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Management of Chocolate weed (*Melochia corchorifolia*) in sesame at Onattukara sandy tracts

***A. JAYAPAL, V. MINI, A. R. RESMI, B. LOVELY AND G. SUJA**

Onattukara Regional Agricultural Research Station, Kerala Agricultural University, Kayamkulam, Alappuzha – 690502, Kerala

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ABSTRACT

Chocolate weed (Melochia corchorifolia), usually found along the roadsides and waste lands are now found to be invading the summer rice fallows of Onattukara sandy tract, where sesame is grown. Since much of the herbicides for controlling broad leaved weeds were found to be phytotoxic to sesame, a study was taken up at Onattukara Regional Agricultural Research Station, Kayamkulam, Kerala, from February 2021 to May 2021 to identify a suitable weed management measure for chocolate weed at Onattukara. Pre-emergent application of oxyfluorfen (T_1), cashew nut shell liquid (CNSL) (T_2), imazethapyr (T_3), glufosinate ammonium (T_4), glyphosate (T_5), unweeded control (T_6) and hand weeding at 20 and 45 DAS (T_7) were the treatments and were replicated thrice in Randomized block design. The results revealed that weed management measures have significant role in the growth and yield of sesame at Onattukara. Hand weeding produced better results in terms of growth and yield in sesame. Weed control efficiency was also found better for hand weeding but BC ratio was significantly higher in imazethapyr (2.02) treated plots. It is concluded that applying imazethapyr (@ 0.75 l ha^{-1}) as a pre-emergent spray followed by weeding using cono-weeder at 15 days after sowing and one hand weeding at 30 days after sowing is required for managing M. corchorifolia in sesame.

***Keywords*:** Chocolate weed, imazethapyr, melochia, sesame

Melochia corchorifolia also known as Chocolate weed belongs to the family of Sterculiaceae. It is considered as an introduced weed. The weed was initially found along the open areas like road sides and in wastelands. Now it is a weed all over the tropics (Pullaiah, 2014). *M. corchorifolia* can quickly infest cultivated areas because of its short life cycle, production of plenty of seeds and adaptation to wide range of soils. It is a herbaceous shrub with a woody taproot. The stem is usually erect or sometimes found prostrate and is usually red in colour. They may grow up to a height of two meter if left unchecked (Menon *et al*., 2020). The leaves are petiolate, in alternate arrangement and are proliferated by seeds. *M. corchorifolia* was found to reduce the yield of upland rice by 67 per cent (De Datta and Liagas, 1984). Menon *et al.* (2020) has reported that control of chocolate weed in rice be done by pre-emergence application of oxyfluorfen.

Onattukara tract in Kerala extends to an area of 71,059 ha covering the sandy tracts of Alappuzha, Kollam and Pathanamthitta districts. The soil of Onattukara is coarse textured loamy sand with low nutrient and water holding capacity. Sesame is one of the major crops suited to Onattukara tract and is usually grown during the summer season. The seeds are generally broadcasted in the main field to save time, labour and cost. Chocolate weed seeds that are already present in the soil from the previous crop also germinates with the broadcasted sesame. In the last few years, it is noticed that sesame has not been able to yield to its potential as the chocolate weed seeds outgrows sesame.The weed seeds are similar in appearance to sesame seeds and is difficult to be separated from sesame. It is difficult to differentiate sesame plants from chocolate weed even at the seedling stage. For the past few years, the weed has achieved its dominance at Onattukara which might be due to the large weed seed bank, its higher seed setting and faster growth habit.The weed has now become a menace to the sesame farmers of this region. Since the herbicides for controlling broad leaved weeds is found to be phytotoxic to sesame,the present study, a pioneer work, was undertaken to identify a suitable weed management measure for chocolate weed at Onattukara.

