INFLUENCE OF DIFFERENT HERBICIDE BASED WEED MANAGEMENT PRACTICES ON GROWTH AND YIELD OF FLUE CURED TOBACCO IN NORTHERN LIGHT SOILS OF ANDHRA PRADESH

Abstract

Field experiments were conducted at Peddpauram village of West Godavari district (Andhra Pradesh) during (*Rabi*) seasons of 2018-19 and 2019-20, to study the effect of different herbicide based weed management practices on growth and yield of flue cured Tobacco crop. The experiment was laid out in Randomized Block Design with 11 weed management practices replicated thrice. The results recorded on growth parameters, in both the years revealed that six inter cultivations with two manual removal of weeds significantly impacted plant height (113.5 cm and 114.4 cm) and leaf area index (2.63 and 2.83) at 90 DAT over Imazethapyr applied at 0.05 kg a.i ha^{-1}. Number of leaves $plant^{-1}$ were higher with six inter cultivation and two manual removal of weeds (21.5 and 20.6) over Imazethapyr 0.05 kg a.i ha^{-1}. Inter cultivations and manual weeding resulted in significantly enhancing yield attributes such as leaf thickness (0.143 mm and 0.143 mm for cutters and 0.183 mm and 0.173 for leaf) and lower leaf count (Number of leaves kg^{-1}) (137 and 129) over weedy check. Application of Sulfentrazone 0.03 kg a.i ha^{-1} was comparable with inter cultivation and manual weeding. Sulfentrazone 0.3 kg a.i ha^{-1} contributed for significantly higher yield (2302 kg ha^{-1} and 2424 kg ha^{-1}) over weedy check and comparable with six inter cultivations and two manual weeding operations. The application of pre emergence herbicides like Pendimethalin, Alachlor and Oxyflurfen resulted achieving higher yield levels over the application of post emergence herbicides such as Quiazalofop-p-ethyl, Fenoxaprop ethyl, Carfentrazone ethyl and Imazethapyr during both years of experimentation.

Key words: herbicide, FC tobacco, growth and yield.

Introduction

Tobacco is one of the most important commercial crop grown on wide range of soils and climatic conditions in India. India ranks 2nd in production with 800 million kg (comprising of cigarette and non-cigarette types) after China [9]. Tobacco occupies 0.24% of arable area of India and majorly cultivated in semi-arid region under rain fed condition. 60% of cigarette tobacco, predominantly flue cured (FC) tobacco produced in India is being exported to different countries and reap foreign exchange earnings of around ₹.3000 crores annually [9]. In addition to other production practices, weed management plays a critical role in enhancing yield and quality of tobacco. The scarcity of labour accentuated demand and consequently rise in wages, manual weeding has turned out to be an expensive operation in FC tobacco farming. Non availability of labour is major challenge, which necessitates the introduction of herbicides in FC tobacco production. Since FC tobacco is export oriented it is imperative to identify herbicides

which are appropriate for tobacco both for pre transplant, pre and post emergence, leaving no traces of residues. Since FC tobacco is wide spaced crop it provides adequate opportunity for same application of herbicides. With this background, a field study was under taken to study the impact of different pre transplant, pre mergence and post emergence herbicides in FC tobacco.

Materials and Methods

Field experiments were conducted at Peddapuram village of West Godavari (District), Andhra Pradesh, India during *Rabi* 2018-19 & 2019-20 in Randomized Block Design with eleven treatments replicated thrice. The treatments were comprised of 11 weed control methods *viz,* W_1 – PRTR (pre transplant)[3],[4] Sulfentrazone 39.6% SC @ 0.3 kg a.i. ha^{-1}, W_2 - PE (Pre emergence) Pendimethalin 30% EC @ 0.75 kg a.i. ha^{-1}, W_3- PE Oxyfuorfen 23.5 % EC @ 0.25 kg a.i. ha^{-1}, W_4- PE Alachlor 50% EC @ 0.75 kg a.i. ha^{-1}, W_5 – POE(Post emergence) Quizalofop-p-ethyl 5% EC @ 0.05 kg a.i. ha^{-1} at 25 DAT, W_6 – POE Imazethapyr 10% SL @ 0.05 kg a.i ha^{-1} at 25 DAT, W_7 - POE Fenoxaprop ethyl 9% EC @ 0.056 kg a.i ha^{-1} at 25 DAT, W_8 – POE Propaquizafop Ethyl 10% EC @ 0.05 kg a.i ha^{-1} at 25 DAT, W_9 – POE Carfentrazone ethyl[8] 40 % DF (Protected spray) @ 0.02 kg a.i ha^{-1} at 25 DAT, W_{10} – Farmers Practice (6 inter cultivations and two manual weeding) and W_{11} – Control (Weedy Check).

