

SOWING DATE – THE FACTOR OF YIELD AND QUALITY OF
FENUGREEK SEED (*Trigonella foenum graecum L*)

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Abstract: Results of a two-year investigation (2005 and 2006) for the yield and quality of fenugreek seed (*Trigonella foenum graecum L*) obtained on the location in South Banat (around Pančevo) on marsh dark soil are presented in the paper. Fenugreek seed used in this investigation was produced in the collection of the Institute of Medicinal Plant Research "Dr Josif Pančić" in Pančevo. The effect of sowing date on yield (kg/ha) and quality of fenugreek seed (germination energy and total germination) were investigated. Sowing was carried out on seven dates, 10 days between dates of each sowing.

Yield of fenugreek seed sowed on different dates differed in both years. Sowing carried out in the first two weeks in April resulted in considerably higher yield compared to sowing at the end of April and during May. The highest yield was produced in the second sowing date from April 10, then in the first (April 1) and the third sowing period (April 20). The lowest yield of fenugreek seed was recorded in sowing carried out at the end of May.

Yield of fenugreek seed wasn't significantly different in study years.

Earlier dates of sowing resulted in seed of better quality (better germination energy and total germination). In the second sowing date fenugreek seed obtained was of best germination energy and total germination (approx. 99%). Later sowing dates gave seed of lower quality. So, sowing carried out at the end of May resulted in seed with the lowest value of germination energy and total germination (approx. 91%).

Key words: fenugreek, sowing date, yield, quality.

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Introduction

Fenugreek (*Trigonella foenum graecum L.*) is annual herbaceous plant from the family of *Fabaceae*. It originates from the Mediterranean region, and today it is grown worldwide mostly in India, Egypt, China and America.

In ancient times it was used in different rituals. Today it is mostly used as livestock feed (Tucakov, J., 1996). In America, it is grown as a plant for green manure (Martin, J. H., and Leonard, W. H., 1967); also, it is frequently used in veterinary and human medicine.

Increasing demand for fenugreek on our market influenced the growing of this plant in plantation conditions, since this plant is not present in wild form in this region. Numerous researches were carried with objective to realize increase of yield and improvement of the quality of fenugreek seed (Dražić, S., Jevdjović, R., 1997; Jevdjović, R., and associates 2003; Jevdjović, R., 2006), as well as plant protection (Ivanović, M. and associates, 2001; Ivanović, M. and associates, 2002).

Fenugreek seed contains 26% of protein matter, approx. 30% mucus, 12% of oil, 0.35% of ether oil and many other active substances. Protein matter contains up to 55% of nucleo-proteids, 25% of globulin, 20% of albumin, whereas fatty matter contains mainly glycerides of unsaturated fatty acids.

The aim of the present paper was to show if and to what extent the date of sowing affects yield and quality of fenugreek seed.

Material and Methods

In this research seed material of the plant species fenugreek (*Trigonella foenum graecum L.*) was used. «Domestic» cultivar was produced and multiplied at the Institute of Medicinal Plant Research "Dr Josif Pančić" from Belgrade.

Research was carried out in the region of South Banat (around Pančevo) on marsh dark soil type in two vegetation seasons, that is, during two years, 2005 and 2006.

Trials were set in four repetitions with the size of the main plot of 40 m². Sowing was carried out on seven dates. First date was April 1, and the last May 30; in other words, every ten days. Sowing norm was 18 kg/ha and sowing depth was 4cm. Sowing was carried out in continuous rows with the distance of 50 cm between rows.

During vegetation usual measures were carried out, and harvesting was carried out in full maturation stage. It should be pointed out that harvest in the second study year (2006) was late, on average, by three days in all variants because maturation was late. The reason is probably slightly higher amount of precipitation in the second year. After harvesting, seed was additionally dried until 10% of moisture and subsequently yield was determined and samples taken

for investigation of the quality. The following quality parameters were investigated: germination energy (GE) and total germination (TG). Investigation was carried out in four repetitions for all variants with hundred seeds per each repetition. Testing was carried out in seed laboratory of the Institute of Medicinal Plant Research "Dr Josif Pančić" in Pančevo, in Petri dishes, on filter paper, on germination location at temperature of constant 20°C. Counting and evaluation of results was carried out in accordance with ISTA standards (1999).

Mathematical-statistical procedure was used to process the obtained experimental data. Testing of the significance of determined differences between calculated mean values of investigated factors (fertilization variant and year) was done using the model of variance analysis. All evaluations of significance were carried out based on F-test and LSD-test for threshold of significance of 5% and 1% (Maletić, R., 2005).

Results and Discussion

Average values of obtained yield of fenugreek seed depending on the sowing date, from four repetitions, for both years are presented in Table 1.

