

# Quantitative Characteristics of Oriental Varieties of The Yaka Type

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## **ABSTRACT**

Nine varieties of the Yaka type (YK 7-4/2, YK-23, YK-48, JK-87, YK-68, YK 10-7/1, YK-261, YK-141 and YV 125/3), as well as one variety of the Prilep type (P-66-9/7), were taken as working material and their quantitative characteristics were analyzed: plant height with inflorescence, number of leaves per plant, dimensions of the leaves of the middle belt of the plant and yield of dry leaves per plant. As a control, for comparison, we took the variety of the Yaka type YV 125/3. In recent years in the Republic of North Macedonia, the most common variety is P-66-9/7, so we placed it in the same experiment as a second control variant. The experiment was set up at the Experimental Field of the Scientific Institute of Tobacco - Prilep in 2022 and 2023, in a randomized block design with four replications, using traditional agricultural practices. Measurements of the first three traits were made at the budding and flowering stages, and the dry leaf mass yield was determined during the manipulation of the cured tobacco. The results were statistically processed.

The aim of the investigation is, by presenting the obtained two-year results on quantitative characteristics, to provide useful information for the selection of oriental tobaccos, as well as to introduce, above all, foreign tobacco buyers to the Yaka-type varieties, which are characterized by a particularly pleasant aroma.

From the analysis of the results obtained from the comparative experiment, it can be concluded that the Yaka-type varieties do not have a significantly higher yield than the Prilep-type variety, with the exception of YK-87, which in 2022 gave a yield higher than that of P-66-9/7 with a significance of 5%). YK-87, YK-261, YK 10-7/1 and YK-141 give approximately the same yield as that of P-66-9/7, and significantly higher than the control variety YV 125/3. The seeds of these varieties can be offered to buyers of oriental tobaccos, in accordance with their wishes and needs.

**Keywords:** *Nicotiana tabacum L., type Yaka, varieties, morphological characteristics, agronomic characteristics.*

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Date of Submission: 20-05-2026

Date of Acceptance: 30-05-2026

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## **I. INTRODUCTION**

Tobacco in the Republic of North Macedonia is a strategic crop with a centuries-old tradition of high quality. Tobacco production in this region mainly consists of oriental small-leaf aromatic tobaccos intended for the domestic and foreign markets. The breeding activity of this crop is a long-term successive process based on phenotypic and genotypic studies of the available assortment. The most common aim of the studies are quantitative characteristics that are related to yield. These are hereditary traits and varietal characteristics that are largely influenced by changes in the external environment.

A large number of works by breeders have been published on the topic of tobacco breeding. So for example: Ramachandra and col. (2015), carried out a genetic analysis of 62 genotypes (six lines of different tobacco types, eight testers and their crosses), at the Nipaniat Agricultural Research Station Belgaum, Karnataka – India, for the number of leaves and for the length and width of the leaves. The best among the parents were Vairam, MS NPN-190, MS A-119 and Kunkumatri. The hybrids MS PL-5 x Vairam and MS GT-4 x Thangam were superior to the control variety in terms of yield and quality parameters. Mitreski and Korubin-Aleksoska (2015), on six varieties of the Prilep type (P-23, P 12-2/1, NS-72, P-66-9/7, P-79-94 and Prilep Basma 82), examined some morphological traits and announce that Prilep Basma 82 had the highest average leaf number, and the lowest length and width of the middle belt leaves. Dimitrieski and Miceska (2015), offer information about quantitative traits of new prospective variety of the oriental Yaka tobacco, and as the most perspective point out Yaka b 65 - 82/1. Kinay and Yilmaz (2016), conducted experimental trials with hybrids obtained by semi-diallel crosses between the varieties: Xanthi-2A, Nail, Gümüşhacıköy, Taşova, Katerini, Canik and Erbaa, in the Tokat province of Turkey, and found an average heterosis of 28.4%. The heterotic effect for stalk height and dry leaf yield was 4%. Korubin – Aleksoska and Ayaz (2016), investigated height of the stalk with inflorescence, leaf number, length of the middle belt leaves and dry mass yield per stalk in five autochthonous