A field investigation was done from February 2021 to May 2021 at Onattukara Regional Agricultural Research Station, Kayamkulam, Kerala with a view to manage chocolate weed. The experimental design was RBD with seven treatment combinations which were replicated thrice. The treatments were pre-emergence (PE) application of oxyfluorfen @ 0.75 l ha^{-1} (T_1), cashew nut shell liquid (CNSL) @ 0.75 l ha^{-1} (T_2), imazethapyr @ 0.75 l ha^{-1} (T_3), glufosinate ammonium @ 0.75 l ha^{-1} (T_4), glyphosate @ 0.75 l ha^{-1} (T_5), unweeded control (T_6) and hand weeding twice at 20 and 45 DAS (T_7). Herbicides and CNSL in the treatments were given as pre-emergent sprays followed by weeding

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Email: atuljayapal87@gmail.com

using conoweeder at 15 DAS and one hand weeding at 30 DAS. The land was prepared as per treatments. The seeds were planted in lines with a spacing of 30 x 15 cm. All other crop management operations were done as per the package of practices (KAU, 2016).

The initial number of weeds per m^2 was recorded before and after the experiment. The prevalence (%), absolute frequency, relative frequency, absolute density, relative density, importance value and SDR were measured using standard procedures (Riaz and Javaid, 2010). The biometric observations *viz*., plant height, number of branches, leaf number and yield characters like number of pods plant^{-1} and yield (kg ha^{-1}) were recorded at harvest. The weed control efficiency was calculated using the formula,

Weed control efficiency,

$$WCE\ (\%) = \frac{WPc - WPt}{WPc} \times 100;$$

Where, WPc = Weed population (m^2) in control plot and WPt = Weed population (m^2) in treated plots (Mani *et al*., 1973). Weed index was calculated using the formula,

$$\text{Weed Index, } WI(\%) = \frac{X - Y}{X} \times 100;$$

Where, X = yield (t ha^{-1}) in treatment with highest yield and Y = yield (t ha^{-1}) in treatment for which weed index is calculated (Prachand *et al*., 2015).

The economics of cultivation of sesame *viz*. cost of cultivation of sesame, gross returns, net returns and BC ratio was calculated as per standard procedures.

Initial weed status

The weeds that were dominant in the experimental area were *Oldenlandia corymbosa, Brachiaria subquadripara and M. corchorifolia*. Initial status of weeds in the experiment area (Table 1) shows that the area was heavily dominated by *M. corchorifolia*. Even though *Oldenlandia corymbosa* and *Brachiaria subquadripara* were found in all of the observed area, their population was very less. *M. corchorifolia* recorded a relative frequency of 45.45% compared to other weeds studied. The absolute density, relative density, importance value and Summed Dominance Ratio (SDR) was found to be more for *M. corchorifolia* confirming its dominance at Onattukara region.

Growth and yield of sesame

All weed management treatments had a significant variation in their results with respect to weedy check (Table 2). The results of the study revealed that significantly taller sesame plants (144.60 cm) were found in hand weeded plots (t_7) compared to the other weed control treatments. Comparable results were obtained by Mathukia *et al*. (2015) who observed taller sesame plants with higher number of branches under weed free check. Application of oxyfluorfen @ 0.75 l ha^{-1} (T_1) and imazethapyr @ 0.75 l ha^{-1} (T_3) as pre-emergence also recorded values that were statistically at par with T_7. Weedy check (T_6) produced the smallest sesame plants with 105.35 cm. Significantly higher number of branches (3.53) were also recorded by hand weeded plots (T_7). This may be due to the fact that hand weeding resulted in reduced crop weed competition and might have created a good environment for better growth of sesame. The un-weeded plots were found to produce lesser number of branches (1.93). Significantly higher number of leaves were observed for T_1 - oxyfluorfen @ 0.75 l ha^{-1} with 122.20 leaves and was on a par with hand weeding (T_7) and imazethapyr @ 0.75 l ha^{-1} (T_3) with 119.07 and 118.58 leaves respectively.