Flue cured (FC) Tobacco Cultivar CH 3 was transplanted at a spacing of 105 cm X 60 cm between rows and plants, respectively, in plots of size 9.0 m X 6.3 m. Herbicides were sprayed with Knapsack sprayer fitted with flat fan nozzle. Sulfentrazone was sprayed two days before plantation, Pendimethalin, Oxyfluorfen and Alachlor were sprayed as pre emergence within two days after plantation and Quizalofop, Imazethapyr, Fenoxaprop, Propaquizafop and Carfentrazone were sprayed as post emergence at 25 DAT. The production practices recommended for FC tobacco by Indian Council of Agricultural Research - Central Tobacco Research Institute were followed for managing the crop.

Five plants were selected randomly and tagged for recording observations in each plot. Growth parameters *viz*., plant height (cm) and leaf area index were recorded at 90 DAT from penultimate rows of each plot. The leaf area was calculated by multiplied by a constant 0.653[6] to get actual leaf are and then leaf area index (LAI) was calculated by dividing the leaf area $plant^{-1}$ by ground area occupied by each plant (6300 cm^{-2}). The harvested leaves were cured and graded based on plant position, ripeness and colour. The graded cured leaf of each net plot (7.8 m X 4.2 m) was recorded and expressed as cured leaf yield. The yield from each plot was recorded separately as kg $plot^{-1}$ and then expressed as kg ha^{-1}.

The data recorded on identified parameters were analysed statistically by the significance of “F” and “t” test was tested at 5% level of significance.

Results and Discussion

Plant height and Leaf area index

The data indicated that weed management practice through Inter cultivations and hand weeding recorded higher plant height (113.5 cm and 114.4 cm) which was statistically comparable with pre emergence, post emergence herbicides and weedy check except POE Imazethapyr 0.05 kg a.i ha^{-1} at 90 DAT during both the years of experimentation. The application of Imazethapyr 0.05 kg a.i ha^{-1} treated plots resulted in lower plant height, since the treatment induced phytotoxicity and retarded plant growth. Among herbicide treatments, pre emergence application of Pendimethalin 0.75 kg a.i ha^{-1} (113.1cm), Quizalofop-p-ethyl 0.05 kg a.i ha^{-1} (114cm) in both the years resulted in statistically comparable plant height with other herbicide treatments and significantly higher than Imazethapyr 0.05 kg a.i ha^{-1}. The results recorded in this experiment were similar to the observations of the study in Anand [7]. Higher leaf area index (2.75 and 2.94) was recorded with POE of Fenoxaprop 0.056 kg a.i. ha-1 and Carfentrazone 0.02 kg a.i ha^{-1} during 2018-19 and 2019-20, and these results were at par with other herbicide treatments and significantly superior over Imazethapyr 0.05 kg a.i ha^{-1}.

Number of leaves $plant^{-1}$ and Leaf Thickness

The mean data of number of leaves $plant^{-1}$ were not significantly different among the different herbicide treatment. Imazethapyr 0.05 kg a.i ha^{-1} resulted in significantly lower number of leaves $plant^{-1}$ (16.5 and 16.7) due to phyto toxic effect. However, higher number of leaves $plant^{-1}$ (21.5 and 20.6) was recorded with Inter cultivations (6) and hand weeding (2) and followed by Quaizalofop-p-ethyl (21.2 and 20.3) treatments in both the crop growing seasons. As number of leaves $plant^{-1}$ depends on genetic potential of each crop, the number of leaves were not significantly affected by the herbicidal treatments. The results are in conformity with the outcome of experimental trials in Pakistan [13]. Results from the study indicated production of thicker leaves in Cutter & Leaf positions (0.143, 183 and 0.143, 0.173) with inter cultivations and hand weeding followed by pre transplant application of Sulfentrazone 0.03 kg a.i ha^{-1} and production of thinner leaves with weedy check (0.097, 0.117 and 0.118, 0120) during 2018-19 and 2019-20 respectively. The response of higher leaf thickness can be attributed to better weed management with the treatments that enabled weed free environment leading to higher availability of nutrients and soil moisture.