tobacco varieties of types: Prilep (P 10-3/2 and P 12-2/1), Jebel (J No 1) and Yaka tobaccos (YK 7-4/2 and KY), and five commercial oriental varieties of Prilep tobacco (P-23, P-84, NS-72, P-66-9/7 and P-79-94). Differences between the genotypes in the investigation period were highly significant, which is a sign of their mutual genotypic and phenotypic diversity. Korubin – Aleksoska and Ayaz (2016), studied ten oriental tobaccos of the types: Basmak (MK-1, MK-2, MB-2, MB-3, MS-8/1, MS-9/3 and YZ-7), Prilep (Prilep Basma-82), Jebel (Xanthi J-1) and Yaka (YV 125/3), for some more important quantitative traits, and gave precise knowledge of the new type Basmak in Macedonia and the Balkans from genetic, morphological and agronomic aspects. All Basmak varieties are characterized by stability and uniformity as a result of their homozygotness. Korubin – Aleksoska and Arsov (2016), studied five old domestic oriental varieties of the types: Prilep, Jebel and Yaka, and five commercial oriental varieties of the Prilep type for the number of leaves over two years, thus determining highly significant differences between the variants for the studied trait, as well as their high stability and homozygosity. Korubin – Aleksoska and col. (2018), examined ten genotypes of oriental tobaccos, including three varieties and seven newly created lines, for the height of the stalk without inflorescence and the number of leaves per stalk, in order to evaluate the variability and stability of the variants and to designate the most superior ones in the selected assortment, and found that the top three lines have a high degree of homogeneity. Vitanova and Dyulgorsk (2018), studied eight genotypes of oriental tobacco ecotype Nevrokop for height of plants and number of leaves, during the three year period. All new lines outperformed the standard variety Nevrokop 1146 in the studied traits. Krumovgrad 90 variety had the highest number of leaves, and the lowest Line 1. The newly-selected lines with the highest value are Line 3 and Line 2, which can successfully be included in future breeding programs. Korubin – Aleksoska and Dojcinov (2019), studied five parental varieties, four of which were oriental in the role of mother and one flue-cured variety in the role of father, as well as their four F1 crosses for the mode of inheritance of the trait, and discovered intermediation and partial dominance, without the occurrence of heterosis, which is an indicator of good successive selection of individuals in subsequent generations and rapid fixation and stabilization of the trait. Kinay and col. (2020), investigated the effect of heterosis on yield in oriental tobaccos, with special accent on those grown in the Black Sea region of Turkey. The two-year research included a hemidiallel of seven genotypes (Xanthi-2A, Nail, Gümüşhacıköy, Taşova, Katerini, Canik, Erbaa) and 21 F1 hybrids, in an experiment set up in two locations (Erbaa and Bafra). The best yield and quality were shown by Xanthi-2A x Katerini and Nail x Katerini, grown in Erbaa, and Nail x Katerini and Katerini x Erbaa, grown in Bafra. Kurt and col. (2021), examined the characteristics of 21 lines and four standard varieties, in an experiment set up under different environmental conditions. (in Bafra district of Samsun Province, with most tobacco production in Mid-Black Sea Region, and Evciler, Karayaka and Gümüşhacıköy where the Basma type oriental tobaccos are produced, in order to select the most stable lines – candidates for promising varieties. The stability of the genotypes was determined by regression coefficient (bi), regression constant (a), determination coefficient ( $r^2$ ), coefficient of variation (CV) and deviation from regression parameters ( $S^2d$ ), using the leaf yield, quality grade index, nicotine and sugar content values. The ERB-6, ERB-7, ERB-11, ERB-13, ERB-16, ERB-18, ERB-21 and ERB-30 were the most stable lines from Basma tobacco type. Malinova, S. (2021), studied two new lines of oriental tobacco and three varieties of high-quality tobacco ecotype Dupnica (Rila 82, Dupnica 160 and Rila 544 - standard), in the field of the Tobacco Experimental Station - Rila, at the Institute of Tobacco and Tobacco Products - Markovo, for the height and number of leaves of the plants, length and width of 14-leaf, yield and quality of dry tobacco, as well as for the chemical composition (content of nicotine, soluble carbohydrates and total nitrogen). The mathematical evaluation of the morphological and economic characteristics was performed by analysis of variance. The data show that lines 505 and 506 have significantly higher yield and quality compared to the control variety. Aleksoski and col. (2023), performed three-year studies for number of leaves per stalk and the length, width and area of the leaves from the middle part of the stalk – traits directly related to the yield in the offspring of the first generation, in four mother parent tobacco varieties of different types (three of the Prilep type and one of the Basmak type), one pollen donor parent Burley B-1-91, and their four F1 hybrids. The hybrids MS 8/1 x B-1/91 and P 18-50/4 x B-1/91 represent very interesting material for future tobacco breeding activities. Aleksoski and col. (2023), studied three oriental varieties (two of the type Prilep and one of the type Yaka), and 7 newly created genotypes, of which four are of the type Yaka and three of the type Prilep. The newly genotypes of the Prilep type have significantly longer leaves than the two control varieties. The highest yielding among the variants from the type Prilep is line L7. Lines L1, L3 and L4 have a significantly higher yield than standard variety type Yaka. Spasova-Apostolova and col. (2023), in a three-year experiment set up in the village of Markovo, investigated the most important quantitative traits in four tobacco genotypes of the Krumovgrad ecotype - the most preferred by commercial companies in Bulgaria and found that in terms of height, the lines belong to the group of oriental tobaccos. All had a greater number of leaves than the control variety Krumovgrad 90, and Krumovgrad 72 is distinguished by the biggest number. Line 71 is distinguished by a greater length of the 14th and 21st leaves. Lines 71 and 73 had the highest average yield (kg/da), 10-15% higher than that of the control variety. Lines 72 and 73 have the highest percentage of 1st class. Lines 71 and 73 had the best values of biometric and quality indicators. Spasova-Apostolova and col. (2024),

