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Control of broomrape in Bidi tobacco by different management practices

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ABSTRACT

An experiment was conducted on loamy sand soil at Bidi Tobacco Research Station Farm, Anand Agricultural University, Anand, Gujarat during *Kharif-Rabi* season of 2011-12 and 2012-13. Twenty treatment combinations comprising of four levels of fertilizer management and five levels of herbicide management were tested in a factorial RBD with four replications. It was concluded that for controlling broomrape effectively and securing maximum cured leaf yield of Bidi tobacco as well as economic returns with management through different fertilizers, an application of ammonium sulphate at 200 kg/ha along with irrigation should be carried out. With regard to management of broomrape, manual weeding of broomrape was found to be the best practice.

Key words: Bidi tobacco, Broomrape, Management, *Orobanche ramosa*

Tobacco (*Nicotiana tabacum* L.) is the most important non-food crop cultivated in more than 100 countries on approximately 4.2 million hectares of land (Anonymous 2010). Tobacco (*Nicotiana tabacum* L. and *Nicotiana rustica* L.) belongs to the order tubiflorae and family solanaceae and is believed to have been introduced in India from its native Central America by Portuguese in 1603. The major tobacco growing countries in the world are China, U.S.A., India, Brazil, Turkey, Russia, Italy and Zimbabwe. 'Bidi' (type of cheap cigarette made of unprocessed tobacco wrapped in leaves) tobacco industry is essentially a cottage industry employing more than 0.3 million of rural population. *Bidi* tobacco plays a vital role in the national economy in generating employment and revenue. Thus, Gujarat is the largest 'Bidi' tobacco growing state in the country. (Anonymous 2006[b]). Among different types of tobacco grown in the country, 'Bidi' tobacco (*Nicotiana tabacum* L.) accounts for the highest area, production and productivity accounting for 32% area and 36% total production in the country.

Weed growth is an important constraint in proper harvest of the crop. Simultaneous emergence and rapid growth of weeds lead to severe crop-weed competition for light, moisture, space and nutrients. Broomrape (*Orobanche* spp.) is an annual, root holoparasitic herb propagated by seeds. It is one of the most serious weeds in the tobacco crop. The host root exudates induce germination of seed within soil. The parasite seedlings then infect the nearby host roots forming haustoria on them. Soon thereafter, the broomrape emerges through the soil as pale shoots devoid of chlorophyll. Broomrape is thus a total parasite. Each plant produces more than a million seeds in a short period of about eight weeks. Considering the importance of management practices on broomrape (*Orobanche ramosa*.) control in bidi tobacco, the present experiment was conducted.

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MATERIALS AND METHODS

A field experiment was conducted during the *Kharif-Rabi* season of the years 2011 and 2012 at Bidi Tobacco Research Station, Anand Agricultural University, Anand, Gujarat. The texture of the soil was loamy sand. The soil was very deep and fairly moisture retentive and was low in organic carbon and nitrogen, high in available phosphorus and medium in potassium with pH 7.6. The soil was free from any kind of salinity/sodicity hazards. Twenty treatment combinations comprising of four levels of fertilizer management Control, ammonium sulphate; 200 kg/ ha, castor cake 200 kg/ha and neem cake 200 kg/ha and five levels of herbicide management *viz*., unweeded, manual weeding, pendimethalin 1.0 kg / ha, isoproturon 1.0 kg/ha and glyphosate 1.0 kg/ha were tried out in a factorial RBD with four replications. The gross plot size of plot was 4.50 x 6.00 m and net plot size was 2.70 x 4.50 m. Herbicides were applied during emergence of *Orobanche* along with irrigation.

RESULTS AND DISCUSSION

Effect of different levels of management through fertilizers

The results revealed that *Orobanche* panicles emerged late with use of ammonium sulphate at 200 kg/ha, *i.e.* 148 and 138 days as compared to early emergence of 119 days in control (**Table 1**). This might be due to inhibitory effect of ammonium form of nitrogen to broomrape and primary inhibition of elongation of seedling and reduction in radical length. The present findings were supported from the results reported by Westwood and Foy (1999).

Effect of different levels of management through herbicides

Manual weeding recorded significantly lowest dry weight of broomrape, *i.e.* 45.56 and 44.35 kg/ha during 2011-12 and 2012-13, respectively but it was statistically at par with glyphosate 1.0 kg/ha during 2011-12. Significantly highest dry weight of broomrape, *i.e.* 126.0 and 123.6 kg/ha was recorded by unweeded during 2011-12 and 2012-13, respectively (**Table 1**). It might be due to manual weeding, which was most efficient and widely practiced method in India for all crops that suffer from their parasites. The present findings were supported from the results reported by Krishnamurthy and Rao (1976), Dhanapal (1996) and Ramchandra Prasad (2011).

The interaction effect was found non-significant in days to broomarape emergence and dry weight of broomrape (kg/ha) during both the years.

