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EFFECT OF PRECEDING CROP, NITROGEN AND IRRIGATION ON YIELD AND QUALITY OF FCV TOBACCO IN RAINFED VERTISOLS OF ANDHRA PRADESH

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A field experiment was conducted during 2004-07 seasons at the CTRI Research Farm, Katheru, Andhra Pradesh to improve the yield of tobacco in the tobacco based cropping systems by providing irrigation and fertilizer nitrogen to tobacco. The experiment was laid out in a split plot design replicated thrice comprising of six main plot treatments with combination of three preceding *kharif* crops *viz.*, maize, soybean, fallow and two irrigation treatments *viz.*, one and two irrigations to FCV tobacco in *rabi* and three sub-plot treatments *viz.*, 30, 45 and 60 kg N/ha applied to FCV tobacco. Among the three cropping sequences maize – tobacco and fallow-tobacco being on a par and recorded significantly higher cured leaf and grade index than soybean – tobacco. Giving two irrigations significantly increased green leaf and cured leaf yields by 15.0 and 10.3% compared to one irrigation, respectively. Application of 60 and 45 kg N/ha being on a par with each other and recorded higher yields and grade outturn compared to 30 kg N/ha. Higher sugars were recorded in fallow-tobacco whereas higher nicotine and chlorides were recorded in soybean–tobacco system. Two irrigations and 45 kg N/ha recorded higher values for reducing sugars and chlorides. Nicotine content increased with increasing levels of N. Though the individual effect of irrigation and N was significant, from the non-significant effect of interaction and on leaf quality, it can be inferred that one irrigation of 25 mm with harvested rain water at 30 days is sufficient for FCV tobacco grown after maize and soybean.

Key words: FCV tobacco, Irrigation, Nitrogen, Preceding crop, Quality

INTRODUCTION

Flue-cured Virginia (FCV) tobacco (*Nicotiana tabacum* L.) is traditionally grown as a mono-crop under conserved soil moisture conditions during post rainy season in Vertisols of Andhra Pradesh, and most of these fields remain fallow in rainy season. Crop rotation studies reported from different parts of the world revealed that continuous tobacco crop reduced yield and quality of tobacco as compared with crop sequence. In these situations, development of sustainable tobacco-based copping systems for a particular zone plays a vital role in realizing maximum monetary returns. Tobacco based cropping systems were advocated by many investigators in traditional black soils. Studies from CTRI, Rajahmundry in Vertisols revealed that the Virginia tobacco planted after fallow gave highest yield as compared to tobacco planted succeeding *kharif* crops. Irrigation and N management study was taken to sustain the yield of tobacco as it is low succeeding *kharif* crops.

MATERIALS AND METHODS

A field experiment was conducted during rainy (*kharif*) and post rainy (*rabi*) seasons from 2004 -2007 at the research farm of Central Tobacco Research Institute, Rajahmundry, East Godavari district of Andhra Pradesh. It is a hot dry sub-humid agro-ecological sub-region (semi-arid tropical climate) with an average annual rainfall of 1100 mm. The soils are silty clay (sand, silt and clay content in 0-22.5 cm soil layer was 17, 32 and 51% and in 22.5-45 cm it was 16, 31 and 53%, respectively). The Godavari Deltaic alluvium-derived Vertisols have slightly alkaline pH (7.75), low electrical conductivity (0.30 dS/m), available N (230 kg/ha) and organic C (0.44 %) and high available P (32.0 kg/ha) and K (437 kg/ha).

The experiment was laid out in a split plot design replicated thrice comprising of six main plot treatments with combination of preceding *kharif* crops *viz.* maize, soybean, fallow and two irrigation treatments *viz.*, one and two irrigations

to FCV tobacco in *rabi* and three sub-plot treatments *viz.*, 30, 45 and 60 kg N/ha applied to FCV tobacco. Seed of maize "GSF 2' hybrid (105 days duration) was direct sown at a spacing of 60 x 25 cm and soybean JS 335 at a spacing of 40 x 10 cm was sown during the second week of July and the crop was harvested in the second fortnight of October in all the three seasons. After harvesting *kharif* maize and soybean, the treatments were imposed in *rabi* tobacco crop planted in the first week of November. In the plots of FCV tobacco, plough furrows were opened in 70 cm marker lines and N in the form of ammonium sulphate, was applied in the furrows and covered with a leveling plank 15 days before tobacco planting. Sixty-day old seedlings of FCV tobacco 'VT-1158' were planted at 70 x 50 cm spacing during first fortnight of November in the plant rows where N was applied. One irrigation was given at 30 and two irrigations at 30 & 45 days after planting of 25 mm each with harvested rain water from the farm pond. The gross plot size was 5.6 x 5.0 m**.** The recommended packages of practices were followed for raising FCV tobacco in *rabi* with conserved soil moisture. Tobacco leaves were harvested at maturity by priming 2-3 matured leaves each time at 7-8 days interval and cured in the flue-curing barn, and on an average eight harvestings were done to complete the harvests of tobacco. Grade index was calculated (first grade equivalent) by summing the product of each grade cured leaf quality and the value of that grade in comparison

Table 1: Yield and quality of FCV tobacco as influenced by preceding crop, irrigation and nitrogen levels under rainfed Vertisols