conducted studies on the typical parameters of Krumovgrad 58, which is the most sought-after tobacco variety on the tobacco market by commercial companies in Bulgaria, and concluded that the variety is stable and uniform, and that phenotypic differences are the result of different environmental conditions.

Our aim is, by presenting the obtained two-year results on quantitative characteristics, to provide useful information for the selection of oriental tobaccos, as well as to introduce, primarily foreign tobacco buyers to the varieties of the Yaka type, which are characterized by a particularly pleasant aroma.

## II. MATERIALS AND METHODS

Nine varieties of the Yaka type: YK 7-4/2 (Fig.1.), YK-23 (Fig.2.), YK-48 (Fig.3.), JK-87 (Fig.4.), YK-68 (Fig.5.), YK 10-7/1 (Fig.6.), YK-261 (Fig.7.), YK-141 (Fig.8.) and YV 125/3 (Fig.9.), and one variety of the Prilep type P-66-9/7 (Fig.10.), were taken as working material and their quantitative characteristics were analyzed: plant height with inflorescence, number of leaves per plant, dimensions of the leaves of the middle belt of the plant and dry leaf yield per plant. As a control, for comparison, we took the Yaka type variety YK 125/3. In recent years in the Republic of North Macedonia, the most common variety is P-66-9/7, so we placed it in the same experiment as a second control variant. The experiment was set up in 2022 and 2023, at the Experimental Field at the Scientific Institute of Tobacco - Prilep, in a randomized block design with four replications. Each variety was sown on 1 m<sup>2</sup>, using 0.3 g of seeds for each variant separately. During the vegetation period, usual agrotechnical and protective activities were applied. The distance was 45 cm row to row and 15 cm plant to plant in the row, and each variety was placed in 4 rows in one replication, i.e. a total of 16 rows in the experiment.

The experiment was irrigated twice, using a "drop by drop" system. Measurements were made during budding and flowering of tobacco. 10 plants per replicate or 40 plants of each variety were measured. Harvesting was done with 6 harvests, and dry tobacco measurements were made during material manipulation (dry leaf mass was divided by the number of stalks from which tobacco was harvested). The obtained measurement results were statistically processed.

## III. RESULTS AND DISCUSSION

Today, in the R.N. Macedonia, varieties of the oriental type Yaka are produced on very small areas. The Department of Genetics, Selection and Seed Control at the Scientific Institute of Tobacco - Prilep is responsible for their maintenance. These varieties are distinguished by a particularly pleasant aroma. The wishes and needs of tobacco buyers are variable, so breeders should be ready at any time to offer seed material in accordance with current trends.

In our work, we popularize original data on the morphological characteristics of varieties of the specified type - property of SIT-P, which we believe will be useful for buyers of oriental tobacco in the republic.

### - Height of plants with inflorescence

The greatest height among the genotypes examined is YK-261 (145 cm – 2022; 140 cm – 2023), followed by YK-68 (140 cm – 2022; 135 cm – 2023). The lowest among the Yaka-type varieties are YK-87 (100 cm – 2022; 98 cm – 2023) and YK-48 (102 cm – 2022; 100 cm – 2023). The P-66-9/7 variety, which belongs to the Prilep type, is distinguished by the lowest height (71 cm – 2022; 70.5 cm – 2023). In terms of this characteristic, all varieties belong to the listed tobacco types. The standard deviation ranges from ± 2.4 cm in P-66-9/7 to ± 6.9 cm in YK-87. The coefficient of variability - CV ranges from 2.3% in YK 7-4/2 (2022) and YK-68 (2023), to 6.8 in YK-87. In all varieties, the CV is lower than 10%, which is a sign of uniformity in the height of their populations.

