparation of vegetables, curries, pickles so also as the used as, hair oil, in medicines and manufacturing of grease. The mustard oil cake is considered as the best animals feed and organic manures. The leaves are consumed as green vegetables. In the leather

industries-mustard oil is used for softening of leather. It is second cultivating crop after the cereals. Although, India is of the leading oil producing country in the world, but it is unable to meet the requirement of edible oil for its large growing human community.

Mustard [*Brassica juncea* (L.) Czern and Cross] is one of the major oilseed crop of the Chhattisgarh. Indian mustard, in India is cultivated in 6.19 million hectares with average production 7.37 million tones and average productiveness of 1190 kg/ha.

In Chhattisgarh the productivity of mustard is very low productivity Chhattisgarh comparable to the national productivity and other state like Haryana (1609 kg), Gujrat (1577 kg), Rajasthan (1187 kg), Uttar Pradesh (1125 kg), Madhya Pradesh (1108 kg) *etc.* The reasons for low productivity of mustard might be due to local genotypes which have low yielder, dwarf in nature, bushy or trailing habit and susceptible to *Alternaria* blight, powdery mildew and aphids *etc.* This results in a big gap between requirement and production of mustard in Chhattisgarh and India.

In Chhattisgarh, Indian mustard is grown in an area of 145.28 thousand hectare. Its every year production is thousand tones with an average productivity of 590 kg/ha. India accounts for 17.28% and 9.07% of the total acreage and production of rapeseed and mustard (USDA, 2016), respectively. During the last nine year significantly increase in productivity from 1750 kg/ha in 2008-2009 to 1850 kg/ha in 2014-2015 and production has been increased 45.98 metrics tone in 2014-2015 (USDA, 2016).

## **Materials and Methods**

A field experiment was conducted at the Instructional Farm, BTC College of

Agriculture and Research Station, Bilaspur, Chhattisgarh during *Rabi* season of year 2018-19. The experiment laid out in randomized block design with three replications.

The amount of herbicides and total volume of spray solution for each plot was calculated on the basis of treatments and the area of each plot which was to be sprayed. Spray solution was prepared using water @ 500 L / ha and was applied using knapsack sprayer. The prepared solutions were sprayed as pre-emergence at 3 Days after sowing and as post-emergence at 35 DAS as per the treatments.

The plant population ( $m^{-2}$ ) was counted at 30 DAS (day after sowing) and at harvest with the help of quadrat. Quadrat was placed randomly in three spots in each plot and plants were counted within the area and then average plant stands were worked out. Five plants were randomly tagged in each plot and height of these plants was recorded from the ground level up to the tip of the plant at an interval of 30 days and at harvest. The average was calculated and expressed as plant height in centimetre (cm). The number of branches per plant was recorded by tagging five plants in each plot at an interval of 30 DAS, 60 DAS and at harvest.

The average numbers of branches were work out. 1000 seeds from the mixture of five selected plants were counted randomly and seed weight in grams (g) was recorded. Weight of the seed was computed on hectare basis and expressed in q / ha. Straw yield was obtain by subtract the seed weight from the corresponding weight of biological produce and was converted into q / ha. To work out the harvest index of mustard, economic yield (grain yield) were divided by the respective biological yield (total produce).

## Results and Discussion

### Effect on growth characters

#### Plant population

The result showed that the plant population was unaffected by the weed management treatments. However, treatment T<sub>8</sub>: Weed free (68.67 m<sup>-2</sup>) recorded highest plant population at initial stage as well as at harvest, followed by treatment T<sub>10</sub>: Two hands weeding (68.00 and 68.33 m<sup>-2</sup>). The treatment T<sub>4</sub>: Weedy check (59.67 and 58.00 m<sup>-2</sup>) recorded minimum plant population in both stages of crop observation. This result is resembled to the finding of Jangir *et al.*, (2017) (Table 1).

