E-ISSN: 2618-0618
P-ISSN: 2618-060X

www.agronomyjournals.com
2024; SP-7(9): 856-859
Received: 17-06-2024
Accepted: 28-07-2024

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Effect of weed management practices on growth and yield of rainfed castor

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DOI: https://doi.org/10.33545/2618060X.2024.v7.i9Sl.1615

Abstract
A field experiment was conducted during *kharif*, 2023 to study the effect of different weed management practices on rainfed castor at Regional Agricultural Research Station, Palem. The experiment was laid out in randomized block design with three replication and nine treatments. The results showed that a weed free condition led to the highest growth and yield attributing characters in rainfed castor and highest seed yield (2264 kg ha^{-1}) recorded due to higher weed control efficiency of 90.5%, reduced weed density (4.7 No. m^{-2}) and weed dry matter (3.5 g. m^{-2}). Among the herbicidal treatments, application of diclosulam 84% WDG 31 g *a.i.* ha^{-1} as pre-emergence (PE) followed by intercultivation with power weeder at 30 DAS and diclosulam 84% WDG 31 g *a.i.* ha^{-1} as pre-emergence (PE) followed by quizalofop-p-ethyl 15% EC 50 g *a.i.* ha^{-1} as post-emergence (PoE) at 30 DAS higher seed yield par with weed free treatment. This suggests that these treatments are effective alternatives for achieving similar weed control and yield benefits as weed free treatment.

Keywords: Diclosulam, quizalofo-p-ethyl, intercultivation, weed free

Introduction
Castor (*Ricinus communis* L.) is an important non-edible, commercial oilseed crop belongs to the Euphorbiaceae family. India is the global leader in castor production, accounting for 68% of the world's area and 85% of its production. This is due to the crop's excellent adaptation to India's semi-arid to sub-tropical climates and saline conditions, making it a key economic crop in dryland farming systems. In India area and production under castor reported during 2023-24 were 10.38 lakh ha and 19.13 lakh tonnes respectively (Ministry of Agriculture and Farmers Welfare, Government of India, 2023-24.) [9] whereas in Telangana state, castor production in 2023-24 is at 0.02 lakh tonnes from 0.02 lakh ha with productivity of 724 kg ha^{-1} (Directorate of Economics and Statistics, 2023) [5]. Castor oil is used in multiple industries as raw material for production of paints, varnishes, soaps, dyes and as a lubricant in jet engines (Copley *et al*., 2005: Ramanjaneyulu *et al*., 2017) [3, 12]. Weeds are the major biotic stress for crop production (Yadav and Singh, 2007) [15] which compete with crop plants for essential resources due to its physiological nature such as longer, deeper and robust roots which enable them access water and nutrients from deeper soil layers more effectively (Choudhary and Dixit, 2021) [2]. Castor is vulnerable to weeds competition because of its wider planting, slow emergence which significantly impact castor yields, with reported reductions reaching up to 73.6% (Azevedo *et al*., 2006) [4]. To minimize these losses, effective weed control within the 30 to 60 days after sowing is essential (Dungarwal *et al*., 2002) [6]. Hand weeding is a traditional weed control method but it has limitations such as high cost and limited labour availability during peak periods. Herbicides are best option which are quick in action, selective in nature, cost effective and efficient to control weeds when applied alone or in combination with other weed control method reduced the crop-weed competition. However, there is limited information on weed management strategies in rainfed castor, there is a need to devise suitable and economically viable practices for managing weeds in castor to achieve higher levels of productivity.

