

## DETERMINATION OF FATTY ACID COMPOSITION OF SEED OF ORIENTAL TOBACCO

Stefka Kirkova<sup>1</sup> Marija Srbinoska<sup>2</sup> Silvia Ivanova<sup>3</sup>  
Anka Georgieva<sup>1</sup>

<sup>1</sup>Tobacco and Tobacco Products Institute –Markovo, Plovdiv, Republic of Bulgaria

<sup>2</sup>Scientific Tobacco Institute-Prilep, Republic of Macedonia

<sup>3</sup>Institute of cryobiology and food technology, Sofia, Republic of Bulgaria

### ABSTRACT

The tobacco is grown in many countries in the world and there are areas where the growing tobacco is only economically viable. Fermented tobacco leaf is a commercial product and it is used in the production of cigarettes in the tobacco processing industries. Only a small amount of best quality seeds are collected from fields for next year production, most of them are a by-product of tobacco leaves production.

In our previous studies we found that the seeds of the three tobacco types cultivated in the Balkans, show potential as a nutrient product. In the present study the seeds from oriental tobacco were evaluated as a potential as renewable source of oil.

The aim of the study is revealing the fatty acid composition of seeds of oriental tobacco. For qualitative and quantitative determination of fatty acids in oil from seeds, a GC/FID procedure was performed. The results show that the tobacco seed oil with its unique fatty acid composition may be regarded as special oil suitable for consumption after refining.

**Key words:** oriental tobacco, seed oil, fatty acid composition, alternative use

### ОПРЕДЕЛУВАЊЕ НА СОСТАВОТ НА МАСНИТЕ КИСЕЛИНИ ВО СЕМЕ ОД ОРИЕНТАЛСКИ ТУТУН

Тутунот се одгледува во многу земји во светот, а постојат области каде одгледување на тутун е единствено економски оправдано. Ферментираниот тутун е комерцијален производ кој се користи во производството на цигари во индустријата за преработка на тутун. Само мала количина на семе со најдобар квалитет се собира од полињата за следната производна година, повеќето од семето е нус-производ на производство на тутунски лист.

Во нашите претходни студии, утврдивме дека семето од три типа на тутун кои се одгледуваат на Баканот, покажуваат потенцијал како хранителен материјал. Во ова испитување беше земено семе од ориенталски тутун и беше евалуиран неговиот потенцијал како обновлив извор на масло.

Целта на испитувањето е да се одреди составот на масните киселини во маслото од семе на ориенталски тутун. За квалитативно и квантитативно определување на масни киселини во маслото од семе, беше изведена GC постапка / FID. Резултатите покажуваат дека маслото од семето има состав на масни киселини кој може да се смета погодни за употреба по рафинирањето.

**Клучни зборови:** ориенталски тутун, масло од семе, маснокиселински состав, алтернативна употреба

## INTRODUCTION

Tobacco is an important industrial crop valued for its leaves. After curing, the leaves are used in manufacturing of different tobacco and tobacco related products. The tobacco industry comprises many companies engaged in the growth, primary tobacco processing, trade, marketing, and distribution of tobacco and tobacco-related products. The international tobacco market is a global, mature, open and cyclical sector. Global because in more than 124 countries in the world is grown different types of tobacco. Mature because growth of production is slow mainly due to strong restrictions WHO anti-smoking campaign. Open because one third of the tobacco produced in the world is exported from the country of origin. And last but not least cyclical due to rapidly changing supply-demand balance and price fluctuations.

A change in European legislation has significantly helped in this regard. Since most subsidized crop, tobacco has become the most neglected. World Health Organization (WHO) policies and measures affected production all types of tobacco, including an Oriental (Health literacy, 1997). The change in the taste of consumers has led to a further reduction share of oriental tobacco in blends. It is known that there are areas where the cultivation of oriental tobacco is the only possible agricultural crop.