In the case of yield parameters (Table 2), the number of pods plant^{-1} was found significantly higher for sesame plants in hand weeding treatment (T_7). The results were statistically at par with imazethapyr treated plants (T_3-123.13) and oxyfluorfen (T_1- 119.87). Similar to the biometrical observations, the number of pods plant^{-1} was found to be least in un weeded (T_6) plots. The highest yield of sesame was recorded in hand weeding (371.74 kg ha^{-1}) which were found not significant with imazethapyr @ 0.75 l ha^{-1} (359.39 kg ha^{-1}). Bhadauria *et al*. (2012) also observed highest yield for sesame when two hand weedings were done at 15 and 30 DAS. The application of pre-emergence herbicides supplemented with periodical weeding might have provided a better environment for higher yielding in sesame in imazethapyr treated plots. The lowest yield was recorded by plots that were left without weeding (T_6). This decrease in yield may be due to the competition with sesame for growth factors like nutrients, moisture, light and space. Walia (2006) has also observed the decrease in yield due to competition for growth factors from weeds. The profuse growth of weeds in un-weeded plots during the crop growth period might have resulted in the lower yield of sesame.

Weed control efficiency and weed index

The highest number of weeds (80.113) was registered for un weeded plots (Table 3). This result was in confirmation with the studies of Adhikary *et al*. (2020) who had reported the highest weed density in un weeded plots. Weeds were found lowest in hand weeded plots (T_7 - 47.22) followed by (T_3 – imazethapyr @ 0.75 l ha^{-1}). Table 3 depicts the weed control efficiency (WCE) for various weed management treatments and the result indicated that highest weed control efficiency was recorded in T_7 (hand weeding). This was followed by imazethapyr @ 0.75 l ha^{-1} (T_3) with 25.42% and was found at par with oxyfluorfen @ 0.75 l ha^{-1} (T_1 - 18.33%). The seeds of *M. corchorifolia* that were

Table 1: Initial weed status of the experimental area

Weeds	Prevalence (%)	Absolute frequency (%)	Relative frequency (%)	Absolute density	Relative density	Importance value	SDR
Oldenlandia corymbose	80	80	36.36	3	5	41.36	20.68
Brachiaria subquadripara	40	40	18.19	0.4	0.67	18.86	9.43
Melochia corchorifolia	100	100	45.45	56.6	94.33	139.78	69.89

Table 2: Weed management on the growth and yield of sesame

Treatments	Height of sesame (cm)	Number of branches	Number of leaves	Number of pods plant^{-1}	Yield ha^{-1} (kg ha^{-1})
T_1 – Oxyfluorfen @ 0.75 l ha^{-1}	133.97	3.53	122.20	119.87	348.42
T_2 - CNSL @ 0.75 l ha^{-1}	108.25	2.13	93.20	101.40	338.82
T_3 – Imazethapyr @ 0.75 l ha^{-1}	137.33	3.67	118.58	123.13	359.39
T_4 – Glufosinate ammonium @ 0.75 l ha^{-1}	119.23	2.07	108.33	118.53	338.82
T_5 – Glyphosate @ 0.75 l ha^{-1}	116.22	2.07	97.73	110.27	341.56
T_6 - Unweeded	105.35	1.93	60.20	58.13	149.52
T_7 -HW @ 20DAS & 45 DAS	144.60	3.53	119.07	125.80	371.74
LSD (0.05)	**10.71**	**0.83**	**6.97**	**6.54**	**20.17**
SEm(±)	**15.16**	**0.82**	**21.81**	**23.57**	**76.65**

Table 3: Weed control treatments on weed control efficiency and weed index

Treatments	Number of weeds	Weed control efficiency (%)	Weed index(%)
T_1 – Oxyfluorfen@ 0.75 l ha^{-1}	65.33	18.33	6.27
T_2 - CNSL @ 0.75 l ha^{-1}	71.45	11.11	8.85
T_3 – Imazethapyr @ 0.75 l ha^{-1}	59.67	25.42	3.32
T_4 – Glufosinate ammonium @ 0.75 l ha^{-1}	67.56	15.56	8.86
T_5 – Glyphosate @ 0.75 l ha^{-1}	67.89	15.14	8.12
T_6 – Unweeded	80.11	-	59.78
T_7 -HW @ 20DAS & 45DAS	47.22	40.97	-
LSD (0.05)	**6.40**	**8.01**	**5.43**
SEm(±)	**10.22**	**12.74**	**20.62**