Leaf Count and Yield

Lower leaf count (Number of leaves kg^{-1}) (133 and 130) was recorded with Sulfentrazone 0.3 kg a.i ha^{-1} and higher leaf count (196 and 194) with weedy check. Application of Sulfentrazone resulted in higher yield (2302, 2424 kg ha^{-1}) which is at par with yield (2429, 2545 kg ha^{-1}) obtained in inter cultivations and hand weeding and these set of treatments are significantly superior over weedy check (1386, 1453 kg ha^{-1}) in both the years. All herbicide treatments are comparable and significantly superior over Imazethapyr 0.05 kg a.i ha^{-1} and weedy check.

Though Imazethapyr application resulted in achieving comparable weed control with other herbicides, it resulted in stunted plant growth and developing phyto toxic symptoms leading to lower yield. Sulfentrazone provided weed free environment throughout the crop cycle influencing yield attributes like leaf count and leaf thickness, leading higher yield and proved to be beneficial over post emergence herbicide application. The experimental outcome are in conformity with results of Yousafzai [13]. They stated that use of herbicides like pendimethalin resulted in improvement in yield. Willian [1], [11] & [12] concluded that herbicide systems that include sulftentrazone enhanced the yield in Dark fire cured tobacco.

Conclusion

Weed management practices had a profound influence on growth, yield attributes and yield of FC Tobacco. The current investigation resulted in identifying an appropriate herbicide like Sulfentrazone, applied at 0.3 kg a.i ha^{-1} as pre transplant application provides effective weed control there by influencing favorable yield attributes leading to higher yield in FC tobacco.

COMPETING INTERESTS DISCLAIMER:

Authors have declared that no competing interests exist. The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

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Table 1: Effect of weed management practices on plant height and leaf area index at 90 DAP during Rabi 2018-19 and 2019-20

Treatments		Plant height (cm)		Leaf Area Index	
		2018-19	2019-20	2018-19	2019-20
W_1:	PRTR (pre transplant) Sulfentrazone 39.6% SC @ 0.3 kg a.i. ha^{-1}	109.5	105.3	2.44	2.81
W_2:	PE Pendimethalin 30% EC @ 0.75 kg a.i. ha^{-1}	113.1	106.4	2.38	2.65
W_3:	PE Oxyfuorfen 23.5 % EC @ 0.25 kg a.i. ha^{-1}	112.8	107.8	2.28	2.73
W_4:	PE Alachlor 50% EC @ 0.75 kg a.i. ha^{-1}	112.3	111.9	2.47	2.70
W_5:	POE Quizalofop-p- ethyl 5% EC @ 0.05 kg a.i. ha^{-1} at 25 DAT	112.9	114.0	2.75	2.85
W_6:	POE Imazethapyr 10% SL @ 0.05 kg a.i ha^{-1} at 25 DAT	82.2	89.3	1.64	1.83
W_7:	POE Fenoxaprop ethyl 9% EC @ 0.056 kg a.i ha^{-1} at 25 DAT	108.1	107.0	2.75	2.81
W_8:	POE Propaquizafop Ethyl 10% EC @ 0.05 kg a.i ha^{-1} at 25 DAT	108.7	106.6	2.12	2.59
W_9:	POE Carfentrazone ethyl 40 % DF @ 0.02 kg a.i ha^{-1} at 25 DAT	105.5	101.1	2.52	2.94

W_{10}:	Farmers Practice (4-6 intercultivations & Hand Weeding)	113.5	114.4	2.63	2.83
W_{11}:	Control (Weedy Check)	99.6	98.8	2.15	2.33
SEd		6.14	5.46	0.25	0.27
CD (P=0.05)		12.81	11.39	0.52	0.56

Table 2: Effect of weed management practices on number of leaves plant-1 at 90 DAP and Leaf thickness after curing during Rabi 2018-19 and 2019-20

