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Growth and Chemical Composition of Tobacco *Nicotiana tabacum* L. under Different Seedling Height

[1]M.H. Siddiqui, [2]F.C. Oad and [3]L. Kumar
[1]University College of Agriculture Rawalakot, Azad Kashmir
[2]Sindh Agriculture University Tandojam, Pakistan
[3]Plant Pathology Section, A.R.I. Tandojam, Pakistan

Abstract: The field experiments were conducted in the farmer's field at Dudu Chack, Shakar Garh, Narowal, Pakistan to assess the effect and relationship of varying seedling heights (2.5, 5.0, 7.5, 10.0 and 12.0 cm) on tobacco variety Tandojam-1 for growth and yield potentials. The plant height, leaf size, green and cured leaves yields, the nitrogen, nicotinic, chloride, potash and reducing sugars of the leaves were found maximum when seedling height increased linearly from 2.5 to 12.0 cm. The relationship of seedling height was significant and positive with all the growth and chemical parameters. It may be argued that better chemical composition and growth of the cured tobacco leaves may be obtained by transplanting the seedlings at the height of 10.0 to 12.0 cm.

Key words: Tobacco, seedlings, growth, yield, chemical, composition

INTRODUCTION

The economic significance of tobacco as cash crop can be regulated from the fact that about 30% of the Pakistan Federal Government Revenue receipts from the Central Excise Duty are derived from this source. In Pakistan, the tobacco crop occupies an area of about 56.40 thousands ha, with the total production of 107.8 thousands tones. In aggregate terms the tobacco companies collect 90% of their requirement from North West Frontier Province and remaining 10% is picked from the province of Punjab and Sindh[1]. Various management practices for boosted tobacco production affect its quality and quantity. Among those, selection of pure seed, nursery preparation and seedling height have emphasis for healthy, uniform and crop survival. The increasing seedling height significantly increases growth as well as green leaves and cured tobacco yields[2] and the chemical composition (N, K and reducing sugar percent) were more in longer seedlings. Keeping in view the economic importance of tobacco, the experiments were conducted in order to determine the effect of seedling heights and their relationship with growth, yield and chemical parameters.

MATERIALS AND METHODS

The field trials were set in RCBD, replicated four times, keeping 30x15 cm distance between rows and plants in a net plot size of 3x6 m in the agro-climatic conditions of Dudu Chack, Shakar Garh, Narowal, Pakistan. The good seedbed was prepared through four dry plowings followed by clod crushing and leveling. Tobacco variety Tandojam-1 was sown in nursery under different dates at 20 days interval to obtain seedlings of various heights of 2.5, 5.0, 7.5, 10.0 and 12.0 cm. The fertilizer dose of 90-60-60 NPK kg ha^{-1} was applied. The full dose of phosphorus and potash with one third of nitrogen was applied at the time of transplanting, whereas remaining nitrogen was split applied into four equal doses and were dressed at the interval of 20 days respectively. All the required cultural operations were adopted uniformly in all the plots throughout the growing period according to crop requirements. The nitrogen content of leaf was worked out according to A.O.A.C[3], leaf nicotinic chloride and potash percents were obtained as suggested by Chapman and Prett[4]. However, reducing sugar content was determined according to the method given by Shmuk[5]. All data were analyzed following the procedures of Gomez and Gomez[6].

RESULTS AND DISCUSSION

Crop growth parameters: Tobacco crop showed highly significant differences among transplanted seedling heights and observed plant characters. It was observed that as the seedling height increased all the plant characters responded positively for increased values. The results of the field experiment revealed that plant height (183.13 cm), Leaf size (664.18 cm^2), green leaves weight

Corresponding Author: Dr. Fateh Chand Oad, Assistant Professor, Department of Agronomy, Sindh Agriculture University, Tandojam, Sindh, Pakistan Tel: 0221-765857 E-mail: F_oad@hotmail.com

per plant and per ha (447.88 g and 13925.10 kg respectively) and cured leaves weight per plant and per ha (43.13 g and 2432.50 kg) were recorded maximum when the transplanted seedlings were tallest enough i.e. 12.0 cm. However, declined trend appeared in the following seedling heights i.e. 10.0, 7.5, 5.0 and 2.5 cm, respectively (Table 1).

Relationship of seedling heights with different tobacco growth characters: The data for inter relationship between seedling heights and plant characters exhibited positive perfect and highly significant relationship by recording plant height r= 0.93, leaf size r=0.76, green leaves weight per plant and per ha r=0.89 and r=0.96, respectively and cured leaves weight per plant and per ha r=0.93 and r=0.94, respectively.

