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Efficacy of weed management practices on weeds in bidi tobacco (*Nicotiana tabacum* L.) nursery

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Abstract
A field experiment was conducted during *kharif* 2016 to study efficacy of weed management practices on weeds in bidi tobacco (*Nicotiana tabacum* L.) nursery at Bidi Tobacco Research Station, Anand Agricultural University, Anand, Gujarat. The experiment was laid out in Randomized Block Design (RBD) with three replications and twelve weed management practices. Among different weed management practices, weed free condition was found superior in effective management of weeds. Among herbicidal treatments, pre plant incorporation or pre emergence application of pendimethalin 38.7 CS at 0.5 kg ha^{-1} managed weeds effectively in bidi tobacco nursery.

Keywords: management practices, *Nicotiana tabacum*, herbicidal treatments

Introduction
Tobacco (*Nicotiana tabacum* L.) is the most widely grown commercial non-food crop in the world. It is an important commercial crop in view of revenue generation, export earnings and employment potential. Tobacco is grown over 0.46 million hectare (9.6% of world area) in India having the production of 0.74 million tonnes with 1612 kg ha-1 average productivity in 2014-15 (Anon., 2015) [2]. Among various types of tobacco, bidi tobacco shares about 30% of total tobacco area and about 40% of tobacco production in the country. Gujarat stands first in bidi tobacco production in India. Raising nursery is an important aspect of bidi tobacco cultivation. In nursery, it is easy and convenient to look after the tender and young seedlings in small and compact area, also it provides favourable condition for growth and helps in getting an early crop. Weeds are a major problem of healthy bidi tobacco seedlings in Gujarat soils. During kharif season, simultaneous emergence and rapid growth of weeds along with bidi tobacco seedlings in seed beds cause severe crop-weed competition. Presence of weeds in the crop decreases the yield through competing with them for space, moisture, light and plant nutrients. Hand weeding is the most common method of weed control in bidi tobacco nurseries. But due to wage escalation and shortage of availability of labour, the operation has become cost prohibitive. These all together warrant for alternate effective and economical weed management specifically by pre and post emergence herbicides. The use of herbicides increases the tobacco yield by 80-100% when compared to control (Dhanapal *et al*., 1998) [3]. Sometimes herbicides also cause phytotoxicity effect on crops and cause yield loss. So the present field study was conducted to know the impact of different herbicide molecules on growth and yield attributes of bidi tobacco seedlings and to find out an alternate effective herbicide.

Materials and methods
The experiment was conducted at Bidi Tobacco Research Station, Anand Agricultural University, Anand, Gujarat which is geographically located at 22°35′ North latitude and 72°56′ East longitude at an elevation of about 45.1 meters above the mean sea level during kharif season of 2016. The experimental site was loamy sand in texture having pH 8.22, electrical conductivity 0.60 dS m-1, organic carbon 0.26%, available N 154 kg ha-1, available P2O5 33 kg ha-1 and available K2O 596.73 kg ha-1. Bidi tobacco crop cultivar GABT 11 was used in this study. 720 mg seeds per plot (1.2 m × 1.2 m) were sown by broadcasting method with recommended fertilizer dose of 180 kg N ha-1. The experiment was carried out in Randomized Block Design (RBD) with twelve treatments and three replications.

The treatments comprised of T1- control (weedy check), T2- hand weeding at 15, 30 and 45 DAS, T3- hand weeding at 20 and 40 DAS, T4- rabbing with bajra husk (5 kg m-2), T_5- pendimethalin 30 EC (0.5 kg ha^{-1}) as pre plant incorporation, T_6- pendimethalin 30 EC (0.5 kg ha^{-1}) as pre emergence, T_7- pendimethalin 38.7 CS (0.5 kg ha^{-1}) as pre plant incorporation, T_8- Pendimethalin 38.7CS (0.5 kg ha^{-1}) as pre emergence, T_9- oxadiargyl 6 EC (75 g ha^{-1})as pre emergence, T_{10}- quizalfop-p-ethyl 5 EC (37.5 g ha^{-1}) as Post emergence, T_{11}- fenoxaprop-p-ethyl 10 EC (0.5 kg ha^{-1}) as post emergence, T_{12}- weed free condition. Pre plant application of herbicides was done 1 week before sowing, while pre emergence application at 2 days after sowing and post emergence application of herbicides was done 15 days after sowing. The spraying was done by using knapsack sprayer fitted with flat fan nozzle with spray volume of 500 litres of water per hectare. Weed species associated with bidi tobacco nursery in experimental area were recorded at 30, 45 and 55 DAS from all the treatments. Weeds were separated species wise from each plot at 30, 45 and 55 DAS and counted accordingly. The monocot, dicot and sedges were counted separately from each plot. The data on weed counts were taken randomly with the help of a quadrate (5 cm × 5 cm) at 4 places per plot for each treatment and then converted in per 100 cm^2. The dry weight of weeds was recorded after weed samples were oven dried at 70 ^{0}C. The data on weed count and dry weight of weeds were analyzed using square root ($\sqrt{X+1}$) transformation. The weed control index was calculated by using the following formula as suggested byMisra and Tosh.

