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Effect of Different Management Practices on Control of Broomrape and Weeds in Rustica Tobacco

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Application of Pendimethalin @ 1 kg ha^{-1} was the most effective for minimum weed dry weight compared to un-weeded check. While different levels of management through fertilizers on weed dry weight was found non-significant. Ammonium Sulphate @ 200 kg ha^{-1} gave significantly lower dry weight of broomrape over Control. Whereas, Manual removal recorded significantly the lowest dry weight of broomrape.

Key words: Broomrape, Fertilizers, Herbicides, Rustica tobacco, Weeds.

Broomrape (*Orobanche* spp.) is an annual, root holoparasitic herb propagated by seeds. It is one of the most serious weed 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. The seeds disseminate by winds, birds and farm animals. They can remain dormant in soil for 2-12 years. There are four major parasitic species of broomrape. These are *Orobanche cernua* on sunflower, *Orobanche ramosa* and *Orobanche aegyptiaca* on tobacco and tomato and *Orobanche crenata* on broadbeans. Broomrape damages their host by creating a powerful sink in host plants for nutrients, especially sugar. Broomrapes reduce the biomass of its host by 30% with main adverse effect on the leaves of tobacco (Ernst, 1986).

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MATERIALS AND METHODS

A field experiment was conducted during *rabi* season of the year 2011-12 at Bidi Tobacco Research Station, Anand Agricultural University, Anand, Gujarat. The soil was loamy sand in texture. The soil was low in available nitrogen, medium in phosphorus and high in potash. The experiment was laid out in Factorial Randomized Block Design (FRBD) with four replications. Twenty treatment combinations comprising of four levels of fertilizer management (F_1: Control, F_2: Ammonium Sulphate; 200 kg ha^{-1}, F_3: Castor cake; 200 kg ha^{-1} and F_4: Neem cake; 200 kg ha^{-1}) and five levels of herbicide management (H_1: Unweeded-check, H_2: Control (Manual removal), H_3: Pendimethalin @ 1 kg ha^{-1}, H_4: Isoproturon @ 1 kg ha^{-1} and H_5: Glyphosate @ 1 kg ha^{-1}). Rustica tobacco variety GCT 2 was transplanted in line sowing at 60 X 60 cm distance on November 18th during the year 2011-12 and fertilized with 200 kg N ha^{-1}.

RESULTS AND DISCUSSION

Effect of different levels of management through fertilizers

Application of Ammonium Sulphate @ 200 kg ha^{-1} recorded significantly later emergence of broomrape but it was at par with treatments F_3

(Castor cake; 200 kg ha^{-1}) and F_4 (Neem cake; 200 kg ha^{-1}) whereas, significantly the earliest broomrape emergence was observed under the treatment F_1 (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 are supported from the results reported by Westwood and Foy (1999). Dry weed weight was found non-significant due to different levels of management through fertilizers. Significantly lower dry weight of broomrape was observed under treatment F_2 (Ammonium Sulphate; 200 kg ha^{-1}) as compared to treatment F_1 (Control) (Table 2). The present findings are supported from the results reported by Westwood and Foy (1999) and Mariam and Suwanketnikom (2004).

Effect of different levels of management through herbicides

Significantly later emergence of broomrape was recorded under treatment H_5 (Glyphosate @ 1 kg ha^{-1}) which was at par with H_3 (Pendimethalin @ 1 kg ha^{-1}) treatment (Table 1). It might be due to inhibiting effect of glyphosate on germination of broomrape ultimately resulting into reduction in number of above ground broomrape spikes. The results are in close conformity with those of Dhanpal *et al.* (1998) and Ramchandra Prasad (2011). Treatment H_3 (Pendimethalin @ 1 kg

Table 1. Days to broomrape emergence in rustica tobacco as influenced

Treatment	Days to broomrape emergence
A. Management through fertilizers (F)	
F_1 : Control	87.9
F_2 : Ammonium Sulphate; 200 kg ha^{-1}	92.3
F_3 : Castor cake; 200 kg ha^{-1}	91.3
F_4 : Neem cake; 200 kg ha^{-1}	91.8
S.Em. ±	0.9
C. D. at 5 %	2.55
B. Management through herbicides (H)	
H_1 : Unweeded – check	88.9
H_2 : Control (Manual removal)	88.8
H_3 : Pendimethalin @ 1 kg ha^{-1}	91.9
H_4 : Isoproturon @ 1 kg ha^{-1}	90.9
H_5 : Glyphosate @ 1 kg ha^{-1}	93.6
S.Em. ±	1.0
C. D. at 5 %	2.85
Interaction F × H	NS
C. V. %	4.43

Table 2. Dry weight of weeds and broomrape at harvest of rustica tobacco as influenced by management through fertilizers and herbicides

Treatment	Dry weight (kg net plot^{-1})	
	Weeds	Broomrape
A. Management through fertilizers (F)		
F_1 : Control	4.850	1.261(1.735)
F_2 : Ammonium Sulphate; 200 kg ha^{-1}	4.783	0.972(1.048)
F_3 : Castor cake; 200 kg ha^{-1}	4.713	1.087(1.317)
F_4 : Neem cake; 200 kg ha^{-1}	4.395	1.023(1.144)
S.Em. ±	0.17	0.05
C. D. at 5 %	NS	0.14
B. Management through herbicides (H)		
H_1 : Unweeded – check	5.217	1.393(1.994)
H_2 : Control (Manual removal)	4.446	0.637(0.478)
H_3 : Pendimethalin @ 1 kg ha^{-1}	4.326	1.179(1.468)
H_4 : Isoproturon @ 1 kg ha^{-1}	4.684	1.225(1.554)
H_5 : Glyphosate @ 1 kg ha^{-1}	4.752	0.994(1.059)
S.Em. ±	0.19	0.055
C. D. at 5 %	0.55	0.16
Interaction F × H	NS	Sig.
C.V. (%)	16.55	20.16

