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Effect of cultural and chemical weed management practices on growth and yield of irrigated cowpea Co (CP) 7

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Abstract
A field experiment was carried out in the farmers's field at Sivapuri village, Chidambaram Taluk, Cuddalore district to study the effect of cultural and chemical weed management practices on growth and yield parameters of irrigated cowpea. The cowpea variety Co (CP) 7 was used for this study. There were altogether nine treatments including the pre-emergence herbicide Pendimethalin and post-emergence herbicide Quizalofop-ethyl in combination with intercultivation at 20 DAS. In addition, two hand weeding at 20 and 40 DAS were also compared with Unweeded control. The growth and yield parameters of cowpea were significantly influenced by all the treatments. Among the treatments, Application of Pendimethalin @ 0.5 kg ha^{-1} as pre-emergence + intercultivation by star weeder at 20 DAS significantly and regarded as the best treatment. It is followed by two hand weeding at 20 and 40 DAS.

Keywords: cowpea, chemical, cultural, growth, yield

Introduction
Cowpea (*Vigna unguiculata* L.) is one among the pulses that is extensively cultivated in arid and semi-arid tropics of Africa and Asia for its use as a multipurpose legume. In India, cowpea is grown widely as a *kharif* crop. Weed competition is one of the most important production constraints in cowpea leading to a reduction in yield of up to 91.6 per cent, if left uncontrolled (Mekonnen *et al*., 2017) [5]. Since, weeds serve as alternate hosts of various insect pests and pathogens of cultivated cowpea, the field is prone to pest and pathogen attack also. The availability of Photosynthetically Active Radiation (PAR) is sometimes restricted to the lower canopy of cowpea due to broad leaved weeds which further affects yield (Ugbe *et al.*, 2016) [12]. The mixing of weed seeds in the final produce affects the quality of cowpea seeds which reduces the market value. This study is designated to study the effect cultural and chemical weed management practices on growth and yield parameters of irrigated cowpea.

Materials and Methods
The Experimental field is geographically situated at 11º38' North latitude and 79º70' East longitude and at an Altitude of ±5.79 m above Mean Sea Level and 6 km away from Bay of Bengal. The climate of Sivapuri is moderately warm with hot summer months. The cowpea crop received a rainfall of 378.4 mm distributed over 23 rainy days. The maximum temperature ranges from 33.2 ºC to 36.2 ºC with a mean of 34.8 ºC. The minimum temperature ranges from 24.1ºC to 26.5ºC with a mean of 25.3 ºC and relative humidity ranges from 65 to 92 per cent. The soil texture of the experimental field was sandy clay loam. The soil was low in available nitrogen, low in available phosphorous and medium in available potassium. The cowpea variety Co (CP) 7 seed were procured and used for the study. The experiment was laid out in a randomized block design with three replications. The details of the treatment schedule were T_1 – Unweeded control, T_2 – Hand weeding alone at 15 DAS,T_3 – Intercultivation alone at 15 DAS, T_4 – Two hand weeding at 20 and 40 DAS, T_5 – Application of Pendimethalin @ 0.5 kg ha^{-1} as pre-emergence, T_6 – Application of Quizalofop-ethyl @ 0.04 kg ha^{-1} as post-emergence at 20 DAS, T_7 – Application of Pendimethalin @ 0.5 kg ha^{-1} as pre-emergence + one hand weeding at 30 DAS, T_8 – Application of Pendimethalin @ 0.5 kg ha^{-1} as pre-emergence + Intercultivation at 20 DAS, T_9 – Application of Pendimethalin @ 0.5 kg ha^{-1} as pre-emergence + Quizalofop-ethyl @ 0.04 kg ha^{-1} as post-emergence at 20 DAS.

Results and discussion
Growth characters
Plant height
The observations were taken on 30, 45 DAS and at harvest for plant height. Of all the treatments, Application of Pendimethalin @ 0.5 kg ha^{-1} as pre-emergence + intercultivation at 20 DAS (T_8) produced taller plants (25.76, 38.77 and 48.59 cm on 30, 45 DAS and at harvest, respectively). This treatment was on par with Two hand weeding at 20 and 40 DAS (T_4). This was followed by Application of Pendimethalin @ 0.5 kg ha^{-1} as pre-emergence + Quizalofop-ethyl @ 0.04 kg ha^{-1} as post-emergence at 20 DAS (T_9) and Application of Pendimethalin @ 0.5 kg ha^{-1} as pre-emergence + one hand weeding on 30 DAS (T_7). The treatment Unweeded control (T_1) recorded the least plant height of 11.94, 20.58 and 24.76 cm on 30, 45 DAS and at harvest, respectively.

