Original Research Article

Comprehensive Analysis of *Orobanche* Management in FCV Tobacco in Northern Light Soils

ABSTRACT

Broomrape (*Orobanche cernua*) has become a major problem to the FCV tobacco in Andhra Pradesh and causing yield loss ranges from 30 - 70%. Therefore, the present study has been taken to critically analyse the farmer's knowledge level, adoption gap, farmers practices and constraints in *orobanche* management practices. The study was conducted in East Godavari and West Godavari districts of Andhra Pradesh. A total of 240 FCV tobacco farmers were selected from two auction platforms viz., Jangareddygudem -I and koyyalagudem. Data was collected by personnel /telephonic interview method through semi structured interview schedule. The results indicated that, 72% of the FCV tobacco farmers were found under low level of knowledge on integrated *orobanche* management practices. Followed by medium category (17.5%) and low knowledge (10.5%). Majority of the respondent had low level of adoption (70%) of integrated orobanche management practices, followed by medium (22%) and high (8%) level of adoption. No single farmers have adopted the community approach to manage orobanche. The multiple regression results revealed that Seven characteristics of farmers out of thirteen variables viz., age, farming experience, education, training received, extension contact, mass media participation, and social participation was found to be significant in explaining the variation in their knowledge level on integrated *orobanche* management practices. Nine characteristics of farmers out of thirteen variables viz., age, farming experience, education, land holding, training received, extension contact, mass media participation, innovativeness and scientific orientation was found to be significant in explaining the variation in their adoption level of integrated Orobanche management practices. High labour wages, availability of labour, lack of knowledge on means of spread *orobanche*, poor phyto sanitary measures and physical removal of orobanche after flowering are the major constraints for management of orobanche. The farmer's practices in orobanche management in are physical removal of *orobanche* before it flowers, physical removing of farmers after flowering, cultivation of trap crop/green manuring crop before tobacco.

Key words: Orobanche, Knowledge, adoption, constraints and FCV tobacco.

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1. INTRODUCTION

Parasitic weeds infect economically important crops like tobacco and seriously threaten the livelihoods of marginal and small farmers. Upon infection, they exploit host plants for water, nutrients, metabolites, and hormones with the help of one or more haustoria (Restuccia et al., 2009). Parasitic plants from the families Convolvulaceae, Loranthaceae, Viscaceae, and Orobanchaceae grow on their host plants (Joel, 2009; Heide-Jorgensen, 2011). Orobanchaceae are by far the largest family of parasitic plants with a large number of species but only a few are considered as important in leading to economic losses (Lambrada, 2008; Joel, 2009; Parker, 2009; Heide-Jorgensen, 2011). Among species, Broomrape *(Orobanche cernua)* is aggressive root parasitic weed in FCV tobacco with a devastating effect on the crop. Broomrapes reduce the biomass of its host by 30% with main adverse effect on the leaves of tobacco (Ernst, 1986). It has become a major problem to the FCV tobacco in East Godavari and West Godavari districts of Andhra Pradesh. O*robanche* infestation occurs almost every year in FCV tobacco.

In spite of research efforts by the weed scientist's plant breeders, agronomists and plant protectionists, this parasitic weed is still serious problem in tobacco and causing yield loss ranges from 30 - 70%. Severe infestation of leads to complete crop failure (100% yield loss), further it makes soils *Orobanche*-sick for a long period of time ranges from 15- 25 years and prevent the cultivation of tobacco in the infested fields. The parasite is directly connected to tobacco roots and takes the nutrients from it. The infection process takes place underground. The damage to the tobacco crop occurs before the *orobanche* appears above the soil. Farmers are also unable to manage this weed in tobacco field. The reasons for the continuous spread of the *orobanche* in northern light soils are unknown/partially known. In this back ground, the present study has been taken to critically analyses *orobanche* management practices in terms of farmer's knowledge level, adoption gap, Factors associate with knowledge and adoption, constraints in *orobanche* management practices by the FCV tobacco farmers.

2. MATERIALS AND METHODS

The present study was undertaken to analyse the *orobanche* management practices followed by the farmers in East Godavari and West Godavari districts of Andhra Pradesh. *Ex-post facto* research design was adopted for the study, since the variables chosen for the study have already been occurred and the researcher does not have any control over independent variables. Two auction platforms viz., Jangareddygudem -I and koyyalagudem were selected based on *orobanche* infestation. Since the *orobanche* infestation is severe in these auction platforms. Considering the time and resources, in selected APFs only 12 viilages from each APF were selected randomly for study. From each village ten respondents were selected randomly for.

