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Effect of weed management on weeds and nutrient uptake in *Rabi* castor (*Ricinus communis* L.) under South Gujarat conditions

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ABSTRACT

Experimental site constituted by monocot weeds *viz*., *Echinochloa crusgalli* (L.) Beauv, *Digitaria sanguinalis* L. and Eragrostis major dicot weeds *viz*., *Amaranthus viridis* L., *Alternanthera sessilis*., *Digera arvensis* Forsk., *Convolvulus arvensis* L., *Trienthma portulacastrum* L., *Euphorbia hirta* L., *Physalis minima* L., *Eurphorbia mudarosptiensis* and among sedge *Cyperus rotundus* L. Weed free condition and pre-emergence application of pendimethalin @ 1.0 kg a.i./ha + interculturing and hand weeding at 30 DAS and pre-emergence application of pendimethalin @ 1.0 kg a.i./ha + post-emergence application of fenoxaprop-p-ethyl @50 g a.i./ha at 25 DAS were effective in reducing total weed density and dry weight of weeds, weed index and higher weed control efficiency. These treatments recorded significantly highest uptake of N, P and K by crop and lowest uptake by weeds.

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KEY WORDS : Herbicides, Castor, Weeds, Nutrient, Uptake

Castor (*Ricinus communis* L.) is valuable non-edible oil seed crop playing an important role in agriculture economy. Castor oil has diversified uses and has great value of foreign trade. Leaves of castor are rich source of protein (23 to 25%) and used for ericulture. Castor cake a byproduct is used as organic manuring. Castor stalks are useful in manufacturing paper, card-board and also widely used as a fuel. Its hull is used as manure after decomposition.

Several measures have been suggested to control the weeds. Hoe and hand weeding on 20th and 40th day of sowing are effective to remove the weeds. Hand weeding and inter-culturing are effective, but always associated with regeneration of weeds and requires frequent operations, which makes this practice sometimes costly and also not feasible all times due to poor soil physical condition and unavailability of labours and implements. In this context, herbicides and other effective methods like mulching can play vital role in management of weeds.

The use of herbicide in crop land, generally results in increase in crop yield, improve crop quality and reduce production cost. Herbicides used alone or in combination with other weed control method reduced the crop-weed competition and the risk of weeds growing in adverse weather or soil condition that would hinder the use of more traditional weed control methods. Alachlor herbicide applied pre-emergence was effective against *Amaranthus* in castor (Chenault *et al*.,1969).

RESEARCH PROCEDURE

A field experiment was conducted during *Rabi* season of 2009-2010 at the College Farm, Navsari Agricultural University, Navsari. Total 9 weed control treatments were assigned in Randomized Block Design with four replications. The castor hybrid GCH 7 was sown at 120 x 60 cm spacing on October 15, 2009 and finally harvested on April 4, 2010. The soil of the experimental field was clayey in texture and showed low, medium and high rating for available nitrogen (219.52 kg ha^{-1}), phosphorus (30.91 kg ha^{-1}) and potassium (387.60 kg ha^{-1}), respectively. The soil was found normal in respect of pH (7.8) and electric conductivity (0.36 dsm^{-1}). Pendimethalin was sprayed next DAS and fenoxaprop-p-ethyl was sprayed on 25 DAS. Follow up weeding operation after herbicide application as per treatment. The crop was grown with standard package of practices for

the region.

RESEARCH ANALYSIS AND REASONING

The results obtained from the present investigation have been duscussed below:

Effect on weeds:

The predominant weed floras recorded on the experimental site were monocot weeds *viz*., *Echinochloa crusgalli* (L.) Beauv, *Digitaria sanguinalis* L. *and Eragrostis major,* dicot weeds *viz*., *Amaranthus viridis* L., *Alternanthera sessilis*, *Digera arvensis* Forsk., *Convolvulus arvensis* L., *Trienthma portulacastrum* L., *Euphorbia hirta* L., *Physalis minima* L., *Eurphorbia mudarosptiensis* and among sedge *Cyperus rotundus* L.

Treatment of weed free registered the lowest monocots, dicots, sedges and total weeds population all which was closely followed by treatments pre-emergence application of pendimethalin @ 1.0 kg ha^{-1} + interculturing and hand weeding at 30 DAS and Pre-emergence application of pendimethalin @ 1.0 kg ha^{-1} + post emergence application of fenoxaprop-p-ethyl @ 50g a.i. ha^{-1} at 25 DAS. This might be due to residual effect of herbicides resulted in remarkable reduction in weed population (Table 1). The findings are confined with those reported by Bhagriya (2006) in green gram and Gamit (2009) in mustard.