Table 4: Weed management on the economics of cultivation of sesame

Treatments	Cost of cultivation (Rs.)	Gross return (Rs.)	Net return (Rs.)	BC Ratio
T_1 – Oxyfluorfen @ 0.75 l ha^{-1}	45,358	87,105	41,747	1.92
T_2 - CNSL @ 0.75 l ha^{-1}	43,470	84,705	41,235	1.95
T_3 – Imazethapyr @ 0.75 l ha^{-1}	44,520	89,848	45,328	2.02
T_4 – Glufosinate ammonium @ 0.75 l ha^{-1}	44,010	84,705	40,695	1.93
T_5 – Glyphosate@ 0.75 l ha^{-1}	43,510	85,390	41,880	1.96
T_6 - Unweeded	34,510	37,379	2,869	1.08
T_7 -HW @ 20DAS & 45DAS	46,990	92,935	45,945	1.98
LSD (0.05)	**-**	**5041**	**5041**	**0.13**
SEm(±)	**-**	**19166**	**15232**	**0.33**

already present in the experimental area might have germinated after the cultural operations resulting in the lower weed control efficiency.

Weed index is the magnitude of yield reduction as a result of presence of weeds in the experimental area. It is found that there is 59.78% yield reduction (Table 3) in sesame due to weeds (T_6). *M. corchorifolia* might have looted the resources intended for sesame thereby reducing the yield of sesame. Imazethapyr @ 0.75 l ha^{-1} (T_3) treated plants produced significantly lowest

weed index (3.32%) followed by oxyfluorfen @ 0.75 l ha^{-1} (T_1 – 6.27%). Comparable results were also obtained by Prachand *et al*. (2015) who reported lowest weed index in soybean due to application of imazethapyr and quinalofop ethyl.

Economics of sesame

Higher cost of cultivation of sesame was in hand weeding (T_7) with Rs. 46,990 (Table 4). This is due to the higher cost incurred due to manual weedings done at 20 and 45 DAS. In all other treatments except T_6, pre-emergence application of herbicides was followed by weeding using conoweeder at 15 DAS and one manual weeding at 30 DAS which has reduced the cost of cultivation. The lowest cost was recorded by T_6 (unweeded). This was reflected in the gross returns obtained from treatments in the experiment. Even though hand weeding (T_7) was costlier than other treatments, it was compensated with a significantly higher gross return (Rs. 92,935) since the yield obtained was higher due to less competition with weeds for resources. The gross returns from T_6 recorded the lowest values (Rs. 37,379) since the yield obtained was the lowest for un weeded plots.

Significantly higher net returns (Rs. 45,945) were obtained from hand weeding twice (Table 4) followed by imazethapyr @ 0.75 l ha^{-1} (T_3). The lowest net returns were received from T_6 (unweeded) which was due to its poor yield. All the weed management measures had significant effects on benefit cost ratio (BCR). A significantly higher BC ratio was obtained in imazethapyr (T_3) treated plants (2.02) followed by hand weeding (T_7 - 1.98). The lowest BCR (1.08) was recorded by non-weeded plots (T_6) suggesting the significance of weed management measures in sesame.

Weed management measures have significant role in the growth and yield of sesame at Onattukara. Even though hand weeding was found to produce better results for growth and yield in sesame, it was closely followed by imazethapyr @ 0.75 l ha^{-1}. The number of weeds per m^2 observed after the experiment were less in hand weeded and imazethapyr treated plots, but hand weeding had better weed control efficiency. Imazethapyr treated plots recoded lesser weed index. The cost of cultivation was found to be more for hand weeded plots even though the yield and net returns were more. This high cost can be reduced without much reduction in yield and net returns when imazethapyr is used. The highest BC ratio was also observed from imazethapyr treated plots. Thus, pre-emergent application of imazethapyr (@ 0.75 l ha^{-1}) and weeding using cono-weeder at 15 DAS and one hand weeding at 30 DAS is required for managing *M. corchorifolia* in sesame at Onattukara. However, possibility of including a post emergent herbicide at 45 DAS of sesame has to be tried to improve the weed control efficiency without affecting growth and yield of sesame**.**

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