Results and discussion

Weed flora

The dominant weed flora among monocot weeds were *Eleusine indica* L., *Cynodon dactylon* L., *Digitaria sanguinialis* L. and *Chloris barbata* L. Among dicot weeds, *Phyllanthus niruri* L., *Amaranthus viridis* L., *Euphorbia hirta* L., *Heliotropium indicum* L., *Gynandropsis pentaphylla* L., *Launaea nudicaulis* L. and *Oldenlandia umbellata* L. were found as major weeds. *Cyperus rotundus* L. was the only sedge found associated with bidi tobacco nursery.

Effect of treatments on weed population

Periodical weed count recorded at 30, 45 and 55 DAS indicated that significantly the lowest number of total weeds was recorded by pre emergence application of pendimethalin 38.7 CS at 0.5 kg ha^{-1} at 30 DAS due to effectiveness in controlling weeds than other treatments. It inhibits both cell division and cell elongation in susceptible weed species. These results were in agreement to those obtained by Amin *et al*. (2015) [1]. Hand weeding at 20 and 40 DAS recorded significantly lower weed density at 45 DAS which was statistically at par with weed free condition. It confirmed the results of Trivedi *et al*. (2001) [7] and Ghosh *et al*. (2012) [5]. At 55 DAS significantly the lowest weed density was recorded by weed free condition. In weed free condition, reduction in number of weeds was due to frequent weeding which might affect the growth of weeds. The results corroborated the earlier findings obtained by Singh *et al*. (2011) [16]. Significantly the highest weed count of monocot, dicot and sedges and total weeds were observed under weedy check treatment.

Effect of treatments on weed dry weight

The data on dry weight of weeds was varied significantly due to different weed management practices. At 30 DAS, the treatments T_3, T_5, T_6, T_7, T_8 and T_{12} were compared to other treatments and they were at par with each other in recording lower dry weight of weed biomass. At 45 and 55 DAS, weed free condition recorded significant reduction in dry weight of total weed biomass. All the chemical treatments recorded lower weed dry weight than weedy check. It confirmed the results of Mali and Suwalka (1987) [10] and Singh *et al*. (2011) [16].

Weed Control Index (WCI %)

Pre plant incorporation of pendimethalin 38.7 CS at 0.5 kg ha^{-1} registered higher weed control index as it controlled monocot, dicot weeds and sedges effectively at 30 DAS, thereby lowered dry weight of weeds than rest of treatments. It confirmed the results of Khurana *et al*. (1987) [8], Yadav *et al*. (2000) [18], Trivedi *et al*. (2001) [7], Shinde *et al*. (2013) [15] and Amin *et al*. (2015) [12]. Weed free condition recorded higher weed control index both at 45 and 55 DAS. It was due to appreciably lower dry weight of weeds in weed free condition due to continuous weeding. The results were in close conformity with the findings of Patel *et al*. (2008), Singh *et al*. (2011) [16] and Patel *et al*. (2015).

