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QUANTITATIVE ANALYSIS OF YIELD AND OTHER TRAITS IN ORIENTAL TOBACCO IN ALBANIA

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SUMMARY

A half diallel analysis among seven lines of oriental tobacco was conducted to estimate quantitative analysis of yield, plant height, leaf number, middle leaf (length and width), dry matter of middle and top leaf and vein percent.

The experiment was carried out in three environments, three replications and in a randomized block system.

The variance analysis revealed the presence of additive genetic variance for the most of traits. The yield was largely controlled by additive gene effect. The graphical analysis showed the presence of allelic interaction and in particular crosses the presence of over dominance.

Leaf number, middle leaf (length and width) and vein percent were controlled by additive gene effect, too. Both additive and non-additive genes action appeared to play a significant role in the inheritance of plant height, top leaf width and dry matter of top leaf. However the overdominance was present in the different crosses for plant height and top leaf width.

The dominance had a positive effect for the most of traits. It had a negative tendency for vein percent, dry matter of middle and top leaf and width and length of top leaf. There was no heterosis for leaf number. Average heterosis ranged from -6.5 for vein percent to 5.4 for plant height.

In the presence of additive genetic control for the most of traits breeding of line cultivars would be more useful in commercial production of oriental tobacco and F_1 hybrids would be effective only particular situations and some regions.

INTRODUCTION

Estimation of genetic parameters is an important aspect in the formulation of breeding programmes aiming the genetic improvement of productivity of tobacco. There one many investigations about there subject (1,6,10,11,12,13,15).

The genetic control of some characters were additive (1,6,13,14,15), but Lee and Chang reported for a non-additive genetic control of yield, leaf number, vein percent etc. In these situations, it becomes important to collect more information on various genetic estimates to enable the breeders to plan their programmes more efficiently and make rapid improvements in raising the productivity of tobacco. The present investigation estimated the inheritance of yield and other traits in Oriental tobacco in a diallel cross.

MATERIALS AND METHODS

In the study were included seven lines of Oriental tobacco. Their origin were different. T-40, Llovine and FA-2 were Albanian lines. Xebel from Bulgaria, Flora from Australia and KII-2a and H-52 from Greec.

The experiment was carried out in three environments, in a randomized block and in three replications. Row to row and plant to plant spacing were 45 x 12 cm respectively. Row length was 5m

replications. Row to row and plant to plant spacing were 45 x 12 cm respectively. Row length was 5m and plot superfice was 6.75 m^2.

The experiment was carried out on different type of soils. Cultural and curing practices were normally employed to Oriental tobacco. The character measured were yield, plant height, middle and top leaf length and width of dry matter of middle and top leaf and vein percent.

A half diallel analysis was performed according to Jinks-Hayman method.

The diallel design was:

1. Xebel	1 x 1	1 x 2	1 x 3	1 x 4	1 x 5	1 x 6	1 x 7
2. H-52		2 x 2	2 x 3	2 x 4	2 x 5	2 x 6	2 x 7
3. T-40			3 x 3	3 x 4	3 x 5	3 x 6	3 x 7
4. Floria				4 x 4	4 x 5	4 x 6	4 x 7
5. Llovine					5 x 5	5 x 6	5 x 7
6. KII-2a						6 x 6	6 x 7
7. FA-2							7 x 7

RESULTS

The variance analysis (tab. 2.1), showed that additive gene effect plays a significant role in the inheritance of yield. The component of non-additive variance showed that in particular crosses the epistases play an evident role in the genetic control of yield of tobacco.

They were significant in Vr-Wr graphic too (graph. 1). The lines nr. 1,2,4 were in the dominance zone of graphic. The yield of these lines was largely controlled by dominant genes and non-allelic interaction plays great role in genetic control of yield. The variety Floria showed a high productivity, and it would be useful as a good genetic material to improve the yield of tobacco.

The allelic interaction was significant in genetic control of yield for the lines 5,3,7. Graphical analysis (graph. 1) showed that yield of KII-2a line was largely governed by recessive genes.