Materials and Methods
The field experiment carried out at Regional Agricultural Research Station (RARS), Palem,

Nagarkurnool, Telangana state during *kharif*, 2023. The soil texture was sandy loam with pH of 7.7, low in organic carbon of 0.54%, low available nitrogen of 210 kg ha^{-1}, high available phosphorus of 55.2 kg ha^{-1} and high available potash of 334 kg ha^{-1}. The study was executed with nine treatments *viz*., T_1- PE- Diclosulam 84% WDG - 31 g *a.i.* ha^{-1} *fb* quizalofop-p-ethyl 5% EC - 50 g *a.i.* ha^{-1} as PoE at 30 DAS; T_2- PE- Diclosulam 84% WDG - 31 g *a.i.* ha^{-1} fb direct spraying of glufosinate ammonium 13.5% SL - 375 g *a.i.* ha^{-1} as PoE at 30 DAS; T_3- PE- Diclosulam 84% WDG - 31 g *a.i.* ha^{-1} fb intercultivation with power weeder at 30 DAS; T_4- PE- Pendimethalin 38.7% CS - 677.25 g *a.i.* ha^{-1} fb quizalofop-p-ethyl 5% EC - 50 g *a.i.* ha^{-1} as PoE 30 DAS; T_5 - PE- Pendimethalin 38.7% CS - 677.25 g *a.i.* ha^{-1} fb direct spraying of glufosinate ammonium 13.5% SL 375 g *a.i.* ha^{-1} as PoE at 30 DAS; T_6 - PE- Pendimethalin 38.7% CS - 677.25 g *a.i.* ha^{-1} fb intercultivation with power weeder at 30 DAS; T_7 - Intercultivation with power weeder at 20 and 40 DAS; T_8 -Weed free (3 Hand weedings); T_9 - Unweeded check. Crop was sown on 15th July, 2023 with a spacing of 120 cm x 45 cm. RDF of 80:40:30 N, P_20_5 and K_2O kg ha^{-1} was applied in the form of urea, single superphosphate and muriate of potash. Nitrogen was applied in three split doses (30, 60, 90 DAS) by pocketing method, while the entire quantity of phosphorous and potassium were applied basally at the time of sowing. Observations on growth and yield parameters were recorded following standard procedures. Weed density was counted with a 1 m^{-2} quadrant in each treatment. For weed dry matter samples collected from each 1 m^{-2} quadrant shade dried followed by oven drying at 60^0C until constant weight was obtained. Weed control efficiency was calculated by using the formula and expressed in percentage (AICRPWC, 1988) [1]. The statistical analysis of data collected on weed and crop was done using analysis of variance technique for randomized block design given by Gomez and Gomez. (1984) [4]. The original data on weed density and weed dry matter subjected to square root transformation ($\sqrt{x+0.5}$).

$$WCE\ (\%) = \frac{DWC - DWT}{DWC} * 100$$

Where,
DWC = Weed dry matter in un weeded control plot
DWT = Weed dry matter in treated plot

Results and Discussion

Weed flora

The predominant weed species observed in the experimental field were, *Cynodon dactylon, Echinochloa crusgalli, Echinochloa colonum (L), Digitaria cilarius, Dactyloctenium aegyptium, Cyperus rotundus, Commelina bengalensis, Mollugo nudicaulis, Trianthema portulacastrum, Euphorbia hirta, Amaranthus viridis, Phyllanthus niruri, Lucas aspera, Parthenium hysterophorus, Tridax procumbens.*

Weed parameters

Among the weed control treatments, significantly lowest weed density (4.72 m^{-2}) and dry matter (3.5 m^{-2}) was noted in T_8- weed free (4.7 No. & 3.5 g. m^{-2}, respectively) it is on par with T_3- diclosulam 84% WDG 31 g *a.i.* ha^{-1} PE *fb* intercultivation with power weeder at 30 DAS (5.2 m^{-2} & 3.8 g. m^{-2} respectively) and T_1- diclosulam 84% WDG 31 g *a.i.* ha^{-1} PE *fb* quizalofop-p-ethyl 15% EC 50 g *a.i.* ha^{-1} as PoE at 30 DAS (5.4 m^{-2} & 4.1 g. m^{-2}, respectively). Unweeded check (T_9) recorded higher weed density (11.2 m^{-2}) and dry matter (10.2 g. m^{-2}). Diclosulam provides effective suppression of all category weeds during initial stages as compared to pendimethalin. Similar was reported by Singh *et al*., 2009 [13] and at later stages either intercultivation or quizalofop-p-ethyl provides effective weed control.