#### Plant height

The treatment T<sub>8</sub>: Weed free (74.67cm) recorded maximum plant height followed by treatment T<sub>10</sub>: Two hand weeding (71.00 cm)

and T<sub>6</sub>: Clodinofof-propagyl 15WP + 1 Hand weeding (70.70 cm).

The T<sub>8</sub>: Weed free treatment recorded significantly maximum plant height (158, 164, 189 cm) respectively. However 60DAS this was at par with T<sub>10</sub>: Two hand weeding (145cm) and T<sub>6</sub>: Clodinofof-propagyl 15WP + 1 Hand weeding (143 cm), at 90 DAS the treatment T<sub>8</sub>: Weed free (164cm) was significantly superior but at par with T<sub>10</sub>: Weed free (156cm), T<sub>6</sub>:Clodinofof-propagyl 15WP + 1 Hand weeding (155cm), T<sub>13</sub>Oxadairgyl 80WP + 1HW (152cm) and T<sub>6</sub>:Clodinofof-propagyl 15WP + 1 Hand weeding (155cm). The similar trend was observed at harvest. The T<sub>4</sub>: Weedy check recorded minimum plant height (64, 122, 106 and 121cm) at 30 DAS, 60 DAS, 90 DAS and at harvest stage of crop, respectively these are in conform to the finding of Gupta *et al.*, (2018) (Table 2).

**Table.1** Effect of weed management on plant population

	Treatment	Plant population (m <sup>-2</sup> )	
		Initial	At harvest
T <sub>1</sub>	Quizalofop-ethyl 5EC + 1 Hand weeding	63.67	62.33
T <sub>2</sub>	Pendimethalin 30EC (PE)	62.00	60.22
T <sub>3</sub>	Oxadiazon 25EC (PE)	63.00	61.33
T <sub>4</sub>	Weedy check	59.67	58.00
T <sub>5</sub>	Oxadairgyl 80WP (PE)	63.00	61.64
T <sub>6</sub>	Clodinofof-propagyl 15WP + 1 Hand weeding	67.67	65.67
T <sub>7</sub>	Pendimethalin 30 EC + 1 Hand weeding	65.00	63.67
T <sub>8</sub>	Weed free	68.67	66.33
T <sub>9</sub>	Quizalofop-ethyl5EC(PoE)	61.67	60.33
T <sub>10</sub>	Two hand weeding at 30 & 60 DAS	68.00	66.33
T <sub>11</sub>	Oxadiazon 25EC + 1 Hand weeding	65.67	64.00
T <sub>12</sub>	Clodinofof-propagyl 15WP(PoE)	63.33	61.67
T <sub>13</sub>	Oxadairgyl 80WP + 1 Hand weeding	66.00	64.33
<b>SEm±</b>		3.52	3.03
<b>CD (P=0.05)</b>		NS	NS
<b>CV (%)</b>		9.47	8.37

**Table.2** Effect of weed management on plant height (cm)

	Treatment	Plant height (cm)			
		30 DAS	60 DAS	90 DAS	At harvest
T <sub>1</sub>	Quizalofop-ethyl 5EC + 1 Hand weeding	66.33	130.33	141.00	165.00
T <sub>2</sub>	Pendimethalin 30EC (PE)	63.00	115.00	125.33	148.67
T <sub>3</sub>	Oxadiazon 25EC (PE)	64.00	129.00	139.67	161.67
T <sub>4</sub>	Weedy check	52.00	84.00	106.33	121.67
T <sub>5</sub>	Oxadairgyl 80WP (PE)	64.00	122.00	134.67	152.67
T <sub>6</sub>	Clodinofof-propagyl 15 WP + 1 Hand weeding	70.70	143.00	155.00	173.00
T <sub>7</sub>	Pendimethalin 30EC + 1 Hand weeding	68.33	132.00	150.67	167.67
T <sub>8</sub>	Weed free	74.67	158.00	164.00	189.33
T <sub>9</sub>	Quizalofop-ethyl 5EC(PoE)	62.67	107.67	120.67	138.67
T <sub>10</sub>	Two hand weeding at 30 & 60 DAS	71.00	145.00	156.67	174.33
T <sub>11</sub>	Oxadiazon 25EC + 1 Hand weeding	68.33	131.33	147.33	167.33
T <sub>12</sub>	Clodinofof-propagyl 15WP	64.00	122.67	137.33	154.00
T <sub>13</sub>	Oxadairgyl 80WP + 1 Hand weeding	70.33	136.00	152.67	170.33
<b>SEm±</b>		5.12	4.83	6.89	6.78
<b>CD (P=0.05)</b>		NS	14.10	20.13	19.79
<b>CV (%)</b>		13.43	6.57	8.59	8.10