The dominance for yield had a positive direction, and heterosis ranged from -3.2 to 20.16% with an average of 4.73% (tab. 1).

The component variance analysis for other traits such as leaf number, middle leaf length, vein percent dry matter of middle leaf and middle leaf width and length (tab. 2.3, 2.4, 2.5, 2.8, 2.10), showed that additive gene effect is more important in their inheritance. In different crosses were present overdominance and epistasis too. That was significant for leaf number, middle leaf length and dry matter of top leaf.

Vr-Wr graphs. (graph. 3,4,5,6,8,9) showed that non-allelic interaction plays particular role in the inheritance of leaf number, vein percent and dry matter of middle leaf.

In the dominance zone was more frequently line H-52. The graphical analysis showed the presence of overdominance and non-allelic interaction of genes in particular locus for dry matter of middle leaf. The dominance for these traits, except leaf number, were significant. The dominance for middle leaf length and width had a positive direction. Average heterosis of them were respectively 5% and 4%, but dominance for vein percent and dry matter of middle leaf had a negative direction. It ranged from -6.5% for vein percent to -2.5 for dry matter of middle leaf.

There had a good relation among yield and middle leaf measurements. For the Floria and H-52 lines, these traits were controlled by dominant gene action, Floria and H-52 lines could be used in genetic improvement programmes to raising yield of tobacco.

Both additive and non-additive genes action appeared to play a significant role in the inheritance of plant height, top leaf length, and dry matter of top leaf (tab. 2.2, 2.6, 2.9). The dominance of plant height had a positive direction and average heterosis was 5.4%. It ranged from -4.14% to 11.65%. Vr-Wr graph. (graph. 2) showed that plant height was largely controlled by dominant genes action in Floria, Xebel and KII-2a lines. The recessive genes action predominated in genetic control of plant height for FA-2 line.

There was a negative relation among top leaf length, dry matter of top leaf and yield. Average heterosis ranged from -1.0 for top leaf length to -3.6 for dry matter of top leaf.

Non-additive gene action appeared to play a small role in the inheritance of top leaf width (tab. 2.7). graphical analysis showed the presence of overdominance in different crosses. Most of lines were in dominance zone of graphic (graph. 7), but top leaf width and yield had a negative relation. The heterosis ranged from -9.86 to 11.95% with an average -1.0%.

DISCUSSION

The predominance of genetic variance in genetic control of most of tobacco traits was reported by many authors (1,6,13,14,15). The results of present investigation were approximated with reports of Wilkinson and others (14,15). That was significant for yield, leaf number, and middle leaf length and width. Except top leaf width all the other results were in contrary of Lee and Chang (7) conclusions.

In circumstances where the agronomic traits were controlled by additive gene effect as were yield, leaf number, middle leaf length and width, vein percent and dry matter of middle leaf, some authors (9,13,14), suggested the selection of pure lines. For the other traits that were controlled by additive and non-additive gene action it was suggested that recurrent selection and multiply breeding procedures may be adapted for the simultaneous exploitation of both additive and non-additive genetic effects in selfpolination plant (6,7,9,13,14).

The average heterosis was evident for all characters analysed. It was shown also a good relation among yield and plant height and middle leaf measurements. Thus these traits would be useful as a criterion of selection in genetic improvement of yield in oriental tobacco.

The yield of Floria line was largely controlled by dominant genes. It had also a high productivity, which would be important in the genetic improvement for heterosis.

Heterotic responses for several agronomic traits of tobacco have been reported in flue-cured tobacco (1,14), burley tobacco (15) and oriental tobacco (6,10,13). Average heterosis of this study were approximated to Wilkinson conclusions.