Tobacco is excellent source of the phytochemicals, edible proteins, seed oil and organic acids having pharmaceutical and industrial uses. There were reports of studies on its usefulness in pharmaceutical practice. Researchers from the University of South Florida have found successful applicability in degenerative brain diseases, which translates into a gradual reduction of intelligence and memory disorders. Have already been developed preparations that help to delay the symptoms of Alzheimer's disease (Health media-Framar, 2012).

Tobacco seed as a secondary product of

tobacco leaf production contains oil in a wide range of 36- 41% of the seed weight depending on a number of factors including the variety, growing conditions of tobacco and plantation area (Hutchens, 1999).

The focus of researchers has been on the oil content of the tobacco seed which does not contain the alkaloid nicotine (Popov, 1940). The main fatty acids in the oil of tobacco seeds are linoleic, oleic, palmitic and stearic acid (Ashraf-Khorassani at al., 2015).

The oil from the seeds of various types and varieties of tobacco contain various amounts of fatty acids. It has been found that the type of solvent used for extraction of oil does not affect the composition (Srbinoska at al., 2003; Srbinoska at al., 2003a). Ten years ago Prof. Zlatanov and colleagues examined tobacco seeds of "small-leaf" and "large leaf" tobacco regarding their lipid composition and more accurate determination of phospholipid, sterol and tocopherol fraction as biologically active substances in the oil (Zlatanov at al., 2007).

There are studies on their use in animal feed because of its biological value (Rossi et al., 2007). There has been even attempts recovered oil from tobacco seeds to be used in food supplements (Zdremtan and Zdremtan, 2006). There were no reports of research on tobacco seeds as food for the human consumption. In our previous studies we found that the three groups of varieties of tobacco are produced in the Balkans. Their seeds possess superior content of polyunsaturated fatty acids close to the content in poppy and sesame seeds (Kirkova at al., 2015, Kirkova at al., 2016).

However, since the content of particular fatty acids in the seed may vary considerably depending on soil conditions, climate and genetic factors, it would be of interest to analyze seed oil from the oriental tobacco type, which are predominantly cultivated in Balkans. In order to establish the potential of the oriental tobacco seed oil as edible oil the

qualitative and quantitative analysis of fatty

acids in oil is research subjects of this study.

## MATERIALS AND METHODS

It has been studied two harvests tobacco seeds of the same variety oriental tobacco under the same agricultural practice and growing conditions in the Experimental field of Institute of tobacco and tobacco products Markovo, Plovdiv. For the extraction of tobacco seed oil Soxhlet procedure was used (plant material to solvent ratio 1:10 w/v), extraction time 8 h and *n*-hexane as solvent) (Stanisavljevic et al., 2007).

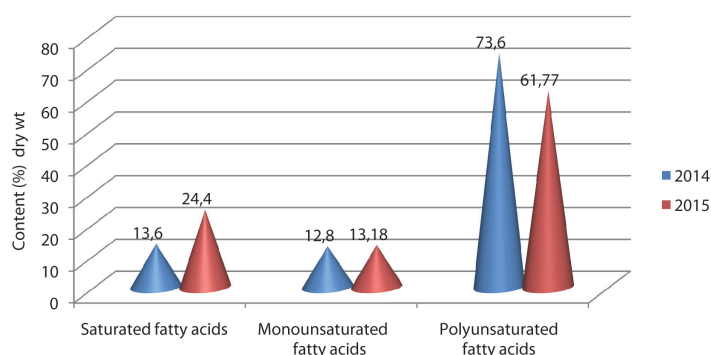
The fatty acid methyl esters (FAMES) were

prepared by boron trifluoride (BF<sub>3</sub>) method. The FAMES were then analysed using a gas chromatography (Varian Star 3400 CX) coupled with a FID detector and with a fused silica capillary column-DB-23 (Agilente Technologies, USA) (60 m x 0.25 mm x 0.25 mm). Identification of individual fatty acid methyl ester was achieved by comparison with reference standards. The results are given as the dry weight percentage of total fatty acids.