The coefficient of determination (R^2) explain that 87, 57, 79, 92, 87 and 94% variation in plant characters i.e. plant height, leaf size, green leaves weight per plant and per hectare, cured leaves weight per plant and per ha was accounted due to variation in seedling heights.

The regression coefficient (b_yx) suggested that for an increase of every unit seedling height corresponded increased plant height, leaf size, green leaves per plant and per hectare, cured leaves per plant and per ha by 11.42 cm, 54.77 cm^2, 31.34 g, 627.93 kg, 3.52 g and 185.64 kg ha^{-1}, respectively.

The results agree with the findings of Wilkinson[7] who reported that increasing length of seedlings proportionally increased growth and yield of tobacco and the yield deviation was highly correlated with seedling size[8]. Feber [9] also concluded that tobacco seedlings transplanted at the height of 15, 20 and 25 cm resulted maximum leaf length, green and cured leaves yields. Further, Kumar *et al.*[10] and Richard[11] from their research reported that early transplanted crop gave higher yields of tobacco green and cured leaves. From the results it was concluded that taller seedlings resulted tall plants, increased leaf size, weight of green and cured leaves. Therefore it is suggested that for obtaining boosted qualitative as well as quantitative tobacco yields one must transplant taller seedlings.

Crop chemical composition: The chemical composition of the tobacco crop significantly affected by different seedling heights. The increase in the seedling height progressively increased all the chemical parameters. Tobacco leaf nitrogen (2.42%), nicotinic (2.29%), chloride (1.56%) potash (3.92%) and reducing sugar (4.48%) recorded higher values when the transplanted seedlings were taller enough i.e. 12.0 cm. However, declined trend appeared in the seedling heights i.e. 10.0, 7.5, 5.0 and 2.5 cm, respectively (Table 2).

Relationship of seedling heights with different tobacco chemical parameters: The seedling heights showed positive perfect relationship with the leaf chemical parameters by recording correlation coefficient values of tobacco leaf nitrogen% (r=0.93), nicotinic% (r=0.91), chloride% (r=0.64), potash% (r=86) and reducing sugar (r = 0.88) (Table 3).

The coefficient of determination explain that 87, 84, 41, 75 and 78% variation in leaf chemical parameters i.e. nitrogen, nicotinic, chloride, potash and reducing sugar were accounted due to variation in seedling heights.

The regression coefficient (b_yx) suggested that for an increase of every unit seedling height corresponded increased leaf chemical parameters by 0.14, 0.03, 0.01, 0.12 and 0.21%, respectively.

The results agree with the findings of Thomas and Killer[12] who reported that increasing length of seedlings proportionally increased chemical composition like

Table 1: Tobacco growth characters and their inter-relationship as affected by varying seedling heights

Seedling Heights (cm)	Plant height (cm)	Leaf size (cm^2)	Green leaves weight/ plant(g)	Green leaves weight kg ha^{-1}	Cured leaves weight plant (g)	Cured leaves weight kg ha^{-1}
2.5	140.93e	272.80d	318.75d	11210.38d	30.33d	1672.98e
5.0	144.60d	511.60c	365.23c	12325.13d	32.38c	1930.33d
7.5	147.88c	588.20b	405.18b	12900.18c	39.23b	2030.00c
10.0	174.38b	664.18a	420.43ab	13175.00b	42.00a	2267.73b
12.0	183.13a	676.55a	447.88a	13925.10a	43.13a	2432.50a
SE+	1.145	30.770	11.392	91.333	0.754	29.874
Cdi	2.490	67.070	24.830	199.100	1.640	65.120
Cdii	3.490	93.840	34.740	278.560	2.290	91.110
Coefficient of Correlation	0.935**	0.764**	0.890**	0.962**	0.934**	0.940**
Coefficient of Determination	0.870	0.570	0.790	0.920	0.870	0.940
Regression Coefficient	11.418	54.770	31.345	627.933	3.523	185.645

Column values followed by similar letter are not significantly different at 1% level of probability
** = Significant at 1% level of probability

Table 2: Tobacco leaf chemical parameters and their relationship as affected by varying seedling heights