Figures in parentheses are original values. All figures subjected to transformed values to square root √(X+1).

ha^{-1}) registered significantly lower weed dry weight compared to treatment H_1 (Un-weeded check) (Table 2). Significantly the lowest dry weight of broomrape was observed under treatment H_2 (Manual removal). The probable reason might be due to manual removal was the most efficiently and widely practiced method in India for all crops that suffer from the parasites. The present findings are supported from the results reported by Krishnamurthy and Rao (1976), Dhanapal (1996).

Interaction effect

Interaction effect between different levels of management through fertilizer and herbicide applications (F × H) failed to exert its significant effect on days to broomrape emergence and dry weed weight except broomrape dry weight. The statistical analysis of the data depicted in Table 2.1 revealed that dry weight of broomrape was found significant due to combined effect of different levels of management through fertilizers and herbicides.

Table 2(1). Interaction effect between different levels of management through fertilizers and herbicides on dry weight of broomrape at harvest of rustica tobacco

Treatment	Dry weight (kg net $plot^{-1}$) of broomrape				
	H_1 : Unweeded-Check	H_2 : Control (manual removal)	H_3 : Pendimethalin @ 1 kg ha^{-1}	H_4 : Isoproturon @ 1 kg ha^{-1}	H_5 : Glyphosate @ 1 kg ha^{-1}
F_1 : Control	1.676 (2.823)	0.662 (0.473)	1.483 (2.205)	1.413 (2.010)	1.069 (1.163)
F_2 : Ammonium Sulphate; 200 kg ha^{-1}	1.184 (1.410)	0.505 (0.320)	1.215 (1.515)	1.007 (1.060)	0.950 (0.935)
F_3 : Castor cake; 200 kg ha^{-1}	1.421 (2.025)	0.465 (0.248)	1.085 (1.210)	1.266 (1.633)	1.198 (1.470)
F_4 : Neem cake; 200 kg ha^{-1}	1.291 (1.718)	0.918 (0.873)	0.934 (0.943)	1.216 (1.515)	0.757 (0.670)
S. Em. +			0.11		
C. D. at 5 %			0.31		
C. V. %			20.16		

Table 3. Economics as influenced by different levels of management through fertilizers and herbicides

Treatment	Yield (kg ha^{-1}) Cured leaf	Stalk	Gross realization (Rs. ha^{-1})	Total cost of cultiva tion (Rs. ha^{-1})	Net realization (Rs. ha^{-1})	BCR
A. Management through fertilizers (F)						
F_1 : Control	3746	2138	123366	27987	95379	4.41
F_2 : Ammonium Sulphate; 200 kg ha^{-1}	4121	2154	135618	30085	105533	4.51
F_3 : Castor cake; 200 kg ha^{-1}	3883	2159	127850	30110	97739	4.25
F_4 : Neem cake; 200 kg ha^{-1}	4009	2192	131980	31976	100004	4.13
B. Management through herbicides (H)						
H_1 : Unweeded- Check	3693	2054	121612	28662	92950	4.24
H_2 : Control (Manual removal)	4061	2245	133722	30999	102723	4.31
H_3 : Pendimethalin @ 1 kg ha^{-1}	4012	2155	132077	30591	101486	4.32
H_4 : Isoproturon @1 kg ha^{-1}	4011	2292	132113	29997	102116	4.40
H_5 : Glyphosate @ 1 kg ha^{-1}	3919	2059	128993	29949	99045	4.31

Sale Price : Cured Leaf : Rs. 32.65 kg^{-1}
Stalk : Rs. 00.50 kg^{-1}

Economics

The economical aspect of cured leaf production is the major consideration for the farmers while making a decision on the adoption of a new technology. Among the different treatments of management through fertilizers, F_2 (Ammonium sulphate; 200 kg ha^{-1}) had given maximum net realization (Rs. 105533 ha^{-1}) along with BCR value of 4.51 followed by treatment F_4 (Neem cake; 200 kg ha^{-1}) with net realization of (Rs. 100004 ha^{-1}) and BCR value of 4.13 (Table 3). With regard to different levels of management through herbicide, treatment H_2 (Manual removal) found superior by recording the highest value of net realization (Rs. 102723 ha^{-1}) along with BCR value of 4.31 followed by treatment H_4 (Isoproturon @ 1 kg ha^{-1}) with net realization of (Rs.102116 ha^{-1}) and BCR value of 4.40. This might be due to higher cured leaf yield of rustica tobacco recorded in treatment F_2 (Ammonium Sulphate; 200 kg ha^{-1}) and treatment H_2 (Manual removal). Similar results were reported by Westwood and Foy (1999), Mariam and Suwanketnikom (2004).

CONCLUSION

In view of results obtained from the present investigation, it could be concluded that for controlling broomrape and weeds effectively as well as economic returns with management through different fertilizers, an application of Ammonium Sulphate @ 200 kg ha^{-1} along with irrigation should be carried out. With regard to management through herbicides, Glyphosate @ 1 kg ha^{-1} was found to be the best for control of broomrape.

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