Weed control efficiency

Significantly higher weed control efficiency recorded under weed free treatment (90.5%) and was on par with T_3- diclosulam 84% WDG 31 g *a.i.* ha^{-1} PE *fb* intercultivation with power weeder at 30 DAS (87.7%) and T_1- diclosulam 84% WDG 31 g *a.i.* ha^{-1} PE *fb* quizalofop-p-ethyl 15% EC 50 g *a.i.* ha^{-1} as PoE at 30 DAS (85.5%). The next best treatments include T_7 - intercultivation with power weeder at 20 and 40 DAS (76.2%) and T_2 - diclosulam 84% WDG - 31 g *a.i.* ha^{-1} PE *fb* direct spraying of glufosinate ammonium 13.5% SL - 375 g *a.i.* ha^{-1} as PoE at 30 DAS (74.8%). This might be due to remarkable reduction in weed density and ultimately low dry weight of weeds observed under these treatments were responsible for higher weed control efficiency.

Table 1: Effect of weed management treatments on total weed density, dry matter and WCE at 40 DAS.

Treatment	Total weed density (No. m^{-2})	Total weed dry matter (g m^{-2})	Weed control efficiency (%)
T_1 - PE- Diclosulam 84% WDG - 31 g *a.i.* ha^{-1} *fb* quizalofop-p-ethyl 5% EC - 50 g *a.i.* ha^{-1} as PoE at 30 DAS	5.4 (24.0)	4.1 (13.3)	85.5
T_2 - PE- Diclosulam 84% WDG - 31 g *a.i.* ha^{-1} *fb* direct spraying of glufosinate ammonium 13.5% SL - 375 g *a.i.* ha^{-1} as PoE at 30 DAS	6.4 (35.1)	5.3 (23.5)	74.8
T_3 - PE- Diclosulam 84% WDG - 31 g *a.i.* ha^{-1} *fb* intercultivation with power weeder at 30 DAS	5.2 (21.9)	3.8 (11.3)	87.7
T_4 - PE- Pendimethalin 38.7% CS - 677.25 g *a.i.* ha^{-1} *fb* quizalofop-p-ethyl 5% EC - 50 g *a.i.* ha^{-1} as PoE 30 DAS	7.1 (43.6)	6.2 (32.3)	65.4
T_5 - PE- Pendimethalin 38.7% CS - 677.25 g *a.i.* ha^{-1} *fb* direct spraying of glufosinate ammonium 13.5% SL 375 g *a.i.* ha^{-1} as PoE at 30 DAS	7.7 (52.3)	6.7 (38.5)	58.5
T_6 - PE- Pendimethalin 38.7% CS - 677.25 g *a.i.* ha^{-1} *fb* intercultivation with power weeder at 30 DAS	7.3 (46.7)	6.3(34.4)	62.9
T_7 - Intercultivation with power weeder at 20 and 40 DAS	6.3 (34.0)	5.2 (22.0)	76.2
T_8 - Weed free (3 Hand weedings)	4.7 (17.6)	3.5 (8.8)	90.5
T_9 - Unweeded check	11.2 (114.0)	10.2 (93.8)	0.0
S.Em±	0.28	0.27	2.92
CD (P=0.05)	0.85	0.81	8.74
CV (%)	8.22	9.23	8.54

Original values are given in parenthesis, which subjected for transformation using ($\sqrt{x+0.5}$).