Economics

The results revealed that maximum net realization of ` 32588/ha along with BCR value of 1.97 was recorded under the treatment ammonium sulphate 200 kg/ha followed by control with net realization of ` 27586/ha along with BCR value of 1.88. On the contrary, treatment of neem cake 200 kg/ha recorded minimum net realization of ` 26513/ ha with BCR value of 1.75. This might be due to higher cured leaf yield of Bidi tobacco recorded in treatment ammonium sulphate 200 kg/ha). Similar results have been reported by Abu-Irmaileh (1981), Westwood and Foy (1999), Mariam and Suwanketnikom (2004).

Manual weeding was found superior by recording the highest value of net realization ` 31257/ ha with BCR of 1.88 followed by isoproturon 1.0 kg/ ha with net realization of ` 29082/ha and BCR of 1.87. Unweeded showed the lowest value of net realization ` 26248/ha and BCR of 1.83 followed by pendimethalin 1.0 kg/ha with net realization of ` 27465/ha and BCR of 1.81 (**Table 2**). The increase in profit was mainly due to more cured leaf yield of *bidi* tobacco. Similar results were found by Kataria *et al.* (2003), Anonymous (2009-10) and Ramchandra Prasad (2011).

Table 1. Days to broomrape emergence, dry weight of broomrape at harvest of *bidi* tobacco as influenced by management through fertilizers and herbicides

Treatment	Days to broomrape emergence			Dry weight of broomrape (kg/ha)		
	2011-12	2012-13	Pooled	2011-12	2012-13	Pooled
Management through fertilizer						
Ammonium sulphate 200 kg/ha at emergence of *Orobache* with irrigation	148	138	143	8.00(81.7)	9.40(96.6)	8.70(89.2)
Castor cake 200 kg/ha at 3rd week after transplanting	131	128	129	8.76(87.9)	8.32(75.0)	8.54(81.4)
Neem cake 200 kg/ha at 3rd week after transplanting	137	132	134	8.42(77.7)	8.52(77.5)	8.47(77.6)
Control	119	118	118	9.29(93.3)	8.78(83.4)	9.03(88.4)
LSD (p=0.05)	5.07	2.98	8.48	NS	NS	NS
Management through herbicide						
Manual weeding as and when required	134	129	131	5.99(45.6)	6.13(44.3)	6.06(45.0)
Pendimethalin 1.0 kg/ha at emergence of *Orobache* with irrigation	134	130	132	9.99(102)	9.81(100)	9.89(101.8)
Isoproturon 1.0 kg/ha at emergence of *Orobache* with irrigation	132	129	130	8.20(78.8)	8.37(76.0)	8.28(77.4)
Glyphosate 1.0 kg/ha at emergence of *Orobache* with irrigation	135	131	133	7.91(72.7)	8.20(71.0)	8.06(71.8)
Unweeded	132	127	130	11.00(126)	11.08(124)	11.04(125)
LSD(p=0.05)	NS	NS	NS	1.958	1.21	1.14

Figures in parentheses are original values subjected to transformed values to square root $(\sqrt{x+1})$. Figures indicating common letters in column do not differ significantly from each other at 5% level of significance according to Duncan new multiple range test

Table 2. Economics as influenced by different levels of management through fertilizers and herbicides (average of two years)

Treatment	Yield (t/ha)		Gross realization ($x10^3$ `/ha)	Total cost of cultivation ($x10^3$ `/ha)	Net realization ($x10^3$ `/ha)	BCR
	Cured leaf	Stalk				
Management through fertilizer						
Ammonium sulphate 200 kg/ha	2.22	1.77	66.14	33.56	32.59	1.97
Castor cake 200 kg/ha	2.04	1.66	60.86	33.51	27.35	1.82
Neem cake 200 kg/ha	2.07	1.72	61.71	35.19	26.51	1.75
Control	1.98	1.60	59.00	31.42	27.59	1.88
Management through herbicide						
Manual weeding	2.23	1.72	66.63	35.37	31.26	1.88
Pendimethalin 1.0 kg/ha	2.06	1.70	61.23	33.76	27.46	1.81
Isoproturon 1.0 kg/ha	2.09	1.67	62.23	33.15	29.08	1.87
Glyphosate 1.0 kg/ha	2.06	1.69	61.53	33.08	28.45	1.86
Unweeded	1.94	1.63	57.97	31.72	26.25	1.83

Sale price: (1) Year: 2011-12: Cured leaf: ` 24.15/kg; Stalk: ` 00.50/kg; (2) Year: 2012-13: Cured leaf: ` 35.25/kg; Stalk: ` 00.50/kg

It was concluded that for effective control of broomrape and securing maximum cured leaf yield of Bidi tobacco as well as economic returns, fertilizer ammonium sulphate 200 kg/ha along with irrigation should be applied. However, manual weeding of broomrape was found to be the best practice.

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