The dry weight of weeds recorded was reduced significantly by all the weed management treatments as compared to unweeded control. Treatment of weed free recorded almost nil dry weight of weeds which closely followed by treatments pre-emergence application of pendimethalin @ 1.0 kg ha^{-1} + interculturing and hand weeding at 30 DAS and pre-emergence application of pendimethalin @ 1.0 kg ha^{-1} + post emergence application of fenoxaprop-p-ethyl @ 50g a.i. ha^{-1} at 25 DAS (Table 2). Better weed control efficiency of these herbicides along with hand weeding might be due to effective weed control obtained under pre emergence application of herbicides in initial and early growth stage and than after by interculturing and hand weeding resulted into the lowest weed counts and finally reduced the dry weight of weeds at harvest might be due to the rapid growth of castor crop as indicated by taller plants and more number of branches per plant, greater crop canopy which did not allow to weeds to grow vigorously due to smothering effect. Similar results were also reported by Kaneria and Patel (1994) in mustard. Bhadoriya and Chauhan (1995) in mustard and Patel (2000) in pigeon pea.

The highest weed control efficiency (100 %) at harvest was recorded under treatment weed free followed by treatments pre-emergence application of pendimethalin @ 1.0 kg ha^{-1} + 1 interculturing and hand weeding at 30 DAS (81.21%) and pre-emergence application of pendimethalin @ 1.0 kg ha^{-1} + post emergence application of fenoxaprop-p-ethyl @ 50g a.i. ha^{-1} at 25 DAS (77.60 %). This might be due to effects of herbicides resulted in remarkable reduction in weed population and ultimately low dry weights of weeds observed under these treatments were responsible for weed control efficiency. These results are confirmed by those reported by Gill *et al*. (2002) in fenugreek. Looking to weed index which is the indicator of losses in seed yield due to presence of weeds. Pre-emergence application of pendimethalin @ 1.0 kg ha^{-1} + interculturing and hand weeding at 30 DAS recorded the lowest weed index (3.11) followed by pre-emergence application of pendimethalin @ 1.0 kg ha^{-1} + post emergence application of fenoxaprop-p-ethyl @ 50g a.i. ha^{-1} at 25 DAS.This might be due to effective weed control achieved under these weed management treatments in terms of reduced bio mass of weeds and higher weed control efficiency. Results were also almost similar as reported by Kaneria and Patel (1994) in mustard and Gill *et al.* (2002) in fenugreek.

Effect of weed management treatments on nutrient uptake by crop and weeds:

Different weed management treatments showed significant influence on uptake of major nutrients *i.e.*, nitrogen, phosphorus and potassium by stalk at harvest. Significantly the lowest uptake of nitrogen, phosphorus and potassium by stalk were noted under unweeded control. The highest uptake of major nutrients was recorded under treatment weed free. This might be due to better development of crop resulting from lesser crop weed competition. Further, the higher content and higher stalk yield under these treatments boosted the nutrient uptake. Similar results were reported by Patel (2000) in pigeonpea and Chauhan (2000) in chickpea.

The highest removal of nutrients (23.92, 10.89 and 19.28 kg ha^{-1} (nitrogen, phosphorus and potassium, respectively) by weeds were recorded under unweeded control (Table 2), whereas the lowest nutrient depletion by weeds were recorded under treatments weed free, pre-emergence application of pendimethalin @ 1.0 kg ha^{-1} + 1 interculturing and hand weeding at 30 DAS followed by pre-emergence application of pendimethalin @ 1.0 kg ha^{-1} + post-emergence application of fenoxaprop-p-ethyl @ 50g a.i. ha^{-1} at 25 DAS. Similar results were reported by Patel (2000) in pigeonpea and

Table 1 : Weed population, dry weight of weeds, weed control efficiency and weed index at harvest as influenced by various weed management treatments in castor