Growth parameters

At harvest, significantly taller plants (133 cm), higher no. of branches (7.5 plant^{-1}) and dry matter production (5120 kg ha^{-1}) was observed under weed free (T_8) and it was on par with T_3- diclosulam 84% WDG 31 g *a.i.* ha^{-1} PE *fb* intercultivation with power weeder at 30 DAS and T_1- diclosulam 84% WDG 31 g *a.i.* ha^{-1} PE *fb* quizalofop-p-ethyl 15% EC 50 g *a.i.* ha^{-1} as PoE at 30 DAS. The least plant height, no. of branches, dry matter production at harvest (7.1 cm, 3.4 plant^{-1} and 1687 kg ha^{-1}, respectively) was recorded in unweeded check (T_9) due to the heavy competition for resources, lower internodal length, less translocation of photosynthates as compared to other treatments same was reported by Patel *et al*. (2014) [11], Naik *et al*. (2016) [10] and Kowser *et al*. (2018) [8].

Table 2: Effect of weed management treatments on growth parameters of rainfed castor at harvest

Treatment	Plant height (cm)	No. of branches plant^{-1}	Dry matter production (kg ha^{-1})
T_1 - PE- Diclosulam 84% WDG - 31 g *a.i.* ha^{-1} *fb* quizalofop-p-ethyl 5% EC - 50 g *a.i.* ha^{-1} as PoE at 30 DAS	125	7.3	5021
T_2 - PE- Diclosulam 84% WDG - 31 g *a.i.* ha^{-1} *fb* direct spraying of glufosinate ammonium 13.5% SL - 375 g *a.i.* ha^{-1} as PoE at 30 DAS	104	6.3	4456
T_3 - PE- Diclosulam 84% WDG - 31 g *a.i.* ha^{-1} *fb* intercultivation with power weeder at 30 DAS	127	7.4	5054
T_4 - PE- Pendimethalin 38.7% CS - 677.25 g *a.i.* ha^{-1} *fb* quizalofop-p-ethyl 5% EC - 50 g *a.i.* ha^{-1} as PoE 30 DAS	102	5.4	3921
T_5 - PE- Pendimethalin 38.7% CS - 677.25 g *a.i.* ha^{-1} *fb* direct spraying of glufosinate ammonium 13.5% SL 375 g *a.i.* ha^{-1} as PoE at 30 DAS	87	4.8	3378
T_6 - PE- Pendimethalin 38.7% CS - 677.25 g *a.i.* ha^{-1} *fb* intercultivation with power weeder at 30 DAS	98	5.3	3877
T_7 - Intercultivation with power weeder at 20 and 40 DAS	111	6.4	4492
T_8 - Weed free (3 Hand weedings)	133	7.5	5120
T_9 - Unweeded check	71	3.4	1687
S.Em±	4.5	0.28	175
CD (P=0.05)	14	0.24	524
CV (%)	8.4	8.09	9.3

Yield attributes

Different weed management treatments have significantly affected the yield attributes except test weight of rainfed castor (Table 3).

Highest effective spike length (58.6 cm), effective no. of spikes (6.9 plant^{-1}) and no. of capsules (104 spike^{-1}) recorded with weed free (T_8) it is on par with T_3- diclosulam 84% WDG 31 g *a.i.* ha^{-1} PE *fb* intercultivation with power weeder at 30 DAS and T_1- diclosulam 84% WDG 31 g *a.i.* ha^{-1} PE *fb* quizalofop-p-ethyl 15% EC 50 g *a.i.* ha^{-1} as PoE at 30 DAS. Whereas the unweeded check (T_9) gave least effective spike length (25.9 cm), effective no. of spikes (2.5 plant^{-1}) and no. of capsules (41 spike^{-1}). This was in accordance with Vaghasia and Nadiyadhara. (2016) [14].