Crop Dry Matter Production (DMP)
Among the weed management practices followed on 30, 45 Days After Sowing and at harvest, Application of Pendimethalin @ 0.5 kg ha^{-1} as pre-emergence +

intercultivation at 20 DAS (T_8) recorded significantly maximum crop Dry Matter Production of 430, 1581 and 2570 kg ha^{-1} on 30, 45 DAS and at harvest, respectively. This treatment was on par with Two hand weeding at 20 and 40 DAS (T_4). Minimum Dry Matter Production was noted under Unweeded control (T_1). This treatment recorded 149, 836 and 1028 kg ha^{-1} of Dry Matter Production on 30, 45 DAS and at harvest, respectively.

Leaf Area Index (LAI)

For the attribute Leaf Area Index, the treatment Application of Pendimethalin @ 0.5 kg ha^{-1} as pre-emergence + intercultivation at 20 DAS (T_8) registered maximum LAI of 0.45 and 2.48 on 30 and 45 DAS respectively. The minimum Leaf Area Index was observed in Unweeded control (T_1) (0.20 and 0.52 on 30 and 45 DAS, respectively).

Since there is less crop weed competition for water, space, nutrients etc., in the above treatments, the crop recorded higher plant height and an increased dry matter production, this findings are corroborated with the findings of Chattha *et al*. (2007) [1]. The poor growth characters in Unweeded control may be due to the uninterrupted weed growth thereby creating a strong crop-weed competition in the Unweeded control. The results also coexist with the research findings of Na Allah *et al*. (2017) [6], Jagadesh *et al*. (2019) [2] and Mekonnen *et al*. (2016).

Yield characters

Number of pods plant^{-1}

Among the weed management practices studied, Application of Pendimethalin @ 0.5 kg ha^{-1} as pre-emergence + intercultivation at 20 DAS (T_8) recorded the maximum number of pods plant^{-1} (25.53/plant) which was significantly on par with Two hand weeding at 20 and 40 DAS (T_4). This was followed by Application of Pendimethalin @ 0.5 kg ha^{-1} as pre-emergence + Quizalofop-ethyl @ 0.04 kg ha^{-1} as post-emergence at 20 DAS (T_9) and Application of Pendimethalin @ 0.5 kg ha^{-1} as pre-emergence + one hand weeding on 30 DAS (T_7). The lowest number of pods plant^{-1} (12.06/plant) was recorded in Unweeded control (T_1).

Number of seeds pod^{-1}

The Application of Pendimethalin @ 0.5 kg ha^{-1} as pre-emergence + intercultivation at 20 DAS (T_8) produced maximum number of seeds pod^{-1} (13.46/pod). This was on par with Two hand weeding at 20 and 40 DAS (T_4). The minimum number of seeds pod^{-1} (5.89/plant) recorded in Unweeded control (T_1).

Length of pod

Among the weed management practices studied, on 30, 45 DAS and at harvest, Application of Pendimethalin @ 0.5 kg ha^{-1} as pre-emergence + intercultivation at 20 DAS (T_8) recorded the maximum length of pod (17.28 cm). This was on par with Two hand weeding at 20 and 40 DAS (T_4). The pod length was minimum (8.82) in Unweeded control (T_1). The poor re-emergence of weeds in the treated plots lead to the availability of adequate moisture, light, space and nutrients during the critical period of weed interference in cowpea. So, the high assimilation of photosynthates led to increase in yield characters. These findings were earlier emphasized by Na-Allah *et al*. (2017) [6], Silva *et al*. (2003) [10] and Sarika Mahor (2017) [9].

Test weight

None of the treatment was significantly influenced the test weight of the seed.