### - Number of leaves per plant

The number of leaves per plant is the most studied morphological trait, included in all breeding programs, because it is directly related to the yield.

Among the varieties of the Yaka type, the highest number of leaves was observed in YK 141 (57 – 2022, 55 - 2023) and YK 10-7/1 (53 – 2022, 52 - 2023). The variety of the Prilep type P-66-9/7 (55 -2022, 56 - 2023) had approximately the same number of leaves. The variety YK-261 (27 – 2022, 26 - 2023) has the fewest leaves. The standard deviation ranges from ±1.2 cm – 2023 (YK-68) to ±2.9 cm – 2023 (YK-48). CV ranges from 2.6% - 2023 (P-66-9/7) to 7.3% - 2023 (YK-48). In all varieties, CV is lower than 10%, which indicates that the trait is uniform.

**- Dimensions of the leaves from the middle belt per plant**

The longest leaf length in the middle belt of the plant has YK 261 (29.5 cm – 2022, 29.2 cm - 2023). The shortest length has YK 10-7/1 (19.5 cm – 2022, 18.3 cm – 2023).

A longest length of the leaves from the middle belt of the plant has YK-261 (29.5 cm – 2022, 29.2 cm - 2023). The shortest length has YK 10-7/1 (19.5 cm – 2022, 18.3 cm – 2023).

The biggest leaf area was recorded in YK-261 (270 cm<sup>2</sup> – 2022, 263.4 cm<sup>2</sup> - 2023), and the smallest in YK 10-7/1 (148.6 cm<sup>2</sup> – 2022, 133.8 cm<sup>2</sup> - 2023). The leaf area from the middle belt in P-66-9/7 was 151.1 cm<sup>2</sup> in 2022 and 131.7 cm<sup>2</sup> in 2023. The standard deviation ranges from ±4.9 cm<sup>2</sup> (YK 10-7/1) to ±20.9 cm<sup>2</sup> (YK 7-4/2), and the coefficient of variability from 3.3% (YK 10-7/1) to 12.9% (P-66-9/7). CV in all varieties is lower or close to 10%, which is a sign of the stability of the trait.

Table 1 shows the values for the height of the plant with inflorescence, the number of leaves per stalk, as well as the dimensions (length, width and area) of the leaves from the middle belt of the plant.

**- Yield of dry leaf mass per plant**

The highest dry leaf yield per plant among the genotypes tested is YK-87 (22 g in 2022; 21.9 g in 2023). Second ranked are YK-261 (20.9 g in 2022; 20.5 g in 2023). and YK-68 (140 cm – 2022; 135 cm – 2023). Third-ranked are P-66-9/7 (19.9 g in 2022; 20.1 g in 2023), YK 10-7/1 (19.8 g in 2022; 19.7 g in 2023) and YK-141 (19.4 g in 2022 and 18.8 g in 2023). The lowest yield among the tested varieties is YK 7-4/2 (11.7 g in 2022; 11.1 g in 2023).

From the Analysis of Variance in 2022, it can be seen that, compared to the control variety YV 125/3, the varieties YK-87, YK-261, YK 10-7/1 and YK-141 have a higher yield with a significance of 0.01.

The yield value of P-66-9/7 is highly significant, compared to the control variety YV 125/3.

Statistical analysis showed the same results in 2023 (with the exception of YK-141 which, compared to the YV 125/3, gave a significantly higher yield, with a significance of 0.05).

The value for the yield of P-66-9/7 is significantly higher, compared to the YV 125/3.

If the yield of the control variety P-66-9/7 is compared with the yield of the Yaka type varieties, only the YK-87 showed a significance of 0.05 in 2022. This is one of the reasons for the current dominance of P-66-9/7 in tobacco production in the republic.

The values for dry leaf mass yield per plant are shown in Table 1.