Treatments	**Tobacco yield (kg/ha)**			
Preceding crop	**Green leaf**	**Cured leaf**	**Bright leaf**	**Grade index**
Maize	16917	2398	1095	1713
Soybean	13910	2034	934	1480
Fallow	16238	2364	1134	1722
SEm±	**150**	**22**	**10**	**18**
CD (P=0.05)	**415**	**62**	**28**	**49**
Irrigation				
One	I4415	2143	1011	1586
Two	16961	2388	1099	1691
SEm±	**122**	**18**	**8.16**	**14.50**
CD (P=0.05)	**415**	**62**	**23**	**49**
CV (%)	**8.10**	**8.39**	**8.04**	**9.22**
Nitrogen levels (kg/ha)				
30	15102	2191	1015	1591
45	15859	2288	1067	1653
60	16102	2316	1084	1672
SEm±	**110**	**14**	**8.20**	**12**
CD (P=0.05)	**306**	**39**	**23**	**33**
CV (%)	**5.97**	**5.31**	**6.59**	**6.16**

to first grade cured leaf (Gopalachari, 2004). The data on leaf yields and grade index were recorded and analyzed statistically.

RESULTS AND DISCUSSION

Tobacco yield

Significant differences were observed in the leaf yields of tobacco due to preceding *kharif* crop (Table 1). Among the three systems, maize – tobacco and fallow-tobacco being on a par with each other and recorded significantly higher cured leaf and grade index. Significantly higher green leaf was observed in maize – tobacco and bright leaf by fallow-tobacco cropping sequence was recorded. Harishu Kumar *et al.* (1992) reported that tobacco in rotation with groundnut and green gram produced more cured leaf compared to tobacco mono cropping and no significant variation was observed in bright leaf yield and grade index. Tobacco yields were highest after maize for grain (3.56 t/ha), compared with 3.05 t/ha with sole tobacco (Borodii, 1986). Soybean – tobacco system produced significantly lower leaf yields and grade outturn. Kasturi Krishna *et al.* (2007) also reported that lower yields were obtained from tobacco succeeding soybean compared to other crop sequences.

Significant differences were observed in the green leaf yields and grade index due to irrigations. Giving two irrigations significantly increased green leaf and cured leaf yields by 15.0 and 10.3% higher than one irrigation respectively.

Nitrogen application showed significant differences in leaf yields and quality of tobacco leaf. Application of 60 and 45 kg N/ha were on a par and recorded higher yields and grade index compared to 30 kg N/ha.

Perusal of the pooled data revealed that interactions between cropping systems, irrigations and nitrogen levels were not significant for green leaf, cured leaf and grade index. It shows that one irrigation and 45 kg N/ha is sufficient for tobacco followed by preceding *kharif* crop or fallow. Though the individual effect of irrigation was significant, from the non significant effect of interaction it can be inferred that one irrigation at 30 days was necessary for tobacco followed by maize and soybean.

Leaf quality parameters

In general, nicotine and reducing sugars were within the desirable levels (Table 3). Significant differences were observed due to the treatments for nicotine, chlorides and reducing sugars. Higher sugars were recorded in fallow-tobacco whereas nicotine and chlorides were recorded due to Soybean –tobacco system. Two irrigations and N at 45 kg/ha recorded higher values for nicotine, reducing sugars and chlorides.

Table 2: **Interaction of preceding crop, irrigation and nitrogen levels on tobacco cured leaf (kg/ha)**

Treatment	Irrigations					
	One			Two		
	30 kg N/ha	45 kg N/ha	60 kg N/ha	30 kg N/ha	45 kg N/ha	60 kg N/ha
Maize	2230	2332	2335	2433	2480	2577
Soybean	1848	1932	1999	2047	2159	2185
Fallow	2154	2207	2247	2436	2560	2580
SEm±			**34.70**			
CD (P =0.05)			**NS**			

Table 3: Quality parameters of FCV tobacco as influenced by preceding crop, irrigation and nitrogen levels under rainfed Vertisols

Treatments Preceding crop	Nicotine (%)	Reducing sugars (%)	Chlorides (%)
Maize	2.07	15.28	1.47
Soybean – Tobacco	2.35	14.20	1.83
Fallow- – Tobacco	2.02	15.94	1.55
SEm±	**0.04**	**0.29**	**0.06**
CD (P=0.05)	**0.12**	**0.81**	**0.16**
Irrigation			
One	2.30	15.42	1.58
Two	1.99	14.86	1.62
SEm±	**0.04**	**0.24**	**0.05**
CD (P=0.05)	**0.12**	**NS**	**NS**
CV (%)	**17.6**	**16.45**	**19.8**
Nitrogen levels (kg/ha)			
30	2.11	15.21	1.58
45	2.15	15.51	1.64
60	2.17	14.70	1.64
SEm±	**0.04**	**0.22**	**0.04**
CD (P=0.05)	**NS**	**0.62**	**NS**
CV (%)	**16.3**	**12.50**	**13.4**

Nicotine content increased with increasing levels of N. Two irrigations recorded higher nicotine content compared to one irrigation. Kasturi Krishna *et al.* (2007) reported that soybean-tobacco recorded significantly higher nicotine content followed by blackgram - tobacco whereas significantly lower values were observed in maize-tobacco. Maize - tobacco and rice-tobacco recorded higher values of reducing sugars than soybean-tobacco and blackgram - tobacco.

Perusal of the pooled data revealed that interactions between cropping systems, irrigations and nitrogen levels were not significant for leaf yields. Based on the associated problems namely increased chlorides and nicotine with irrigation and nitrogen it is advisable to restrict for one irrigation of 25 mm with harvested rain water and 45 kg N/ha for FCV tobacco succeeding *kharif* maize and soybean in vertisols.

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