Table 1 Means of parents and hybrids and amount of heterosis for characters measured in a Oriental tobacco diallel

		Means		% Heterosis		
	Characters	Parents	Hybrids	Average	Low	High
1	Yield kg/ha	18.35	19.21	4.73++	-3.2	20.16
2	Plant height (cm)	104.16	109.16	5.4+-	-4.14	11.65
3	Leaf number	32.26	32.27	0	-5.13	6.44
4	Middle leaf length (cm)	22.29	23.34	5.0++	-4.13	13.27
5	Middle leaf width (cm)	11.32	11.77	4.0++	-9.40	14.60
6	Top leaf length (cm)	11.55	11.42	-1.0++	-6.99	21.06
7	Top leaf width (cm)	5.67	5.61	-1.0++	- 9.86	11.95
8	Dry matter M.Leaf g/cm^2	0.4628	0.4514	-2.5++	-22.29	6.55
9	Dry matter top leaf g/cm^2	0.5443	0.5247	-3.6++	-11.01	1.37
10	Vein percent	28.11	26.25	-6.5+	-11.64	-1.88

+,++ *Indicate significance at the 0.01 level of probability, respectively*

Table 2 Variance analysis of additive and non-additive effects

Tab. 2.1

Effect	Degree of freedom	Sum of squares	Mean squares	F
a	6	86.773	14.462	57.73++
b	21	25.017	1.191	4.75++
b_1	1	4.51	4.510	18.003++
b_2	6	4.035	0.673	2.68-
b_3	14	16.473	1.171	4.69++
E	54	13.527	0.2505	

Plant height: Tab. 2.2

a	6	724.373	120.728	174.97++
b	21	682.256	32.488	47.08++
b_1	1	38.636	38.636	55.98++
b_2	6	237.493	39.582	57.36++
b_3	14	406.127	29.009	42.3 ++
E	54	37.26	0.690	

Leaf number: Tab. 2.3

a	6	91	15.167	561.74++
b	21	20.502	0.976	35.148++
b_1	1	0.013	0.013	0.49
b_2	6	9.549	1.591	58.92++
b_3	14	10.953	0.872	32.22++
E	54	1.458	0.027	

Middle leaf length: Tab. 2.4

a	6	60.174	10.119	316.22++
b	21	7.749	0.369	11.53++
b_1	1	1.138	1.138	35.56++
b_2	6	1.766	0.279	8.72+-
b_3	14	4.963	0.355	11.09++
E	54	1.728	0.032	

Middle leaf Width: Tab. 2.5

a	6	13.82	2.203	194.752++
b	21	9.935	0.187	15.844++
b_1	1	0.838	0.838	70.854++
b_2	6	5.008	0.833	62.45++
b_3	14	2.1	0.150	11.680--
E	54	0.648	0.012	

Top leaf length:				Tab. 2.6
a	6	6.407	1.068	109.341+-
b	21	6.051	0.288	29.505++
b_1	1	0.093	0.093	9.498+-
b_2	6	2.011	0.355	34.314++
b_3	14	3.948	0.282	28.874++
E	54	0.527	0.00976	
Top leaf width:				Tab. 2.7
a	6	1.547	0.257	39.54++
b	21	1.693	0.081	12.46++
b_1	1	0.001	0.001	0.15+-
b_2	6	0.907	0.151	23.13++
b_3	14	0.685	0.048	7.38++
E	54	0.35	0.00649	
Dry matter of middle leaf:				Tab. 2.8
a	6	12.2174	2.00332	154.10++
b	21	9.1853	0.4374	33.64++
b_1	1	1.1107	1.1107	85.48++
b_2	6	1.99042	0.33273	25.59++
b_3	14	7.08389	1.18669	91.28++
E	54	0.702	0.013	
Dry matter of top leaf:				Tab. 2.9
a	6	13.9347	2.3225	103.22++
b	21	12.9997	0.6109	27.15++
b_1	1	1.9335	1.9335	85.93++
b_2	6	2.0442	0.3407	15.14++
b_3	14	0.022	0.6444	28.64++
E	54	1.216	0.0225	
Vein percent:				Tab. 2.10
a	6	105.91	17.659	59.89++
b	21	60.31	2.872	9.89++
b_1	1	19.961	19.961	66.784++
b_2	6	21.887	3.648	12.372++
b_3	14	18.732	1.338	4.538++
E	54	15.922	0.295	