**Table 1. Quantitative characteristics of varieties of the type Yaka (2022, 2023)**

Varieties	Height of plants with inflorescence			Number of leaves per plant			Dimensions of the leaves from the middle belt per plant					Yield of dry leaf mass per plant (g)
	$\bar{x}$ (cm)	$\sigma$ (±)	CV (%)	$\bar{x}$	$\sigma$ (±)	CV (%)	Length (cm)	Width (cm)	Area (cm <sup>2</sup> )			
							$\bar{x}$	$\bar{x}$	$\bar{x}$	$\sigma$ (±)	CV (%)	
2022												
1. YK 7-4/2	110	2.6	2.3	36	1.6	4.4	24.2	11.0	169.3	15.2	9.0	11.7
2. YK-23	105	4.5	4.3	39	1.7	4.3	23.0	12.0	175.4	11.7	6.7	14.6
3. YK-48	102	3.8	3.7	41	1.8	4.5	22.5	11.3	161.5	10.2	6.3	15.9
4. YK-87	100	6.9	6.8	40	2.1	5.4	25.7	13.6	222.1	12.5	5.6	22.0 ***
5. YK-68	140	5.0	3.6	33	1.6	4.9	24.3	11.7	180.5	7.3	4.0	17.3
6. YK 10-7/1	120	4.5	3.7	53	2.2	4.2	19.5	12.0	148.6	4.9	3.3	19.8 **
7. YK-261	145	3.7	2.6	27	1.9	7.0	29.5	14.4	270.0	16.6	6.2	20.9 **
8. YK-141	133	4.0	3.0	57	1.9	3.3	23.0	12.8	197.6	11.9	6.0	19.4 **
9. YV125/3Ø	119	3.7	3.1	40	2.0	5.1	22.0	11.2	156.6	10.9	7.0	16.7
10. P-66-9/7Ø	71	2.4	3.4	55	2.3	4.1	20.5	11.9	155.1	13.5	8.7	19.9 **
											LSD <sub>0.05</sub>	= 1.39
											0.01	= 2.50
2023												
1. YK 7-4/2	105	3.9	3.7	36	1.5	4.1	25.0	10.7	170.3	20.9	12.3	11.1
2. YK-23	103	4.6	4.4	38	1.7	4.6	22.0	12.0	167.6	11.5	6.9	14.7
3. YK-48	100	5.5	5.5	40	2.9	7.3	22.0	11.7	163.6	12.6	7.7	15.5
4. YK-87	98	4.6	4.7	38	1.8	4.7	26.6	13.8	233.3	15.0	6.4	21.9 **
5. YK-68	135	3.2	2.3	34	1.2	3.5	23.0	11.4	166.6	13.6	8.2	17.5
6. YK 10-7/1	115	3.9	3.4	52	1.7	3.3	18.3	11.2	133.8	12.4	9.3	19.7 **
7. YK-261	140	3.9	2.8	26	1.7	6.7	29.2	14.2	263.4	14.3	5.4	20.5 **
8. YK-141	130	5.9	4.5	55	2.0	3.6	23.5	12.9	192.7	13.6	7.1	18.8 *

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9. YV125/3Ø	118	3.3	2.8	41	2.0	4.9	21.4	10.7	145.6	13.8	9.5	17.2
10. P-66-9/7 Ø	70.5	2.7	3.8	56	1.5	2.6	19.0	10.9	131.7	16.9	12.9	20.1 *
											LSD <sub>0.05</sub>	= 1.34
											<sub>0.01</sub>	= 2.42



Fig. 1. YK 7-4/2



Fig. 2. YK-23



Fig. 3. YK-48



Fig. 4. YK-87



Fig. 5. YK-68



Fig. 6. YK 10-7/1



Fig. 7. YK-261



Fig. 8. YK-141



Fig. 9. YV 125/3 Ø



Fig. 10. P-66-9/7 Ø

#### IV. CONCLUSIONS

According to the data obtained, we can come to the following conclusions:

- The complete values for the quantitative characteristics indicate that the studied varieties belong to the Yaka type assortment.
- The statistical analysis, i.e. the percentage values for the coefficient of variability, are a sign of stability and uniformity of the studied varieties.
- The Yaka type varieties do not have a significantly higher yield than the Prilep type variety P-66-9/7 (with the exception of YK-87, which in 2022 gave a yield higher than that of P-66-9/7 with a significance of 5%).
- YK-87, YK-261, YK 10-7/1 and YK-141 give approximately the same yield as that of P-66-9/7, and significantly higher than the control variety YV 125/3 with a significance of 1%. The seeds of these varieties can be offered to buyers of oriental tobaccos, in accordance with their wishes and needs.

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