**Table.3** Effect of weed management on number of branches

	Treatment	Number of branches		
		30 DAS	60 DAS	At harvest
T <sub>1</sub>	Quizalofop-ethyl 5EC + 1 Hand weeding	3.50	8.43	8.90
T <sub>2</sub>	Pendimethalin 30EC (PE)	3.36	7.63	8.13
T <sub>3</sub>	Oxadiazon 25EC (PE)	3.40	7.79	8.20
T <sub>4</sub>	Weedy check	2.43	6.50	7.12
T <sub>5</sub>	Oxadairgyl 80WP (PE)	3.45	7.80	8.23
T <sub>6</sub>	Clodinofof-propagyl 15WP + 1 Hand weeding	3.85	9.45	9.83
T <sub>7</sub>	Pendimethalin 30EC + 1 Hand weeding	3.60	8.80	9.23
T <sub>8</sub>	Weed free	3.91	9.71	10.20
T <sub>9</sub>	Quizalofop-ethyl 5EC(PoE)	3.18	7.52	8.00
T <sub>10</sub>	Two hand weeding at 30 & 60 DAS	3.90	9.70	10.13
T <sub>11</sub>	Oxadiazon 25EC + 1 Hand weeding	3.80	9.18	9.53
T <sub>12</sub>	Clodinofof-propagyl 15WP(PoE)	3.45	8.20	8.63
T <sub>13</sub>	Oxadairgyl 80WP + 1 Hand weeding	3.85	9.33	9.80
<b>SEm±</b>		0.17	0.37	0.36
<b>CD (P=0.05)</b>		0.51	1.10	1.06
<b>CV (%)</b>		8.66	7.73	7.11

**Table.4** Effect of weed management on yield attributing characters

	Treatment	Yield attributing characters			
		No. of siliqua /plant	No. of seed /siliqua	Length of siliqua (cm)	Test weight (g)
T <sub>1</sub>	Quizalofop-ethyl 5EC + 1 Hand weeding	107.33	12.00	4.37	3.50
T <sub>2</sub>	Pendimethalin 30EC (PE)	88.67	9.33	4.23	3.27
T <sub>3</sub>	Oxadiazon 25EC (PE)	90.00	10.67	4.30	3.37
T <sub>4</sub>	Weedy check	80.00	8.00	4.20	3.13
T <sub>5</sub>	Oxadairgyl 80WP (PE)	97.00	10.67	4.33	3.37
T <sub>6</sub>	Clodinofof-propagyl 15 WP + 1 Hand weeding	133.00	13.33	4.60	3.60
T <sub>7</sub>	Pendimethalin 30EC + 1 Hand weeding	120.33	12.00	4.40	3.50
T <sub>8</sub>	Weed free	139.33	14.33	4.60	3.67
T <sub>9</sub>	Quizalofop-ethyl 5EC(PoE)	88.67	9.67	4.27	3.30
T <sub>10</sub>	Two hand weeding at 30 & 60 DAS	133.00	13.33	4.60	3.60
T <sub>11</sub>	Oxadiazon 25EC + 1 Hand weeding	121.33	12.53	4.47	3.50
T <sub>12</sub>	Clodinofof-propagyl 15WP	97.67	11.67	4.37	3.40
T <sub>13</sub>	Oxadairgyl 80WP + 1 Hand weeding	129	13.00	4.50	3.53
SEm±		8.31	0.78	0.26	0.07
CD (P=0.05)		24.26	2.28	0.18	0.23
CV (%)		13.08	11.72	10.60	3.96