Table 3: Effect of weed management treatments on yield attributes of rainfed castor

Treatments	Effective spike length (cm)	Effective no. of spikes plant^{-1}	No. of capsules spike^{-1}	Test weight (g)
T_1 - PE- Diclosulam 84% WDG - 31 g *a.i.* ha^{-1} *fb* quizalofop-p-ethyl 5% EC - 50 g *a.i.* ha^{-1} as PoE at 30 DAS	56.3	6.6	98	31.8
T_2 - PE- Diclosulam 84% WDG - 31 g *a.i.* ha^{-1} *fb* direct spraying of glufosinate ammonium 13.5% SL - 375 g *a.i.* ha^{-1} as PoE at 30 DAS	45.8	5.4	85	30.6
T_3 - PE- Diclosulam 84% WDG - 31 g *a.i.* ha^{-1} *fb* intercultivation with power weeder at 30 DAS	57.3	6.7	102	32.1
T_4 - PE- Pendimethalin 38.7% CS - 677.25 g *a.i.* ha^{-1} *fb* quizalofop-p-ethyl 5% EC - 50 g *a.i.* ha^{-1} as PoE 30 DAS	37.6	4.5	73	30.4
T_5 - PE- Pendimethalin 38.7% CS - 677.25 g *a.i.* ha^{-1} *fb* direct spraying of glufosinate ammonium 13.5% SL 375 g *a.i.* ha^{-1} as PoE at 30 DAS	33.0	3.6	61	30.1
T_6 - PE- Pendimethalin 38.7% CS - 677.25 g *a.i.* ha^{-1} *fb* Intercultivation with power weeder at 30 DAS	34.9	4.3	68	30.3
T_7 - Intercultivation with power weeder at 20 and 40 DAS	48.3	5.6	87	31.6
T_8 - Weed free (3 Hand weedings)	58.6	6.9	104	32.3
T_9 - Unweeded check	25.9	2.5	41	29.5
S.Em±	1.73	0.27	3.5	2.2
CD (P=0.05)	5.20	0.82	10	NS
CV (%)	8.80	9.22	8.5	12.4

Seed yield (kg ha^{-1})

Significantly higher seed yield of rainfed castor was recorded under T_8- weed free (2264 kg ha^{-1}), it was on par with T_3- diclosulam 84% WDG 31 g *a.i.* ha^{-1} PE *fb* intercultivation with power weeder at 30 DAS (2209 kg ha^{-1}) and T_1- diclosulam 84% WDG 31 g *a.i.* ha^{-1} PE *fb* quizalofop-p-ethyl 15% EC 50 g *a.i.*

ha^{-1} as PoE at 30 DAS (2188 kg ha^{-1}), followed by T_7- intercultivation with power weeder at 20 and 40 DAS and T_2- diclosulam 84% WDG 31 g *a.i.* ha^{-1} PE *fb* direct spraying of glufosinate ammonium 13.5% SL 375 g *a.i.* ha^{-1} as PoE at 30 DAS recorded seed yield of 1923 and 1898 kg ha^{-1}, respectively. The lowest seed yield was observed in T_9- unweeded check (550 kg ha^{-1}).

The increased seed yield in these treatments was due to lower weed parameters and higher weed control efficiency which provided congenial environment for better expression of growth and yield character. (Depicted in Fig. 1).

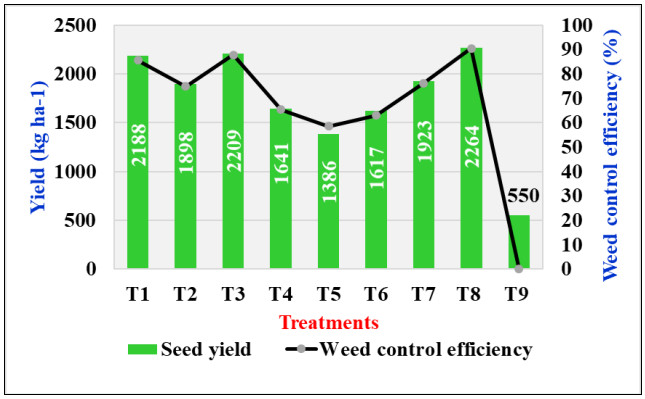

Fig 1: Influence of weed management treatments on weed control efficiency and seed yield of rainfed castor