Table 1. Mean yield of fenugreek seed obtained on different sowing dates (kg/ha)

Sowing date	Year		\bar{x}	Cv (%)
	2005	2006		
I (01.04.)	2484.00 ^a	2610.25 ^a	2547.125	3.58
II (10.04.)	2838.75 ^b	2917.50 ^b	2878.125	5.11
III (20.04.)	2059.75 ^c	2190.75 ^c	2125.250	6.15
IV (30.04.)	986.50 ^d	1076.50 ^d	1031.500	6.25
V (10.05.)	842.75 ^e	928.75 ^e	885.750	5.88
VI (20.05.)	669.50 ^f	711.25 ^f	690.375	4.64
VII (30.05.)	391.50 ^g	412.75 ^g	402.125	5.43
\bar{x}	1467.536	1549.679		
Iv	2604	2661		
Cv (%)	62.67	61.10		
Test	Sowing date	Year		
F-value	983.9422	0.1084		
p-level	0.001	0.7432		
LSD	0.05	123.3306	1293.5814	
	0.01	162.3434	1702.7755	

*a-g- Different letters in one column indicate significant differences between terms of sowing in a single year at the level of 0.01%.

Sowing dates considerably determined the level of production of fenugreek seed. (tab. 1).

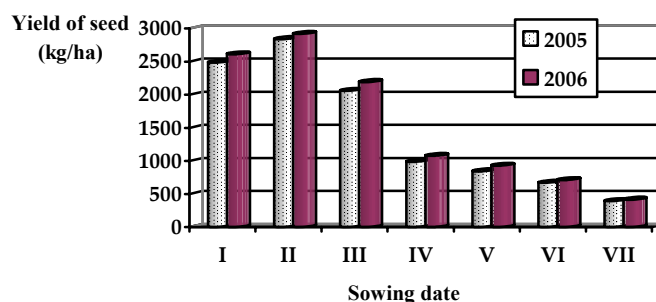
The highest yield of fenugreek seed in both years was realized on the first sowing dates, in the first two weeks of April. Sowing in the period from April 10 (second sowing date) resulted in the highest yield 2838.75 kg/ha in 2005, i.e. 2917.50 kg/ha in the year 2006. Slightly lower yield, but statistically considerably different ($p < 0.05$), was recorded on the first sowing date, from April 1 (2484 kg/ha, i.e. 2610.25 kg/ha per years). Also, sowing carried out on April 20 (third date) resulted in the yield of over 2000 kg/ha. Yields of fenugreek seed recorded for all other sowing dates from the end of April and during May were below 1000 kg/ha. The lowest yield, of only 400 kg/ha (in both experimental years), was measured for seed sown at the end of May (30.05.). Therefore, the amplitude of variations between minimum and maximum values of seed yield between sowing dates, per year, were considerably high and amounted to over 2600 kg/ha ($I_v = 2604$ kg/ha in 2005., i.e. $I_v = 2661$ kg/ha in 2006.).

Obtained results indicate statistically significant differences in average values of fenugreek seed yield between all sowing dates ($p < 0.01$), tab. 1.

In the second year, for all sowing dates, slightly higher yield of fenugreek seed was realized, which is probably the result of higher precipitation amount in 2006. However, measured differences in yields between years showed no statistical significance ($p > 0.05$), tab. 1.

Realized yields in this research are in accordance with certain previous researches (Jevdžović, R., et al, 2001; Glamočlija, Dj., et al., 2002), as well as other literature data (Stepanović, B., 1998).

Obtained results for average germination energy of fenugreek seed show considerable homogeneity of seed material for all sowing dates and in both investigation years ($C_v < 2\%$).



Graph. 1. - Yield of fenugreek seed obtained for different sowing dates (kg/ha)

Average values of germination energy for all sowing dates and both investigation years were from 91% to 99%. In the first sowing dates the value of

germination energy of seed was higher (over 96%), whereas sowing in May resulted in seed germination energy below 94%.

T a b. 2. - Quality indicators of fenugreek seed

Quality indicators	Year	Stat. indic.	Sowing date						
			I	II	III	IV	V	VI	VII
GE	2005	\bar{x}	96.75	98.00	97.00	95.25	95.00	93.25	91.00
		Sd	0.9574	0.8165	0.8165	1.2583	2.4495	1.7078	1.8257
		Cv (%)	0.99	0.83	0.84	1.32	2.58	1.83	2.01
	2006	\bar{x}	96.50	98.50	96.75	94.50	94.00	92.50	90.75
		Sd	1.2910	0.5774	1.2583	0.5774	1.4142	1.2910	0.9574
		Cv (%)	1.34	0.59	1.30	0.61	1.50	1.40	1.05
\bar{x}		96.625	98.250	96.875	94.875	94.500	92.875	90.875	
Cv (%)		1.10	0.72	1.02	1.04	2.04	1.52	1.49	
TG	2005	\bar{x}	98.25	99.50	98.00	96.50	96.25	94.75	93.50
		Sd	0.9574	0.5774	0.8165	1.2910	1.7078	1.2583	2.0817
		Cv (%)	0.97	0.58	0.83	1.34	1.77	1.33	2.23
	2006	\bar{x}	98.00	99.25	97.75	96.00	95.50	94.25	92.50
		Sd	0.8165	0.9574	0.5000	0.8165	1.2910	0.9574	1.2910
		Cv (%)	0.83	0.96	0.51	0.85	1.35	1.02	1.40
\bar{x}		98.125	99.375	97.875	96.250	95.875	94.500	93.000	
Cv (%)		0.85	0.75	0.65	1.08	1.52	1.13	1.82	
			GE-Germination energy		TG-Total germination				
			Sowing date	Year	Sowing date	Year			
F_{exp}			31.9012	0.3032	31.0484	0.6424			
p-level			0.0000001	0.5842	0.0000001	0.4264			
	0.05		1.7584	3.6998	1.5590	3.2350			
LSD									
	0.01		2.3146	4.8701	2.0521	4.2583			