**Table.5** Effect of weed management on seed yield, stover yield and harvest index

	Treatment	Yield parameters		
		Seed Yield (kg /ha)	Stover yield (kg /ha)	Harvest index (%)
T <sub>1</sub>	Quizalofop-ethyl 5EC + 1 Hand weeding	1189	4880	19.59
T <sub>2</sub>	Pendimethalin 30EC (PE)	1043	4543	18.67
T <sub>3</sub>	Oxadiazon 25EC (PE)	1043	5133	16.96
T <sub>4</sub>	Weedy check	790	4998	13.60
T <sub>5</sub>	Oxadairgyl 80WP (PE)	1133	5365	17.43
T <sub>6</sub>	Clodinofof-propagyl 15WP + 1 Hand weeding	1320	5400	19.64
T <sub>7</sub>	Pendimethalin 30EC + 1 Hand weeding	1246	5097	19.64
T <sub>8</sub>	Weed free	1460	5593	20.70
T <sub>9</sub>	Quizalofop-ethyl 5EC(PoE)	1083	5240	17.14
T <sub>10</sub>	Two hand weeding at 30 & 60 DAS	1420	5577	20.00
T <sub>11</sub>	Oxadiazon 25EC + 1 Hand weeding	1280	5550	18.74
T <sub>12</sub>	Clodinofof-propagyl 15WP(PoE)	1163	5006	18.91
T <sub>13</sub>	Oxadairgyl 80WP + 1 Hand weeding	1287	4933	20.69
SEm±		35.31	164.26	0.57
CD (P=0.05)		103.80	479.45	1.68
CV (%)		5.14	5.52	5.29

### Number of branches

The highest number of branches (3.91) was recorded under treatment T<sub>8</sub>: Weed free which was at par with T<sub>10</sub>: Two hand weeding (3.90), T<sub>6</sub>: Clodinfop-propagyl 15WP + 1 HW (3.85), T<sub>13</sub>: Oxadiargyl 80WP + 1 HW (3.85) T<sub>11</sub>: Oxadiazon 25EC + 1 HW (3.80), T<sub>7</sub>: Pendimethalin30EC + 1 HW (3.60), T<sub>1</sub>: Quizalofop ethyl 5EC+ 1 HW (3.50), T<sub>12</sub>: Clodinfop-propagyl 15WP (3.45), T<sub>5</sub>: Oxadiargyl 80WP (3.45) and T<sub>3</sub>: Oxadiazon 25EC (3.40) at 30 DAS of observation. The similar number of branches (9.71) was recorded under T<sub>8</sub>: weed free, T<sub>10</sub>: Two hand weeding at 30 & 60 DAS (9.7), T<sub>6</sub>: Clodinfop-propagyl 15 WP + 1 HW (9.45) T<sub>13</sub>: Oxadiargyl 80 WP + 1 HW (9.33) at 60 DAS and at harvest stage of crop. The highest number of branches was recorded under T<sub>8</sub>: weed free at all the time intervals *i.e.* 3.91, 9.71 and 10.20 at 30, 60 and at harvest, respectively. The differences were not significant with the treatments T<sub>10</sub>: Two hand weeding, T<sub>6</sub>: Clodinfop-propagyl 15WP + 1 HW, T<sub>13</sub>: Oxadiargyl 80WP + 1 HW and T<sub>11</sub>: Oxadiazon 25EC+ 1 HW at 30 DAS, T<sub>10</sub> and T<sub>6</sub> at 60 DAS and at harvest. The lowest number of branches was recorded under T<sub>4</sub>: Weedy check (2.43, 6.50 and 7.12) at all the stages. Sinha *et al.*, (2005) also reported that one hand weeding at 30 DAS gave the higher number of secondary branches (Table 3).