Table 1: Weed count as influenced by different weed management practices

Treatment	Monocot weed count 100 cm^{-2}			Dicot weed count 100 cm^{-2}			Sedge weed count 100 cm^{-2}			Total weed count 100 cm^{-2}		
	30 DAS	45 DAS	55 DAS	30 DAS	45 DAS	55 DAS	30 DAS	45 DAS	55 DAS	30 DAS	45 DAS	55 DAS
T_1	3.74	3.79	3.91	4.69	5.13	5.29	3.42	3.79	4.08	6.76	7.28	7.61
T_2	3.05	2.58	2.08	2.41	2.71	2.16	1.82	2.23	1.88	4.07	4.12	3.25
T_3	2.16	1.52	2.51	1.96	1.82	2.51	1.28	1.28	1.72	2.88	2.29	3.69
T_4	2.58	3.05	3.11	3.05	3.60	3.91	2.89	2.89	3.11	4.54	5.35	5.71
T_5	1.00	1.00	1.00	3.05	3.91	3.99	1.00	1.00	1.00	3.05	3.91	3.99
T_6	1.00	1.00	1.00	2.70	3.31	3.59	1.00	1.00	1.00	2.70	3.31	3.59
T_7	1.00	1.00	1.00	2.75	3.46	3.78	1.00	1.00	1.00	2.75	3.46	3.78
T_8	1.00	1.00	1.00	2.31	3.00	3.37	1.00	1.00	1.00	2.31	3.00	3.37
T_9	1.00	1.00	1.00	1.52	1.69	2.71	2.16	2.38	2.76	2.44	2.75	3.74
T_{10}	1.00	1.00	1.00	3.87	4.34	4.54	1.82	2.44	2.77	4.16	4.89	5.22
T_{11}	1.00	1.00	1.00	4.12	4.69	4.83	1.72	2.16	2.51	4.36	5.06	5.35
T_{12}	2.08	1.63	1.52	2.07	1.99	1.63	1.52	1.28	1.00	3.00	2.51	1.99
$S.E_m\pm$	0.05	0.05	0.05	0.16	0.14	0.12	0.08	0.09	0.10	0.12	0.14	0.12
C. D. at 5%	0.14	0.16	0.15	0.46	0.41	0.36	0.23	0.25	0.29	0.37	0.42	0.35

Table 2: Weed dry weight as influenced by different weed management practices

Treatment	Monocot weed dry weight 100 cm^{-2}			Dicot weed dry weight 100 cm^{-2}			Sedge dry weight 100 cm^{-2}			Total weed dry weight 100 cm^{-2}		
	30 DAS	45 DAS	55 DAS	30 DAS	45 DAS	55 DAS	30 DAS	45 DAS	55 DAS	30 DAS	45 DAS	55 DAS
T_1	1.99	2.24	2.42	3.02	3.57	3.82	1.85	1.99	2.14	3.80	4.44	4.80
T_2	1.28	1.32	1.15	1.06	1.11	1.05	1.07	1.11	1.06	1.38	1.49	1.24
T_3	1.08	1.04	1.19	1.04	1.03	1.08	1.03	1.03	1.10	1.14	1.12	1.35
T_4	1.41	1.77	1.95	1.37	1.68	1.89	1.34	1.37	1.67	1.91	2.42	2.86
T_5	1.00	1.00	1.00	1.12	1.32	1.36	1.00	1.00	1.00	1.12	1.32	1.36
T_6	1.00	1.00	1.00	1.10	1.24	1.27	1.00	1.00	1.00	1.10	1.24	1.27
T_7	1.00	1.00	1.00	1.09	1.24	1.27	1.00	1.00	1.00	1.09	1.24	1.27
T_8	1.00	1.00	1.00	1.15	1.25	1.31	1.00	1.00	1.00	1.15	1.25	1.31
T_9	1.00	1.00	1.00	1.05	1.09	1.20	1.24	1.13	1.46	1.28	1.21	1.61
T_{10}	1.00	1.00	1.00	1.30	1.48	1.60	1.08	1.10	1.22	1.36	1.55	1.75
T_{11}	1.00	1.00	1.00	1.55	1.76	1.82	1.06	1.02	1.18	1.59	1.77	1.93
T_{12}	1.05	1.02	1.03	1.03	1.03	1.02	1.03	1.00	1.00	1.10	1.05	1.04
$S.E_m\pm$	0.02	0.01	0.02	0.03	0.05	0.06	0.01	0.02	0.03	0.04	0.05	0.05
C. D. at 5%	0.06	0.03	0.06	0.09	0.15	0.19	0.03	0.06	0.08	0.10	0.15	0.16

Table 3: Weed Control Index at various intervals as influenced by different weed management practices

Treatment	WCI (%)		
	30 das	45 das	55 das
T_1	-	-	-
T_2	63.68	66.44	74.17
T_3	70.00	74.77	71.88
T_4	49.74	45.50	40.42
T_5	70.53	70.27	71.67
T_6	71.05	72.07	73.54
T_7	71.32	72.07	73.54
T_8	69.74	71.85	72.71
T_9	66.32	72.75	66.46
T_{10}	64.21	65.09	63.54
T_{11}	58.16	60.14	59.79
T_{12}	71.05	76.39	78.33

Conclusion

Weed free condition was found highly superior in managing weeds efficiently. Among herbicidal treatments, pre plant incorporation or pre emergence application of pendimethalin 38.7 CS at 0.5 kg ha^{-1} could also be recommended for effective weed management in bidi tobacco nursery.

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