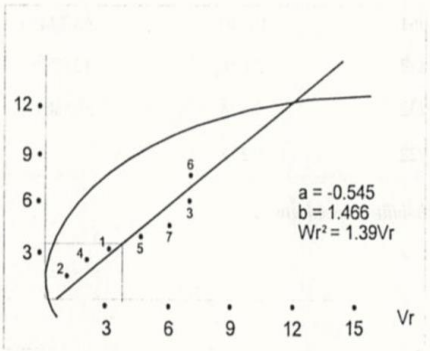
+,++ *Indicate significance at the 0.05 and 0.01 level of probability respectively.*

Table 3 Means of parents and hybrids for several traits of Oriental tobacco in a diallel cross

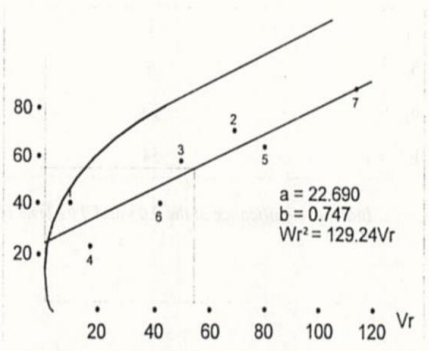
Lines and hybrids	Yield kg/ha	Plant height (cm)	Leaf number	Middle leaf (cm)		Top leaf (cm)		Dry matter (g/cm^2)		Vein percent
				L	W	L	W	Midd.	Top	
1. Xhebel	1456	104.87	30.05	19.21	9.93	9.4	5.19	4356	5825	25.86
2. H-52	1573	92.22	30.22	22.00	10.82	10.88	5.56	5011	5366	27.36
3- T-40	1711	97.43	30.44	24.01	11.5	12.46	5.37	4678	5466	30.56
4. Floria	2049	123.75	35.44	23.48	12.38	12.06	6.35	4137	5540	26.56
5. Llovinc	1842	98.61	33.94	22.3	11.10	11.9	5.67	5091	4897	27.50
6. KII2a	1972	115.22	35.27	24.09	10.73	12.25	5.38	4416	5095	27.63
7. FA-2	2244	97.08	30.44	25.03	13.17	11.96	6.18	5029	6021	31.33
8. 1 x 2	1826	100.94	30.16	21.41	10.86	10.81	5.8	5140	5788	23.56
9. 1 x 3	1690	102.66	29.55	22.00	11.01	11.69	5.75	4389	5531	24.73
10. 1 x 4	1917	112.64	30.88	21.43	12.1	11.71	6.04	4466	5468	21.10
11. 1 x 5	1733	99.17	30.5	21.67	11.5	11.5	6.04	3899	4738	22.10
12. 1 x 6	1702	106.87	31.05	22.98	10.73	10.84	5.34	7208	5017	22.27
13. 1 x 7	1921	102.56	29.27	23.40	12.08	11.77	5.89	4305	5251	24.8
14. 2 x 3	1829	107.95	32.55	23.49	11.61	11.5	5.35	4712	5434	26.47
15. 2 x 4	1872	113.75	32.16	22.49	11.95	11.16	5.96	4744	5416	26.16
16. 2 x 5	1744	102.47	30.83	22.85	11.38	11.07	5.63	4517	5165	26.67
17. 2 x 6	1749	109.40	32.33	22.72	10.91	10.97	5.35	4201	4946	26.37
18. 2 x 7	1783	94.71	29.5	23.49	11.52	10.67	5.3	4690	5887	28.40
19. 3 x 4	2147	118.57	33.94	23.85	11.92	11.27	5.81	4665	5103	26.90
20. 3 x 5	1819	104.14	32.55	26.00	11.86	11.86	5.73	4238	5050	27.70
21. 3 x 6	1892	113.86	33.27	25.34	11.95	12.05	4.99	4195	5207	29.30
22. 3 x 7	2130	105.55	32.55	23.18	12.26	12.62	5.58	4183	5019	29.23
23. 4 x 5	2223	120.60	34.38	25.08	13.26	11.77	5.58	3890	5113	26.73
24. 4 x 6	2115	125.16	35.77	25.26	12.32	11.93	5.61	4118	5369	27.13
25. 4 x 7	2171	121.00	34.16	23.66	12.75	11.25	5.7	4566	5539	28.3
26. 5 x 6	1932	113.56	33.88	24.48	11.17	11.27	5.32	4028	5035	27.43
27. 5 x 7	1926	111.31	33.44	25.51	12.10	10.7	5.50	4408	5325	24.60
28. 6 x 7	2225	118.85	35.00	25.03	12.10	11.66	5.42	4555	5127	30.60
LSD 0.05	118	3.56	0.93	0.68	0.46	0.41	0.22	0.08	0.03	4.90
LSD 0.01	167	5.03	1.33	0.97	0.73	0.64	0.31	0.12	0.04	7.50