Seed obtained on the second sowing date (10.04.) had the highest value of germination energy (approx. 98%), followed, with regard to the quality, by seed produced on the first and the third sowing date (>96.6%). Seed produced on the last sowing date (30.05.) had the lowest germination energy (approx. 91%) in both years.

Recorded data indicated no statistically significant difference in the energy of germination of seed on the first (01.04.) and the third (20.04.), as well as the fourth (30.04.) and the fifth (10.05.) sowing dates ($p > 0.05$). The energy of germination of seed on the first and the second, also the second and the third sowing dates statistically significant differs ($p < 0.05$). But germination energy of seed between other sowing dates showed statistically very significant differences ($p < 0.01$), tab. 2.

Recorded differences in germination energy of seed depending on the study year for the same sowing date weren't statistically significant ($F_{\text{exp}}=0.3032$ in relation to F from tables 5% \rightarrow 4.06).

Total germination of fenugreek seed showed the same absolute and relative variability with previous indicator of germination, germination energy (tab. 2). Values of this seed quality indicator in the second year were slightly lower (from 92.5% to 99.25%), compared to the same, in the previous year 2005 (93.5% to 99.5%). However, achieved results with respect to total germination of seed showed no statistically significant differences between years ($p>0.05$), tab. 2.

Seed obtained on earlier sowing dates (first two weeks of April) had considerably better total germination compared to seed obtained on other sowing dates. Values of total germination for first sowing dates in both years were over 98%, and for last sowing dates below 95%. In accordance with these researches obtained differences of average values of indicators of total germination were statistically very significant ($p<0.01$). Only the difference between total germination of seed obtained on first (01.04.) and third (20.04.), as well as fourth (30.04.) and fifth (10.05.) sowing dates wasn't exhibited ($p>0.05$).

Results of investigation of the quality of fenugreek seed are in accordance with those obtained in previous researches (Glamočlija, et al., 2002).

C o n c l u s i o n

Based on performed research and analysis of obtained results, the following can be concluded:

The period at the beginning of April (second sowing date) was best suited for sowing of fenugreek seed, since it provided the highest seed yield.

The second sowing date also resulted in seed of the best quality. Seed obtained from this sowing date had the best germination energy as well as total germination.

Sowing in May wasn't suitable for the production of fenugreek seed in regard to the yield as well as the quality of seed.

Based on obtained results, it can be concluded that production of fenugreek seed should be organized so as to carry out sowing at the beginning of April, before the 20th in this month, in order to achieve the highest yields and the best quality of seed.

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VREME SETVE - FAKTOR PRINOSA I KVALITETA SEMENA
PISKAVICE (*Trigonella foenum graecum L*)

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R e z i m e

U radu su prikazani rezultati dvogodišnjih istraživanja (2005. i 2006. god.) prinosa i kvaliteta semena piskavice (*Trigonella foenum graecum L*) dobijenog na lokalitetu regiona Južnog Banata (okolina Pančeva) na zemljištu tipa ritska crnica. Za istraživanje je korišćeno seme piskavice koje se umnožava u kolekciji Instituta za proučavanje lekovitog bilja "Dr Josif Pančić" u Pančevu. Proučavan je uticaj vremena setve na prinos (kg/ha) i kvalitet semena piskavice (energija klijanja i ukupno klijanje). Setva je obavljena u sedam rokova, sa razmakom od 10 dana između rokova.

Prinos semena piskavice se razlikovao po rokovima setve u obe eksperimentalne godine. Setva obavljena u prvoj polovini aprila meseca je dala znatno veći prinos u odnosu na setvu krajem aprila i tokom maja meseca. Najveći prinos je ostvaren u drugom terminu setve od 10.04, zatim prvom (01.04.) i trećem periodu setve (20.04.). Najmanji prinos semena je izmeren u setvi krajem maja meseca.

Prinos semena piskavice nije se značajno razlikovao između eksperimentalnih godina.

Raniji termini setve dali su seme boljeg kvaliteta (bolja energija klijanja i ukupno klijanje). Iz drugog termina setve dobijeno je seme piskavice najbolje energije klijanja i ukupne klijavosti (oko 99%). Sa kasnijom setvom kvalitet semena se znatno smanjuje. Tako je setva krajem maja meseca dala seme najniže vrednosti energije klijanja i ukupne klijavosti (oko 91%).

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