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EFFECT OF SPACING AND NITROGEN LEVELS ON THE FIRST GRADE LEAF YIELD AND QUALITY OF CHEWING TOBACCO

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Chewing tobacco is a *rabi* crop of Tamil Nadu grown under irrigated conditions in about 12000 ha. The crop is widely grown in the districts of Dindigul, Erode, Coimbatore and Dharapuram. In tobacco, leaf being the economic produce, plant geometry and nitrogen plays a key role in first grade leaf production. Adopting proper spacing increases the leaf area and thickness of chewing tobacco thereby leaf yield. The advance breeding line HV 2000-6 recorded maximum total cured leaf yield and net returns at the spacing of 75 x 75 cm (Kumaresan *et al.*, 2009a). The advance breeding line HV 98-16 required a N level of 75 kg/ha for higher total cured leaf yield (Kumaresan *et al.*, 2009b). As the information on the suitable agronomic practices for producing higher first grade leaf is limited, the present study was taken up.

A field experiment was conducted at the experimental farm of CTRI-Research station, Vedasandur during 2008-10 to study the effect of spacing and nitrogen on the first grade leaf production of the variety Abirami. The soil of the experimental site was Alfisol with alkaline pH (8.1), low in available N (210 kg/ha), P (6.5 kg/ha) and medium in available K (275 kg/ha). Three spacings *viz.,* 75 x 75, 90 x 75 and 90 x 90 cm and three N levels *viz.,* 75, 125 and 175 kg/ha were tested in a factorial randomized block design with three replications. Farm yard manure was applied @ 25 t/ha, ridges and furrows were formed as per the treatments and 45 days old seedlings were planted. Phosphorus @ 44 kg/ha as super phosphate was mixed with 2.5 t/ha of sieved farm yard manure and spot applied**.** Nitrogen as per the treatments was given in the form of urea in two splits at 45 and 60 days of planting. Potassium was given in the form muriate of potash on 45th day of planting. The N and K fertilizers were placed near the root zone. The crop was topped at 60 days after planting and the suckericide, decanol was applied at 6 % concentration. Crop was harvested by stalk-cut method at 120 DAP. The first grade leaf yield (FGLY) and total cured leaf yield (TCLY) were recorded after sun-curing and standard fermentation process. The samples collected were chopped, air dried and then oven dried at 65 ± 5^{0}C until attaining constant weight. The leaf samples were used for estimating chemical quality constituents *viz.,* nicotine, reducing sugars (Harvey *et al.*, 1969) and chlorides (Hanumantha Rao *et al.*, 1980). The soil samples were drawn from 0-22.5 cm depth and analyzed for available N, P and K as per the standard procedures. The quality in terms of chewability was evaluated by the method suggested by Palanichamy and Nagarajan (1999) including body of the leaf (10), aroma (10), whitish incrustation (10), taste (10), pungency (10), saliva secretion (10), retention of pungency (10), stiffness in mouth (10) totaling to 80. A score of 60 and above was considered to indicate the better quality for chewing purposes. Economics were calculated as per the cost of inputs and the price of cured leaf realized. The total rainfall was 41.4 mm and 226.4 mm during the seasons 2008-09 and 2009-10, respectively. The minimum and maximum temperature were 19.8 and 31.0, and 20.8-30.6^{o}C during 2008-09 and 2009-10 respectively.

The leaf length and width were significantly influenced by levels of spacing and nitrogen (Table 1). Wider spacing of 90 x 75 cm significantly increased the leaf length and width over the existing spacing of 75 x 75 cm. The leaf length with 90 x 75 cm and 90 x 90 cm are comparable. Application of 175 kg N/ha significantly increased the leaf length and width over the 75 kg N/ha.

The leaf length with 175 kg N/ha and 125 kg N/ ha are comparable.

The FGLY significantly increased with 90 x 75 cm over the existing 75 x 75 cm spacing. The spacing 90 x 75 cm significantly increased the FGLY by 7 and 26 % over the spacing 90 x 90 cm and 75 x 75 cm respectively. The FGLY recorded with 90 x 75 cm was 2419 kg/ha. The spacing 90 x 90 cm significantly recorded higher FGLY by 17 % over the existing spacing of 75 x 75 cm. The FGLY recorded was 2251 kg/ha with 90 x 90 cm

Table 1: Leaf length, leaf width, FGLY and TCLY as influenced by spacing and nitrogen (Pooled data).

Treatments	Leaf length (cm)	Leaf width (cm)	FGLY* (kg/ha)	TCLY** (kg/ha)	Quality scores (out of 80)	Cost of cultivation (Rs. x 10^3)	Gross returns (Rs. x 10^3)	Net returns (Rs. x 10^3)	B: C ratio
Spacing (cm)									
75 x 75	73.6	40.4	1911	3152	60	51.7	141.5	89.8	1.74
90 x 75	75.3	43.2	2419	3253	69	54.4	148.9	97.5	1.90
90 x 90	74.1	41.7	2251	2679	62	51.1	121.3	70.2	1.38
SEm±	**0.42**	**0.35**	**40.1**	**40.6**	**-**	**-**	**4.00**	**2.26**	**0.03**
CD (P=0.05)	**1.17**	**0.96**	**111.1**	**112.5**	**-**	**-**	**13.8**	**7.60**	**0.09**
N levels (kg/ha)									
75	72.6	40.0	2097	2876	62	50.8	130.7	79.9	1.58
125	74.7	41.9	2236	3096	62	51.3	139.1	87.8	1.71
175	75.7	43.3	2249	3119	64	51.9	141.8	89.9	1.73
SEm±	**0.42**	**0.35**	**40.1**	**40.6**	**-**		**3.80**	**0.52**	**0.03**
CD (P=0.05)	**1.17**	**0.96**	**111.1**	**112.5**	**-**	**-**	**10.6**	**2.20**	**0.09**
CV (%)	**6.19**	**3.53**	**7.75**	**5.69**	**-**	**-**	**0.11**	**0.24**	**8.32**