## RESULTS AND DISCUSSION

Results for fatty acid composition of the studied tobacco seeds of oriental tobacco

Regarding to the fatty acid composition by groups varies throughout the two years,



**Fig.1. Fatty acid composition of seeds of oriental tobacco, crop 2014 – 2015 (% dry wt)**

are presented in Figure 1.

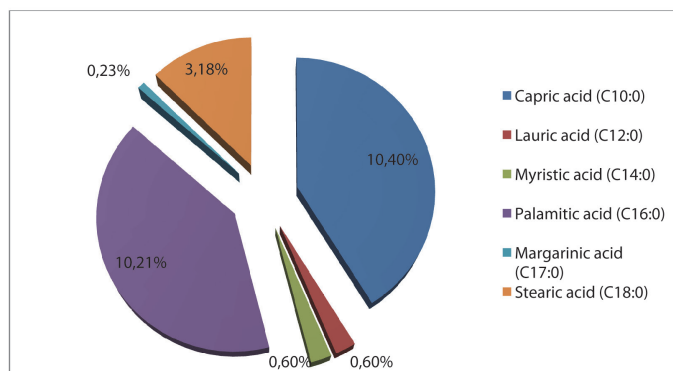
The content of fatty acids as well as the ratio between unsaturated and saturated fatty acids is important parameter for determination of nutritional value of certain oil. The tobacco seed oil does is a mixture of saturated fatty acids (SFAs) and unsaturated fatty acids (UFAs). The group of unsaturated fatty acids includes monounsaturated fatty acids (MUFAs) and polyunsaturated fatty acids (PUFAs).

From the results it appears that the predominant fatty acids present in oil are polyunsaturated fatty acids (PUFAs) with range of 61.77 % to 73.66% on dry weight (Fig.1).

although variety is the same and tobacco is grown in relatively close agricultural and growing conditions. Content of saturated fatty acids (SFAs) in 2015 have increase compared to polyunsaturated fatty acids (PUFAs). The amounts of monounsaturated fatty acids (MUFAs) are similar (Fig.1).

The results for individual saturated, monounsaturated and polyunsaturated fatty acids contents are presented in Fig. №. 2, 3 and 4.

The results from this study, showed that the percentage of the SFAs ranged from 13.6 % to 90.5%  $\pm$  25.41% on dry weight, with the predominant presence of palmitic (C16:0)



**Fig. 2. Content of saturated fatty acids (SFAs) (% dry wt), crop2015**

and capric acid (C10:0) (Fig.2).

The fatty acid composition of tobacco seed oil revealed that the oil is rich in unsaturated fatty acids, having linoleic acid, oleic acid and palmitic acid as the most abundant unsaturated and saturated fatty acids respectively. This composition indicates the suitability of the oil as edible oil after refining and also shows that tobacco seed oils follow the usual pattern of seed-fat glyceride structure.

MUFAs refers to present of the major monounsaturated fatty acid in oil, which is oleic acid (C18:1). The content of the MUFAs ranged from 12.8 % to 13.18% on dry

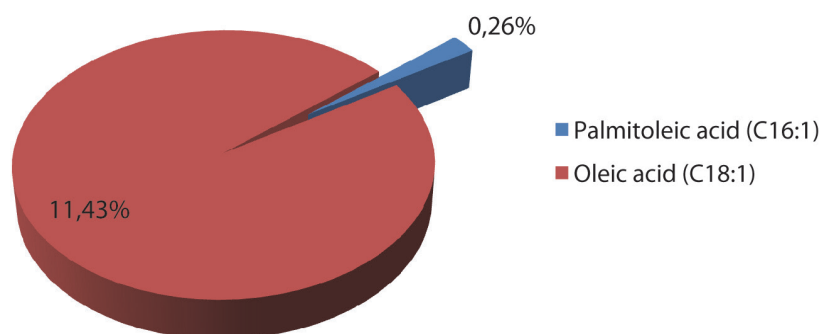
weight. Among the polyunsaturated fatty acids present in the oil in the largest amount represented linoleic acid 60.82 % dry weight.