Vr - Wr graphs of studied properties

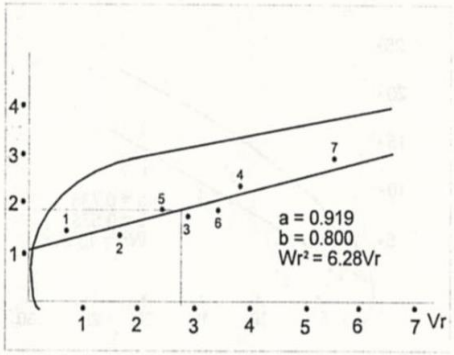
Graph. 1 Yield



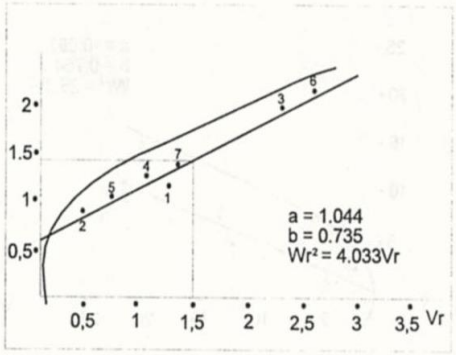
Graph. 2 Plant height



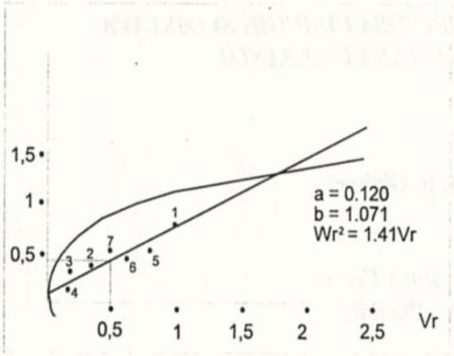
Graph. 3 Leaf number



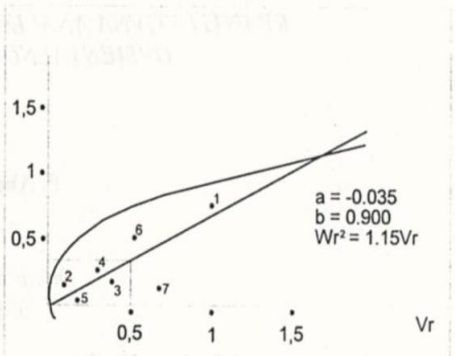
Graph. 4 Middle leaf lenght



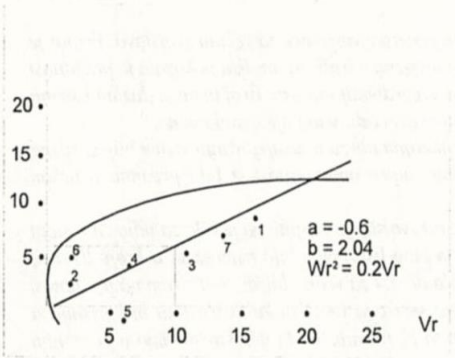
Graph. 5 Middle leaf width



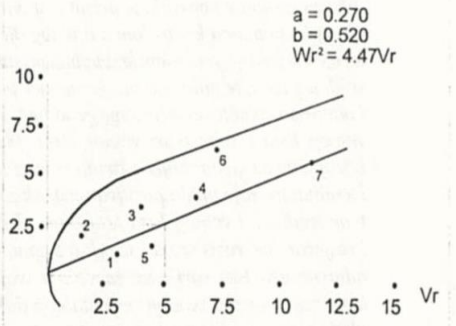
Graph. 6 Top leaf lenght



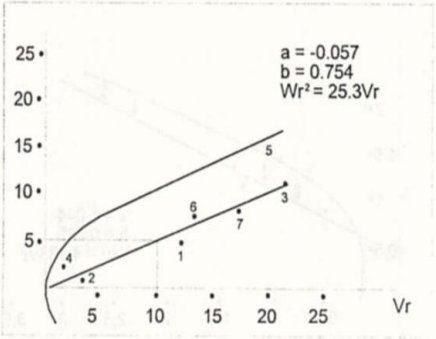
Graph. 7 Top leaf width



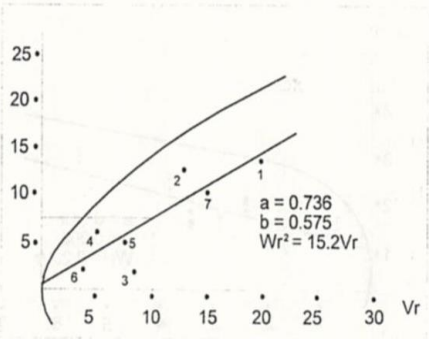
Graph. 8 Vein percent



Graph. 9 Dry matter of middle leaf



Graph. 10 Dry matter of top leaf



KVANTITATIVNA ANALIZA PRINOSA I DRUGIH SVOJSTAVA ORIJENTALNOG DUHANA U ALBANIJI

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SAŽETAK

Provedena je dialelna analiza sedam linija orijentalnog duhana da bi se ocijenila kvantitativna analiza prinosa, visine biljke, broja listova, dužine i širine srednjeg lista, suhe tvari srednjeg i vršnog lišća i postotak nervature. Pokus je izveden na tri lokacije u tri ponavljanja po randomiziranoj blok metodi.