Yield

The seed yield was significantly influenced by treatments. Among the treatments, Application of Pendimethalin @ 0.5 kg ha^{-1} as pre-emergence + intercultivation at 20 DAS (T_8) registered significantly higher seed yield of 1231 kg/ha. This was on par with Two hand weeding on 20 and 40 DAS (T_4). The next best treatments were Application of Pendimethalin @ 0.5 kg ha^{-1} as pre-emergence + Quizalofop-ethyl @ 0.04 kg ha^{-1} as post-emergence at 20 DAS (T_9) and Application of Pendimethalin @ 0.5 kg ha^{-1} as pre-emergence + one hand weeding on 30 DAS (T_7). Rather than application of herbicides alone, the treatment of application of herbicides with intercultural operation showed an increased yield. This is due to the improved tilt of soil during hand weeding and providing easy accessibility to soil moisture and nutrients. These findings are in accordance with the findings of Jakhar *et al*. (2015) [3]. The crops in Unweeded control could not get required nutrients and other growth resources during early vegetative stage of crop growth from 10 to 45 DAS. These findings emphasize with the earlier research findings of Sah *et al*. (2015) [8], Rathi *et al* (2004) [7], Kumar and Singh (2017) [4] and Telugu *et al*. (2014) [11].

Haulm yield

Pre-emergence application of Pendimethalin @ 0.5 kg ha^{-1} + intercultivation at 20 DAS (T_8) recorded higher haulm yield of 3126 kg/ha and this treatment was on par with Two hand weeding at 20 and 40 DAS (T_4). This was followed by Application of Pendimethalin @ 0.5 kg ha^{-1} as pre-emergence + Quizalofop-ethyl @ 0.04 kg ha^{-1} as post-emergence at 20 DAS (T_9) and Application of Pendimethalin @ 0.5 kg ha^{-1} as pre-emergence + one hand weeding on 30 DAS (T_7). The lowest haulm yield of 1226.96 kg ha^{-1} was recorded in Unweeded control (T_1).

Conclusion

From the results of the field experiments carried out, it is evident that the treatment Application of Pendimethalin @ 0.5 kg ha^{-1} as pre-emergence + intercultivation on 20 DAS by star weeder was most effective weed management practices of cowpea with an optimum yield of 1231 kg/ha.

Table 1: Effect of cultural and chemical weed management practices on growth and yield parameters of irrigated Cowpea

Treatments	Plant height			DMP			LAI		Number of pods /plant	Number of seeds/pod	Length of pod (cm)	Seed Yield (kg ha^{-1})	Halum Yield (kg ha^{-1})
	30 DAS	45 DAS	At harvest	30 DAS	45 DAS	At harvest	30 DAS	45 DAS					
T_1 – Unweeded control	11.94	20.58	24.76	149	836	1028	0.20	0.52	12.06	5.89	8.82	486.53	1229.96
T_2 – Hand weeding alone at 15 DAS	15.43	26.28	33.04	240	1095	1502	0.27	1.17	16.09	8.15	11.27	751.01	1834.58
T_3 – Intercultivation alone at 15 DAS	17.83	29.03	36.42	289	1212	1702	0.31	1.42	18.37	9.24	12.81	850.62	2088.53
T_4 – Two hand weeding at 20 and 40 DAS	25.38	38.73	48.13	426	1571	2551	0.44	2.35	24.93	13.12	17.16	1224.34	3033.33

T_5 – Application of Pendimethalin @ 0.5 kg ha^{-1} as pre-emergence	20.21	31.55	40.27	349	1330	1912	0.37	1.69	20. 10	10.41	14.04	956.51	2355.51
T_6 – Application of Quizalofop-ethyl @ 0.04 kg ha^{-1} as post-emergence at 20 DAS	13.73	23.15	28.18	205	975	1297	0.24	0.92	14.18	7.01	10.01	662.04	1574.77
T_7– Application of Pendimethalin @ 0.5 kg ha^{-1} as pre-emergence + one hand weeding at 30 DAS	22.57	34.74	43.46	382	1447	2270	0.39	1.92	22.35	11.54	15.55	1069.44	2616.16
T_8 – Application of Pendimethalin @ 0.5 kg ha^{-1} as pre-emergence + Intercultivation at 20 DAS	25.76	38.77	48.59	430	1581	2570	0.45	2.48	25.53	13.46	17.28	1230.81	3126.07
T_9 – Application of Pendimethalin @ 0.5 kg ha^{-1} as pre-emergence + Quizalofop-ethyl @ 0.04 kg ha^{-1} as post-emergence at 20 DAS.	22.99	35.12	43.98	390	1455	2351	0.40	2.09	22.71	12.03	16.00	1100.85	2781.84
S.Ed	0.76	1.18	1.50	16	48	86	0.01	0.11	0.81	0.49	0.52	41.31	115.03
CD (p = 0.05)	1.60	2.52	3.18	34.73	102.59	183.13	0.03	0.22	1.73	1.05	1.09	87.58	243.88

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