	Leaf chemical content of tobacco (%)				
Seedling Heights (cm)	Nitrogen	Nicotine	Chloride	Potash	Reducing sugar
2.5	1.86d	2.13e	1.50	3.37e	3.65d
5.0	2.05c	2.16d	1.51	3.47d	3.73d
7.5	2.16b	2.20c	1.52	3.53c	3.96c
10.0	2.37a	2.22b	1.53	3.64b	4.21b
12.0	2.42a	2.29a	1.56	3.92a	4.48a
SE+	0.04	0.01	0.01	0.04	0.093
Cdi	0.90	0.02	-	0.18	0.20
Cdii	0.13	0.03	-	0.14	0.28
Coefficient of Correlation	0.93**	0.91**	0.64**	0.86**	0.88**
Coefficient of Determination	0.87	0.84	0.41	0.75	0.78
Regression Coefficient	0.14	0.03	0.01	0.12	0.21

Column values followed by similar letter are not significantly different at 5% level of probability.
** = Significant at 1% level of probability

Table 3: Correlation matrices of growth and chemical parameters of tobacco crop

1	2	3	4	5	6	7	8	9	10
1.00									
0.78	1.00								
0.86	0.96	1.00							
0.86	0.96	0.99	1.00						
0.88	0.92	0.97	0.94	1.00					
0.94	0.94	0.97	0.98	0.94	1.00				
0.93	0.95	0.97	0.97	0.96	0.99	1.00			
0.92	0.86	0.95	0.96	0.92	0.97	0.94	1.00		
0.93	0.81	0.92	0.93	0.88	0.95	0.91	0.99	1.00	
0.93	0.78	0.90	0.92	0.86	0.95	0.90	0.98	0.99	1.00
0.97	0.84	0.94	0.93	0.95	0.97	0.96	0.98	0.98	0.97

1= Plant height 2= leaf size 3= Green leaves wt./plant
4= Green leaves wt ha^{-1} 5= Cured leaves wt/plant
6= Cured leaves wt.ha^{-1} 7= Nitrogen 8= Nicotine
9= Chloride 10= Potash 11= Reducing sugars

nitrogen and potash. Wilkinson[7] also concluded that chemical composition was superior in longer seedling sizes as compared to smallest seedling height. However, Pandey and Sherma[13] reported that chemical characters like nicotine and chloride percent were less or un-affected by seedling height, but, nitrogen, potash and reducing sugar were significantly higher in longer seedlings.

From the results it was concluded that taller seedlings resulted satisfactory leaf chemical content. Therefore, it is suggested that for obtaining boosted qualitative tobacco yields one must transplant taller seedlings.

REFERENCES

1. Anonymous, 2002. Pakistan Statistical Year Book. Federal Bureau of Statistics, Statistics Division, Govt. of Pakistan.
2. Singh, R.K., B.S. Chopra and S.K. Nath, 1989. Effect of various seedling sizes on the growth and yield of tobacco. Tobacco Abst., 34: 120.
3. A.O.A.C., 1955. Method of Analysis. ASSOC. Official Analytical. Chemist, Washington. 5th Edn.
4. Chapman, H.O. and P.F. Prett, 1961. Methods of analysis for soil, plant and water. University of California.
5. Shmuk, A.A., 1953. The chemistry and technology of tobacco. N.I. Carrilor, Editor. English translation. Vol. III. Pischetomizedate Publishers, Moscow.
6. Gomez, K.A. and K.K. Gomez, 1984. Statistics for Agricultural Research. (2nd Edn.) John Willy and Sons, New York.
7. Wilkinson, W., 1990. Effect of various seedling sizes on the yield performance of Virginia tobacco Nicotiana tabacum L. Tobacco Abst., 36: 310.
8. Morrison, J.E. and W.O. Atkinson, 1980. Seedling size influence on survival and growth uniformity of no-tell Burl rely. Tobacco Abst., 25: 151.
9. Feber, A., 1992. Effect of various seedling heights on the growth and yield of tobacco. Tobacco Abst., 37:70.
10. Kumar, J.B., B.R. Singh and S.K. Singh, 1990. Influence of different transplanting dates on the yield and growth parameters of tobacco *Nicotiana tabacum* L., 35:160.
11. Richard, S.R.P., 1989. Influence of different transplanting dates on the growth and yield of tobacco. Tobacco Abst., 35: 310.
12. Thomas, K.K. and S.R. Killer, 1987. Yield responses of tobacco. Tobacco Abst., 32: 11.
13. Pandey, P. and B.C. Sherma, 1990. Effect of various seedling heights on the green leaves and cured tobacco yield. Tobacco Abst., 36:540.