Analiza varijance potvrdila je prisutnost aditivne genetske varijance za većinu svojstava. Prinos je bio uglavnom pod kontrolom aditivnog djelovanja gena. Grafička analiza pokazala je prisutnost alelne interakcije, a u nekim križanjima prisutnost superdominantnosti. Broj listova, dužina i širina srednjeg lista, te udio žila bio je također pod utjecajem aditivnog djelovanja gena.

I aditivno i neaditivno djelovanje gena imalo je značajnu ulogu u nasljedivanju visine biljke, širine vršnog lista i suhe tvari vršnog lista. Međutim, superdominantnost je bila prisutna u nekim križanjima za visinu biljke i širinu vršnog lista.

Dominantnost je imala pozitivan učinak za većinu svojstava. Negativna je bila za udio žila, suhu tvar srednjeg i vršnog lista te dužinu i širinu vršnog lista. Nije bilo heterozisa u broju listova. Prosječan heterozis kretao se od -6.5 za udio žila do 5.4 za visinu biljke. S obzirom na prisutnost aditivne genetske varijance za većinu svojstava, selekcija linijskih kultivara bila bi korisnija u komercijalnoj proizvodnji orijentalnog duhana, a F_1 hibridi bili bi učinkoviti samo u posebnim okolnostima i nekim područjima.

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