Conclusion

Among all the weed management treatments weed free recorded lower weed density, drymatter at 40 DAS and higher weed control efficiency which led to improved growth and yield attributes and it was on par with diclosulam 84% WDG 31 g *a.i.* ha^{-1} PE *fb* intercultivation with power weeder at 30 DAS (T_3) and diclosulam 84% WDG 31 g *a.i.* ha^{-1} PE *fb* quizalofop-p-ethyl 15% EC 50 g *a.i.* ha^{-1} as PoE at 30 DAS (T_1). Diclosulam effectively controls the weeds at earlier stages of crop growth as compared to pendimethalin and at later stages wider window of weed control caused by the either intercultivation or spraying of quizalofop-p-ethyl as post emergence. Based on results it can be suggested that pre emergence application of diclosulam *fb* either intercultivation or quizalofop-p-ethyl as postemergence can be used for effective weed control in the rainfed castor.

References

1. AICRPWC, ICAR. Third annual report of All India Coordinate Research Project on Weed Control. Sriniketan center, Viswa Bharathi, Sriniketan; c1988. p. 185-190.
2. Choudhary VK, Dixit A. Bio-efficacy of sequential herbicide application for weed management in dry direct seeded rice. Indian J Agric Sci. 2021;91(1):79-83.
3. Copley MS, Bland HA, Rose P, Horton M, Evershed RP. Gas chromatographic, mass spectrometric and stable carbon isotopic investigations of organic residues of plant oils and animal fats employed as illuminants in archaeological lamps from Egypt. Analyst. 2005;130(6):860-871.
4. Azevedo DMP, Dos Santos JW, Santos TDS, Leão AB. Critical period of competition between castor bean and weeds. Braz J Oilseeds Fibers. 2006;10(1):1017-1024.
5. Directorate of Economics and Statistics. [Internet]. 2023. Available from: https://data.desagri.gov.in/website/crops-apy-report-web
6. Dungarwal HS, Chaplot PC, Nagda BL. Pre-and postemergence herbicides for weed control in castor crop. Indian J Agric Sci. 2002;72:525-527.
7. Gomez KA, Gomez AA. Statistical procedures in agricultural research. 2nd ed. New York: Wiley; 1984. p. 96-98.
8. Kowser T, Halepyati AS, Chittapur BM, Channabasavanna AS, Goud IS, Gowda B. Phytotoxicity and weed control efficiency of castor (*Ricinus communis* L.) as influenced by weed management practices. J Pharmacogn Phytochem. 2018;7(1):126-131.
9. Ministry of Agriculture and Farmers Welfare, Government of India; c2023-24. Available from: https://www.indiastat.com/table/agriculture/selected-state-wise-area-production-productivity-c/1457040
10. Naik AK, Sridhara S, Sanjay MT. Pre-and post-emergent herbicides for control of castor weeds in central dry zone of India. Indian J Weed Sci. 2016;48(3):1-5.
11. Patel DD, Thanki JD, Usdadiya VP, Arvadia MK, Tandel BB, Patil PA. Effect of critical period of crop-weed competition on nutrient content and uptake by weed and rabi castor (*Ricinus communis* L.). Res Crops. 2014;15(4):816-823.
12. Ramanjaneyulu AV, Anuradha G, Venkata Ramana M, Vishnu Vardhan Reddy A, Madana Gopal N. Multifarious uses of castor (*Ricinus communis* L.). Int J Econ Plants. 2017;4(4):70−176.
13. Singh SP, Singh VP, Nainwal RC, Tripathi N, Kumar A. Efficacy of diclosulam on weeds and yield of soybean. Indian J Weed Sci. 2009;41(3&4):170-173.
14. Vaghasia PM, Nadiyadhara MV. Influence of pre and post-emergence herbicides in castor (*Ricinus communis* L.). Res Crops. 2016;17(1):68-72.
15. Yadav JS, Singh B. Optimization of castor production under resource constraints. In: Biennial Conference on New and Emerging Issues in Weed Science; CCS Haryana Agricultural University, Hisar; c2007 Nov 2-3.
16.