Treatments	Weed population per sq.m. at harvest				Dry weight of weeds (kg ha^{-1}) at harvest				WWCE (%)	Weed index (%)
	Monocot	Dicot	Sedge	Total	Monocot	Dicot	Sedge	Total		
W_1: Unweeded control	5.02	13.38	4.82	15.02	11.40	39.90	10.14	42.69	0.00	45.60
	(24.16)	(177.89)	(22.18)	(224.48)	(128.77)	(1591.01)	(101.71)	(1821.80)		
W_2: Weed free	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	100	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)		
W_3: Hand weeding and interculturing at 30 DAS	4.97	10.15	4.32	12.02	10.69	28.10	9.06	31.37	45.99	28.82
	(23.67)	(102.06)	(17.60)	(143.34)	(113.26)	(788.63)	(80.96)	(983.14)		
W_4: Hand weeding and interculturing at 30 and 60 DAS	3.96	7.84	4.21	9.63	9.29	17.99	8.21	21.80	73.74	15.74
	(14.65)	(60.37)	(16.69)	(91.73)	(85.29)	(322.56)	(66.38)	(474.48)		
W_5: Sugarcane trash mulching @ 10 t/ha.	3.99	7.86	4.24	9.68	9.35	18.39	8.40	22.25	72.88	16.58
	(14.96)	(60.80)	(16.93)	(92.74)	(86.44)	(337.27)	(69.60)	(494.06)		
W_6: Pre emergence application of pendimethalin @ 1 kg	3.23	6.78	3.74	8.28	6.35	15.75	7.40	18.49	81.21	3.11
a.i./ ha interculturing and hand weeding at 30 DAS.	(9.44)	(44.99)	(12.96)	(67.45)	(39.28)	(247.04)	(53.69)	(340.86)		
W_7: Post emergence application of fenoxaprop p ethyl	4.97	9.18	4.29	11.20	8.79	25.08	8.87	28.00	56.94	19.50
@ 50g a.i./ha at 25 DAS	(23.72)	(83.27)	(17.41)	(124.49)	(76.34)	(628.13)	(77.79)	(783.30)		
W_8: Post emergence application of fenoxaprop p ethyl	3.89	7.64	4.31	9.50	7.53	17.940	8.74	21.28	75.09	13.12
@ 50g a.i./ha at 25 DAS hand weeding and	(14.16)	(57.38)	(17.62)	(89.35)	(55.80)	(320.77)	(75.43)	(452.20)		
interculturing at 60 DAS										
W_9: Pre emergence application of Pendimethalin @1kg	3.31	7.53	4.08	9.08	7.29	17.14	7.82	20.17	77.60	3.77
a.i/ha Post emergence application of fenoxaprop p	(9.95)	(55.76)	(15.68)	(81.45)	(52.20)	(293.09)	(60.29)	(406.22)		
ethyl @ 50g a.i./ha at 25 DAS										
C.D. (P 0.05)	0.40	0.88	0.44	0.97	0.81	2.08	0.69	2.00		

Table 2 : Nitrogen, phosphorus and potassium uptake (kg ha^{-1}) by stalk and weeds as influenced by various weed management treatment

Treatments	Nutrient uptake by stalk (kg ha^{-1})			Nutrient uptake by weed (kg ha^{-1})		
	N	P_2O_5	K_2O	N	P_2O_5	K_2O
W_1: Unweeded control	4.59	1.99	12.74	23.92	10.89	19.28
W_2: Weed free	10.46	6.94	38.52	0.00	0.00	0.00
W_3:Hand weeding and interculturing at 30 DAS	5.76	2.52	17.67	12.41	5.56	10.02
W_4:Hand weeding and interculturing at 30 and 60 DAS	7.80	4.47	30.10	5.31	2.46	4.65
W_5:Sugarcane trash mulching @ 10 t/ha.	7.06	3.72	28.60	5.68	2.54	4.93
W_6:Pre-emergence application of pendimethalin @ 1 kg a.i./ ha + interculturing and hand weeding at 30 DAS.	9.81	6.54	37.21	3.18	1.44	3.07
W_7:Post-emergence application of fenoxaprop-p -ethyl @ 50g a.i./ha at 25 DAS	6.46	3.10	25.06	9.08	4.31	7.87
W_8:Post-emergence application of fenoxaprop- p- ethyl @ 50g a.i./ha at 25 DAS + hand weeding and interculturing at 60 DAS	8.30	5.56	33.59	4.62	2.26	4.36
W_9:Pre-emergence application of pendimethalin @1kg a.i/ha + Post-emergence application of fenoxaprop- p- ethyl @ 50g a.i./ha at 25 DAS	9.58	6.22	36.35	3.87	1.85	3.83
C.D. (P=0.05)	1.00	0.81	4.22	1.45	0.57	0.95

Chauhan (2000) in chickpea.

Conclusion:

It can be concluded from the experimental results that, to obtain higher profitable yield of castor, it should be kept weed free. In area where there is paucity of labour, it is advisable to apply pendimethalin @ 1.0 kg ha^{-1} as pre-emergence supplemented either with 1 interculturing + one hand weeding at 30 days after sowing or post emergence application of fenoxaprop-p-ethyl @ 50 g a.i. ha^{-1} at 25 DAS under south Gujarat conditions.

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