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Thus a total of 240 respondents were constituted for the study. Data was collected by personnel /telephonic interview method through semi structured interview schedule designed for the study. The different statistical tools viz., frequency, percentage, Friedman's two-way ANOVA and regression analysis were used in the data analysis.

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3. RESULTS AND DISCUSSION

1. Knowledge of the FCV tobacco farmers on integrated *orobanche* management practices.

Table 1: Categorisation of farmers as per their knowledge level on integrated *orobanche* management practices.

S. No.	Knowledge level	Respondents (n=240)	
		Frequency	Percentage
1.	Low	173	72
2.	Medium	42	17.5
3.	High	25	10.5

The results revealed that (72%) of the FCV tobacco farmers were found under low category of knowledge on integrated *orobanche* management practices. The FCV tobacco farmers belonging to medium category of knowledge were found (17.5%) and low level of knowledge (10.5%).

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Table 2 Rank ordering of the items based on the frequency of respondents knowledge on recommended *orobanche* management practices.

Comment [Ak26]: Table 2:

S.No	Statement	Frequency	Percentage	Rank
Multiple choice				
1.	What is the best time of planting to escape from *orobanche* seed germination?	96	40	V
2.	What is the recommended dose neem cake application per acre to control *orobanche*	60	25	VI
3.	How much seed can single *orobanche* plant produces?	38	16	IX
True/False				
4.	Deep summer ploughing at the depth of about 60 cm will reduce the *orobanche* infestation	200	83	I
5.	Farm implements are means of spread of *orobacnche* seeds from one field to other field.	38	16	VIII
6.	Only one or two management practices are good enough to control *orobanche*	43	18	VII

7.	Grazing animals will spread of *orobacncne* seeds from one field to other field.	22	9	XII
8.	Crop Rotation will reduce the *orobanche* infestation	156	65	III
One word answer				
9.	Please name any two or three trap crops used for crop rotation in tobacco to manage *orobanche*?	127	53	IV
10	Which method is very effective to completely eradicate orobanche?	24	10	XI
11	How many years can *orobanche* seed remain viable in the soil?	31	13	X
12	What is best time for Physical removal of *Orobanche?*	158	66	II

The result, it can be concluded that, majority of the FCV tobacco farmers (83%) had knowledge on deep summer ploughing benefits, followed by the timely manual weeding (66%), crop rotation benefits (65%) and trap crops used for crop rotation with FCV tobacco (53%). Only few FCV tobacco farmers are having knowledge on *orobanche* management practices viz., early planting to escape from *orobanche* seed germination (40%), recommended dose neem cake application per acre to control *orobanche* (25%), integrated methods for management of *orobanche* (18%), spread of *orobanche* seeds through farm implements ((16%), viability period of *orobanche* seed in the soil (13%), very effective methods to completely eradicate *orobanche* (10%) and spread of *Orobanche* seeds from field to field by through grazing animals (9%).

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2. Adoption of integrated *orobanche* management practices.

Adoption of integrated *orobanche* management practices is studied in terms of adoption of available *orobanche* management practices by the FCV tobacco farmers.

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Table 3: Categorisation of farmers as per their Adoption of integrated *orobanche* management practices.

Sr. No.	Adoption level	Respondents (n=240)	
		Frequency	Percentage
1	Low	168	70
2	Medium	53	22
3	High	19	8

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It was evident from table 3 that 70 per cent respondent had low level of adoption of integrated *orobanche* management practices, followed by medium (22%) and high (08%) level of adoption.

Comment [Ak30]: Table

This might be due to the low level of knowledge, low level of scientific orientation and innovativeness.