*FGLY-First grade leaf yield **TCLY-Total cured leaf yield

Table 2: Effect of spacing and nitrogen on the nutrient uptake and leaf chemical quality

Treatments	Nutrient uptake (kg/ha)			Lamina chemical quality		Residual nutrient status		
	N	P	K	Nicotine (%)	Reducing sugars (%)	OC (%)	Available P (kg/ha)	Available K (kg/ha)
Spacing (cm)								
75 x 75	129.3	8.29	96.3	2.66	3.78	0.56	10.2	310
90 x 75	119.3	7.57	88.3	2.66	3.77	0.55	11.0	316
90 x 90	122.6	7.43	88.7	2.66	3.80	0.60	11.0	316
N levels (kg/ha)								
75	100.5	7.30	86.5	2.56	4.14	0.54	11.6	320
125	128.4	7.80	91.6	2.61	3.82	0.58	11.0	318
175	142.3	8.20	95.2	2.82	3.41	0.58	11.6	321

spacing. The lowest FGLY was recorded with the spacing 75 x 75 cm spacing. Nitrogen played a significant role in the production of FGLY. Nitrogen 175 kg/ha significantly increased the FGLY by 7 % over the 75 kg N/ha. The FGLY recorded with 175 kg N/ha was 2249 kg/ha. Nitrogen at 175 kg/ha and 125 kg/ha are comparable with respect to FGLY.

The TCLY significantly increased with levels of spacing. The spacing 75 x 75 cm significantly increased the total cured leaf yield over the other two spacings. The spacing 90 x 75 cm significantly increased the TCLY by 21% over the wider spacing 90 x 90 cm. The TCLY recorded with 90 x 75 cm was 3253 kg/ha. The TCLY recorded with 90 x 75 cm and 75 x 75 cm are comparable. The increased TCLY at closer spacing could be attributed to increased plant population (Subba Rao and Harishu Kumar, 2008). The spacing 90 x 90 cm recorded a lower TCLY. The lesser plant population decreased the TCLY. The TCLY significantly increased with 175 kg N/ha over the 75 kg N/ha. The increase in TCLY with 175 kg N/ha was 8 % over the 75 kg N/ha. The TCLY with 175 kg N/ha and 125 kg N/ha were at a par. Positive influence of nitrogen on the yield of chewing tobacco was observed by Shanthi *et al.* (1991). Nitrogen at 75 kg/ha recorded a lower TCLY. The interaction effects between the spacing and nitrogen on the FGLY as well as on the TCLY were non-significant.

Preferable chewability scores were recorded with all the treatments. Maximum quality score of 69 and 64 were recorded with 90 x 75 cm spacing and 125 kg N/ha, respectively.

The cost of cultivation was higher at 75 x 75 cm spacing and 175 kg N/ha. The increase in number of seedlings, fertilizer N and labour requirement could be attributed for the increased cost of cultivation. Gross returns significantly increased with 90 x 75 cm spacing and 175 kg N/ha due to higher FGLY and TCLY. The gross returns recorded with 125 and 175 kg N/ha were at a par. Higher TCLY with the spacing 90 x 75 cm and 175 kg N/ha resulted in maximum gross returns. Lower gross return was recorded with 75 kg N/ha. Net returns and B:C ratio were higher with the spacing 90 x 75 cm and 175 kg N/ha. Net returns and B:C ratio with 175 kg N/ha and 125 kg N/ha were at a par.

Nutrient uptake *viz.*, N, P and K was higher with the closer spacing of 75 x 75 cm. As the nutrient uptake is the function of the lamina yield and nutrient content, the increased dry matter production at closer spacing and nutrient content is responsible for the increased N, P and K uptake. Nitrogen at 175 kg/ha increased the N, P and K uptake. The increased availability of nitrogen in the soil increased the N, P and K content of plant, thereby improved nutrient uptake.

The nicotine content increased with increasing N levels. The nicotine content ranged from 2.56 to 2.82% (Table 2). Nitrogen at 125 kg/ha significantly increased the nicotine content and decreased the reducing sugars over 75 kg N/ha. As N has positive correlation with nicotine content, there was increased nicotine content at higher levels of N. Higher N levels decreases the starch accumulation in the leaf which in turn reduced the reducing sugar content. Kasturi Krishna *et al.* (2003) reported that nicotine content in FCV tobacco increased with higher N levels. The reducing sugars ranged between 3.41 and 4.14%. The residual soil nutrient status *viz.*, organic carbon, ranged from 0.50 to 0.60%, available P from 10.2 to 11.9 kg/ha and available K from 310 to 320 kg/ha. As compared to the initial status, residual available P and K levels were increased. The available P and K was less at the spacing 75 x 75 cm due to the higher uptake by the crop.

It can be concluded from this study that a spacing of 90 x 75 cm and 125 kg N/ha would be the best combination to produce higher first grade leaf yield in the variety Abirami.

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