From the fatty acid composition, it can be observed that the tobacco seed would be classified as a linoleic oil.  $\gamma$ -Linoleic acid contains ranges from non-detectable to 0.25 (% dry wt).

The data for linoleic are comparable with the data obtained for tobacco seed oils reported by Srbinoska et al.(2003a), and Stanisavljević et al. (2007).

*Fatty acid profile of seed oil obtained from Oriental tobacco is presented in Figure 5.*

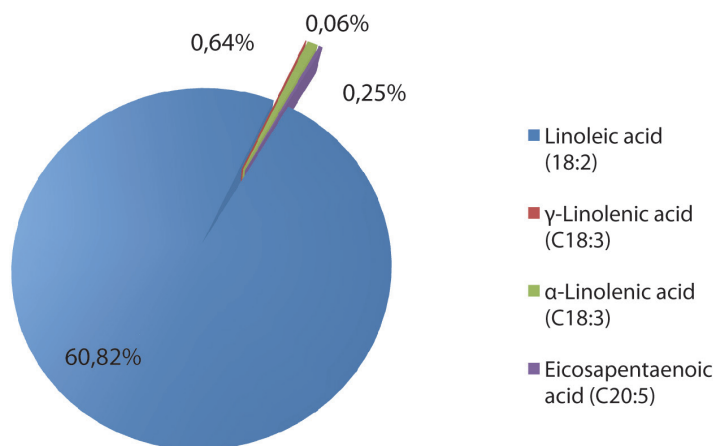
The unsaturated fatty acids are classified into



**Fig. 3. Content of monounsaturated fatty acids (MUFAs) (% dry wt), crop2015**

weight, with the predominant presence of oleic acid (C18:1)-11.3% and palmitoleic acid (C16:1)-0.26 % on dry weight (Fig.3). PUFAs refers to the linoleic acid (LA) (C18:2)60.82 % on dry weight, and lower proportion of alpha-linolenic acid (ALA) (C18:3)on 0.64 % dry weight (Fig.4).

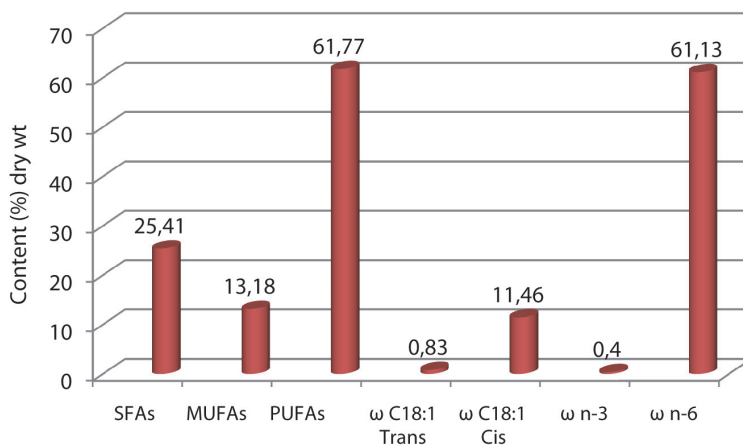
series known as omega, being  $\omega$ -9 considered nonessential for humans, and the  $\omega$ -3 and  $\omega$ -6 as essential fatty acids, because the latter ones cannot be synthesized by mammals; therefore, they are obtained from diet. *Omega-3 ( $\omega$ 3) and omega-6 ( $\omega$ 6) fatty acids are two different types of PUFAs. Both of*



**Fig. 4. Content of polyunsaturated fatty acids (PUFAs) (% dry wt), crop2015**

they are essential fatty acids required for maintaining healthy skin, regulating cholesterol metabolism, and as a precursor of prostaglandins, hormone-like substances that regulate many body processes. It was found that if the body synthesizes  $\omega 6$

absorbs  $\omega 6$  fatty acids from food. On their ratio have conflicting opinions. Widespread opinion about daily dose is that the ratio of  $\omega 3$ :  $\omega 6$  be from 1: 1 to 1: 4. Different studies recommend different daily doses, including 2: 3. In the case studied tobacco seed ratio



**Fig. 5. The fatty acid profile of seed oil from Oriental tobacco**

simultaneously takes place and synthesis of omega-3 fatty acids. Otherwise, the body

is highly unbalanced in favor of  $\omega 6$  fatty acids.