### Yield attributing characters

The significantly maximum number of siliqua (139.33 /plant) was observed under treatment T<sub>8</sub>: Weed free. Which was at par with treatment T<sub>10</sub>: Two hand weeding (133.00), T<sub>6</sub>: Clodinfop-propagyl 15WP + 1 HW (133.00), T<sub>13</sub>: Oxadairgyl 80WP + 1 HW (129.00) and T<sub>11</sub>: Oxadiargyl 80WP + 1 HW (121.33). The minimum number of siliqua /plant (80.00) was observed under treatment T<sub>4</sub>: weedy check. These results are in

conformity with finding of Gupta *et al.*, (2018). The number of seeds /siliqua was found significantly under T<sub>8</sub>: Weed free (14.33). Which was like T<sub>10</sub>: Two hand weeding (13.33), T<sub>6</sub> Clodinfop-propagyl 15WP + 1 HW (13.33) and T<sub>13</sub>: Oxadiargyl 80WP + 1 HW (13.00). The T<sub>4</sub>: weedy check recorded lowest number of seed /siliqua (8.0). The length of siliqua (4.62) was recorded significantly higher number under treatment T<sub>8</sub>: Weed free. Which was at par with the treatment T<sub>10</sub>: Two hand weeding (4.61) and T<sub>6</sub>: Clodinfop-propagyl 15WP + 1 HW (4.60). The T<sub>4</sub>: weedy check recorded lowest length of siliqua (4.20). The test weight recorded significantly highest under treatment T<sub>8</sub>: Weed free (3.67), which was at par with treatment T<sub>10</sub>: Two hand weeding (3.60), T<sub>6</sub>: Clodinfop-propagyl 15WP + 1 HW (3.60), T<sub>13</sub>: Oxadairgyl 80WP + 1 HW (3.53), T<sub>7</sub>: Pendimethalin30EC+ 1 HW (3.50), T<sub>1</sub>: Quizalofop ethyl 5EC (3.50) and T<sub>12</sub>: Clodinfop-propagyl 15WP + 1 HW (3.40). The lowest test weight was recorded under treatment T<sub>4</sub>: weedy check (3.13). These higher result might be due to better weed control in these treatments. These results are in conformity with Sharma and Singh (2003) and Jangir *et al.*, (2007) (Table 4).

### Seed Yield, stover yield and harvest index

The treatment T<sub>8</sub>: Weed free, recorded significantly highest seed yield (1460 kg /ha) among all weed management treatments, followed by T<sub>10</sub>: Two hand weeding (1420 kg /ha), which were in turn at par to each other. The treatments T<sub>6</sub>: Clodinfop-propagyl 15WP + 1 HW (1320 kg /ha), T<sub>13</sub> Oxadairgyl 80WP + 1 HW (1287 kg /ha) and T<sub>11</sub>: Oxadiazon 25EC + 1 HW (1280 kg /ha) were at par and significantly superior to other treatments (Table 5). The lowest seed yield was recorded with T<sub>4</sub>: Weedy check which was significantly lower (790 kg /ha) to all

treatments. The higher yield in respective treatment is might be due to better yield attributing characters. These results are in accordance with the findings of Singh *et al.*, (2001). The significantly highest stover yield (5593 kg /ha) was recorded under treatment T8: Weed free, which was at par with T11: Oxadiazon 25EC + 1 HW (5550 kg /ha.). The treatment T6: Clodinofof-propagyl 15WP + 1 HW (5400 kg /ha.) also gave good stover yields, which was at par with T10: Two hand weeding (5577). These results in agreement with finding of Yadav *et al.*, (2017). The treatment T8: Weed free gave highest harvest index (20.70), followed by T13: Oxadairgyl 80WP + 1 Hand weeding (20.69) and T1: Quizalofop-ethyl 5EC + 1 Hand weeding (19.59). The minimum harvest index (13.60) was obtained with T4: weedy check is might be due to effect of heavy infestation of weed which in turn effects the proper growth of the stem. The similar results obtained by Chauhan and Sharma (1995), Singh *et al.*, (1999), Singh *et al.*, (2001), Patel *et al.*, (2001), Tomar (2015), and Yadav et.al (2017).

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