Treatments		No. of leaves plant^{-1}		Leaf Thickness (mm)			
		2018-19	2019-20	2018-19	2019-20	2018-19	2019-20
				Cutters	Leaf	Cutters	Leaf
W_1:	PRTR (pre transplant) Sulfentrazone 39.6% SC @ 0.3 kg a.i. ha^{-1}	20.5	19.8	0.135	0.183	0.142	0.176
W_2:	PE Pendimethalin 30% EC @ 0.75 kg a.i. ha^{-1}	19.5	18.9	0.126	0.164	0.134	0.164
W_3:	PE Oxyfuorfen 23.5 % EC @ 0.25 kg a.i. ha^{-1}	20.4	19.8	0.126	0.162	0.135	0.163
W_4:	PE Alachlor 50% EC @ 0.75 kg a.i. ha^{-1}	20.4	19.8	0.112	0.164	0.130	0.162
W_5:	POE Quizalofop-p- ethyl 5% EC @ 0.05 kg a.i. ha^{-1} at 25 DAT	21.2	20.3	0.120	0.154	0.148	0.144
W_6:	POE Imazethapyr 10% SL @ 0.05 kg a.i ha-1 at 25 DAT	16.5	16.7	0.123	0.158	0.131	0.148
W_7:	POE Fenoxaprop ethyl 9% EC @ 0.056 kg a.i ha^{-1} at 25 DAT	20.3	19.9	0.114	0.158	0.124	0.147
W_8:	POE Propaquizafop Ethyl 10% EC @ 0.05 kg a.i ha^{-1} at 25 DAT	20.7	18.4	0.112	0.154	0.127	0.144
W_9:	POE Carfentrazone ethyl 40 % DF @ 0.02 kg a.i ha^{-1} at 25 DAT	20.5	19.6	0.100	0.132	0.125	0.130
W_{10}:	Farmers Practice (4-6 intercultivations & Hand Weeding)	21.5	20.6	0.143	0.183	0.143	0.173
W_{11}:	Control (Weedy Check)	19.6	18.0	0.097	0.117	0.118	0.120
SEd		1.13	0.97	0.005	0.007	0.005	0.009
CD (P=0.05)		2.35	2.02	0.01	0.015	0.01	0.02

Table 3: Effect of weed management practices on Leaf Count and cured leaf yield of Tobacco during Rabi 2018-19 and 2019-20

Treatments		Leaf Count (No. of leaves kg^{-1})		Cured leaf yield(kg $ha^{-1)}$	
		2018-19	**2019-20**	**2018-19**	**2019-20**
W_1:	PRTR (pre transplant) Sulfentrazone 39.6% SC @ 0.3 kg a.i. ha^{-1}	133	130	2302	2424
W_2:	PE Pendimethalin 30% EC @ 0.75 kg a.i. ha^{-1}	134	131	2234	2304
W_3:	PE Oxyfuorfen 23.5 % EC @ 0.25 kg a.i. ha^{-1}	138	134	2184	2341
W_4:	PE Alachlor 50% EC @ 0.75 kg a.i. ha^{-1}	145	142	2045	2272
W_5:	POE Quizalofop-p- ethyl 5% EC @ 0.05 kg a.i. ha^{-1} at 25 DAT	159	156	1918	2112
W_6:	POE Imazethapyr 10% SL @ 0.05 kg a.i ha^{-1} at 25 DAT	170	160	1419	1626
W_7:	POE Fenoxaprop ethyl 9% EC @ 0.056 kg a.i ha^{-1} at 25 DAT	154	150	2002	2092
W_8:	POE Propaquizafop Ethyl 10% EC @ 0.05 kg a.i ha^{-1} at 25 DAT	157	152	1879	2046
W_9:	POE Carfentrazone ethyl 40 % DF @ 0.02 kg a.i ha^{-1} at 25 DAT	183	182	1620	1741
W_{10}:	Farmers Practice (6 inter cultivations & Hand Weeding)	137	129	2429	2545
W_{11}:	Control (Weedy Check)	196	194	1386	1453
SEd		7.14	6.94	170.2	143.9
CD (P=0.05)		14.89	14.54	355.0	300.0