## CONCLUSIONS

The result showed that the oriental tobacco seed oil contain the highest percentage of long chain mono and polyunsaturated fatty acids: oleic acid (C18:1), linoleic acid (C18:2) and linolenic acid (C18:3). Ratio to monounsaturated fatty acids (MUFAs) to polyunsaturated fatty acids (PUFAs) governs the good stability of oil.

General nutrition quality of oriental tobacco seed oil free from nicotine is close to the safflower oil. The high percentage of unsaturated acids, mainly oleic and linoleic, which has been found comparable to grape seed oil, also suggests potential food use of tobacco seed oil. The quality of the oil would be better if the linoleic acid content

is lower.

The chemical characterisation of oriental tobacco seeds has been found important to look at alternative products of the crop i.e. oil and meal and find some uses of these products. The study is also useful for

preserving seed purity. Also, the obtained information will make a good contribution to determination of the genotypic and phenotypic variations of tobaccoform different growing regions.

## ITERATURE

1. Ashraf-Khorassani M., Coleman W., Dube M., Isaac G., Taylor L., 2015. Synthesis, Purification, and Quantification of Fatty Acid Ethyl Esters After trans-Esterification of Large Batches of Tobacco Seed Oil. *Beiträge zur Tabakforschung International/ Contributions to Tobacco Research*, 26(5):205-213, DOI: 10.1515/cttr-2015-0008
2. From the First to the Last Ash: The History, Economics & Hazards of Tobacco <http://healthliteracy.worlded.org/docs/tobacco> (10 September, 2016)
3. Health medium - Framar <http://media.framar.bg> (10 September, 2016)
4. Hutchens T.W (1999). Tobacco Seed in Tobacco Production, Chemistry and Technology, Davis D. L and Nielsen M. T.(edt) Blackwell Science. 66-69
5. Kirkova S., Katsarova S., Zlatanov M., 2015. Preliminary studies on the consumable properties of tobacco seeds, *Journal of Global Biosciences*, vol.4, 7, 2888-2892
6. Kirkova S., Srbinoska M., Ivanova S., Georgieva A., 2016. Investigation on fatty acid compositions of seeds by type tobacco Virginia, *Ecology and Health* 2016
7. Popov M., 1940. A comprehensive use of tobacco. *Tobacco review*, 29-30
8. Rossi L., Selmini G., Cheli F., Fusi E., Fogher C., 2007. Possibile Impiego di Pannello di Seme di Tobacco Nell Abimentazione del Suinetto, *Large Animal Review*, vol.13, 211-215
9. Srbinoska M., Filiposki K, Rafajlovska V.,2003. Fatty Acid Composition of Tobacco Seed Oil and its Potential as Source of Linoleic Acid, 164-167 <http://semenarska.rs/UNS-PSU/radovi/2/32%20Fatty%20Acid%20164-167.pdf>
10. Srbinoska M., Gercar N., Simonovska B., Najdenova V., Rafajlovska V., 2003. Fatty acids content in oil of the seed of tobacco variety P-23. *Tutun/Tobacco*. Vol. 53. No.7-8, 225-233
11. Stanisavljević I., Lakičević S., Veličković D., Veljković V., 2007. The extraction of oil from tobacco (*Nicotiana tabacum* L.) seeds. *Chemical Industry & Chemical Engineering Quarterly*.13 (1) 41-50.
12. Zdremtan, M., Zdremtan D., 2006. The Tobacco Oil A and Its Qualities. *Buletin USAMV-CN*, 63:1-4, ISSN 1454-2382
13. Zlatanov M., Angelova M., Antova G., 2007. Lipid Composition of Tobacco Seeds. *Journal of Agricultural Science*.13:539-544