Table 4. Practice wise adoption of *orobanche* management practices

Comment [Ak31]: Table 4:

S.No.	Statement	Frequency	Percentage
1.	Deep summer ploughing (about 60 cm deep)	204	85
2.	Crop rotation with maize/ cotton	62	26
3.	Cultivation of trap crop/green manuring crop before tobacco.	82	34
4.	Cleaning of farm implements after use in the infested fields	46	19
5.	Grazing animals' movement restriction f in tobacco fields.	36	15
6.	Application of fermented farm yard manure instead of fresh farm yard manure	197	82
7.	80 to 100 kg per acre neem cake application	53	22
8.	Physical removal of *Orobanche* before it flowers	140	58
9.	Burning of the *orobanche* shoots far off place from the tobacco fields.	38	16
10.	Early plantings before 15th October.	77	32
11.	Timely inter cultural operations	151	63
12.	Community approach to manage *orobanche*	0	0

It was evident from the study that, majority of the FCV tobacco farmers have adopted *orobanche* management practices viz., Deep summer ploughing (85%) followed by application of fermented farm yard manure instead of fresh farm yard manure (82%), timely inter cultural operations (63%), physical removal of *Orobanche* before it flowers (58%). Few farmers only adopted recommended *orobanche* management practices viz., cultivation of trap crop/green manuring crop before tobacco (34%), early plantings (32%), Crop rotation (26%), 80 to 100 kg per acre neem cake application (22%), cleaning of farm implements after use in the infested fields (19%), burning of the *orobanche* shoots far off place from the tobacco fields (16%) and Grazing animals' movement restriction f in tobacco fields (15%). No single farmers have adopted the community approach to manage *orobanche*.

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3. Relationship between selected independent variables and level of knowledge and adoption on recommended integrated *orobanche* management practices.

Multiple regression analysis was carried out to find out the contribution made by the independent variables and also to identify variables which contribute significantly towards the

variation in the knowledge and adoption on integrated *orobanche* management practices by the farmers. The results of the multiple regression analysis were as follows

Table: 5: Contribution of variables of the respondents with their knowledge on integrated *orobanche* management practices.

S.No.	Variables for contribution of knowledge	Regression coefficient (b)	Standard error	t-value
1	**Age**	**.63**	**1.017**	**2.396***
2	**Farming Experience**	**.310**	**.241**	**1.981***
3	Family size	.196	.312	.587
4	**Educational Status**	**.467**	**.912**	**2.471***
5	Annual Income	-.270	.816	-1.374
6	Land holding	-.202	.124	.318
7	**Training received**	**.711**	**.041**	**3.871****
8	**Extension contact**	**.251**	**1.21**	**4.767****
9	**Mass media participation**	**.128**	**.084**	**2.014***
10	Innovativeness	.019	.067	.261
11	Scientific orientation	.118	1.072	1.12
12	Risk orientation	-.048	.842	-.575
13	**Social Participation**	**.314**	**.557**	**2.17***
	R^2 = 0.514			**F= 11.31****
	**** Significant at 5% level of probability***		***** Significant at 1% level of probability***	

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It could be observed from the results that, 'F' value (11.31) obtained was significant at one per cent level of significance indicating that, all the independent variables put together contributed significantly to the variation in the extent of adoption of integrated *Orobanche* management practices by the farmers. The coefficient of determination (R^2) was 0.514, which revealed that the variation in the extent of adoption of integrated *Orobanche* management practices by the farmers was together explained by all the independent variables selected for the study.

The study revealed that seven characteristics of farmers out of thirteen variables *viz.*, age, farming experience, education, training received, extension contact, mass media participation, and social participation was found to be significant in explaining the variation in their knowledge level on integrated *Orobanche* management practices. It is referred that increasing unit of these variables results in turn increase in level of knowledge of the respondents. Hence, these variables could be considered as good indicators of knowledge by the farmers. The value of co-efficient of

determination (R^2 =0.514) indicated that all the thirteen variables together explained 51.40 per cent of the variation in the knowledge. Since 51.40 per cent per cent of the variation could be explained in the study by thirteen variables.

Table: 6: Contribution of variables of the respondents of the respondents with their adoption on integrated *orobanche* management practices.

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S.No.	Variables for contribution of adoption	Regression coefficient (b)	Standard error	t-value
1	**Age**	**.230**	**.063**	**3.521****
2	**Farming Experience**	**1.040**	**.396**	**2.34***
3	Family size	.628	1.186	.714
4	**Educational Status**	**-.484**	**1.210**	**2.121***
5	Annual Income	.191	.821	.232
6	**Land holding**	**.514**	**.191**	**3.814****
7	**Training received**	**.209**	**.158**	**2.541***
8	**Extension contact**	**.165**	**.070**	**2.721***
9	**Mass media participation**	**.477**	**.221**	**1.164***
10	**Innovativeness**	**.812**	**.220**	**4.141****
11	**Scientific orientation**	**.447**	**.261**	**1.98***
12	Risk orientation	.634	.460	1.379
13	Social Participation	-.260	.446	-.583
	R^2 = 0.418			**F= 9.160****
	** Significant at 5% level of probability*		*** Significant at 1% level of probability*	

It could be observed from the results that, 'F' value (9.160) obtained was significant at one per cent level of significance indicating that, all the independent variables put together contributed significantly to the variation in the extent of adoption of integrated *Orobanche* management practices by the farmers. The coefficient of determination (R^2) was 0.418, which revealed that the variation in the extent of adoption of integrated *Orobanche* management practices by the farmers was together explained by all the independent variables selected for the study.

The Table 6 revealed that nine characteristics of farmers out of thirteen variables *viz.*, age, farming experience, education, land holding, training received, extension contact, mass

media participation, innovativeness and scientific orientation was found to be significant in explaining the variation in their adoption level of integrated *Orobanche* management practices. It is referred that increasing unit of these variables results in turn increase in level of adoption of the respondents. Hence, these variables could be considered as good indicators of adoption by the farmers. The value of co-efficient of determination (R^2 =0.418) indicated that all the thirteen variables together explained 41.80 per cent of the variation in the adoption. Since 41.80 per cent of the variation could be explained in the study by thirteen variables.

Constraints faced by the farmers in management *orobanche* in FCV tobacco in NLS region.

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An effort has been made to identify the major constraints faced by tobacco farmers for management of *orobanche* and the responses were recorded on a five point continuum starting from 1= to a very low extent to 5= to a very high extent on different components. These constraints were compared using Friedman's two-way ANOVA.

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Table 7. Mean ranks comparison of constraints by tobacco farmers

Comment [Ak40]: Table 7:

S.No.	Problem	Mean Rank (N=240)
1	High labour wages	8.76
2	Timely availability of labour	8.15
3	Lack of knowledge on means of spread *orobanche*	7.05
4	Poor phyto sanitary measures	6.28
5	Physical removal of *orobanche* after flowering	5.31
6	Non availability of effective management methods	4.37
7	Lack of community level management of *orobanche*	4.15
8	Lack of resistant varieties	3.87
9	Poor intercultural operations	2.48

It is evident from the results (table.7) that among the constraints, high labour wages availability of labour, lack of knowledge on means of spread *orobanche*, poor phyto sanitary measures and physical removal of *orobanche* after flowering are the major constraints for management of *orobanche* in FCV tobacco.

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Table 8. The farmer's practices in orobanche management in FCV tobacco in NLS area

S.no	Farmers Practice	Frequency (N=240)	Percentage
1	Physical removal of *orobanche* before it flowers	139	58
2	Physical removing of farmers after flowering.	106	44
3	Cultivation of trap crop/green manuring crop before tobacco.	74	31
4	Neem cake application	53	22
5	Crop rotation	60	25
6	Timely inter cultural operations	144	60
7	Phyto sanitary measures	79	33

SUMMERY AND CONCLUSION:

From the study, it can be inferred that majority of the FCV tobacco farmers are having low level of knowledge especially on biology of the parasitic weed and its modes of transportation from one field to other field. Farmers are aware about benefits of deep summer ploughing, timely physical removal of *Orobanche*, benefits of crop rotation and trap crops used for crop rotation. Majority of the farmers had low to medium level of adoption. Majority of the farmers are following the practices like deep summer ploughing, application of fermented farm yard manure, timely inter cultural operations and physical removal of *Orobanche*. The farmers are not adopting the proper phytosanitory and quarantine measures to manage *Orobanche*. It was found from the study that the variables viz., age, education, land holding, training, extension contact, scientific orientation are the driving forces to increase the knowledge and adoption of recommended Orobanche management practices. Therefore there is a strong need to sensitize and train the farmers about the *orobanche* management practices. Tobacco Board, ICAR-CTRI, and Trade should initiate efforts for fostering the adoption of integrated *Orobanche* management practices.

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Comment [Ak53]: Put comma after each name throughout e.g Arslan, Z.F., Aksoy, E. And Uygur, F.N. 2012.

Comment [Ak54]: Be consistent in placing the initials as in Ref 1 above

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