

## EFFECTS OF APPLICATION OF CERTAIN TYPES OF FERTILIZERS ON ANISE SEED YIELD AND QUALITY

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**Abstract:** The results of two-year research on the effect of application of certain types of fertilizers on yield and quality of anise seed are analyzed in this paper.

Application of fertilizer has significantly influenced the yield, so in both study years (2004, 2005) the highest yield was achieved in fertilization variant with Baktofil 80 l/ha.

Year as a factor (in this case probably higher precipitation in 2004 by 127 mm) has significantly influenced the yield of anise seed and in all fertilization variants (even in the variant without fertilization – control) seed yield was higher in 2004.

The situation in regard to the quality of seed (GE, TG) wasn't the same like with the yield, since the quality in all variants was better in the second study year (2005) when yield was lower. The best quality of seed was realized in the second investigation year in variant of fertilization, using organic fertilizer (ecological manure) 10 t/ha.

**Key words:** anise, Baktofil, Fertikare, organic fertilizer, yield, quality of seed.

### **I n t r o d u c t i o n**

Anise is annual herbaceous plant from the family of Apiaceae. It is characterized by shallow, spindle-shaped root of poor absorption capacity and upright stem of 30-60 cm height which is inclined to flattening.

As a spice and medicinal plant, anise has been used from ancient times. It was mentioned in the time of Dioscoridus and Plinius. Growing of anise in

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Europe was initiated by the order of Charles the Great. In our country, the growing of anise is increasing, since the demand for it is greater.

It is used as aromatic spice. In folklore medicine it is recommended as cure for blowing up, improved digestion, regulation of digestion, curing of asthma, easier coughing and as stimulator of secretion of gull and saliva (K o v a č e v i ć, 2002). Ether oils of anise have favourable effect on central nervous system and also its positive effect on sleeping is already well known (T u c a k o v, 1996).

The aim of our work was to show to what extent the application of certain types of fertilizers effect the yield and quality of anise seed.

### Material and Methods

In this research, the seed material of plant species *Pimpinella anisum L* was used. Cultivar NS-210, which is grown and propagated at the Medicinal Plant Research Institute "Dr Josif Pančić", Belgrade, was tested.

Research was carried out during two vegetation seasons, i.e. in two years 2004 and 2005. During vegetation in the year 2004 higher precipitation amount was registered, compared to the year 2005, by 127 mm.

Trials were set according to random block system on marsh black soil in the vicinity of Pančevo. The size of basic trial parcel was 15 m<sup>2</sup>. Four variants with four repetitions according to the same model for each study year were set. Variant I-fertilization with Baktofil 80 l/ha, variant II-Fertikare 250 kg/ha, variant III-organic fertilizer (ecological manure) 10,000 kg/ha and variant IV–no fertilization (control).

After maturation, seed was picked, processed and yield was measured, and from all other variants samples were taken for analysis of the seed quality. Investigation of the quality (germination energy – GE, total germination – TG and mass) was done in four repetitions with 100 seeds for each variant and each year. Testing was carried out in Petri dishes on filter paper and in germination premises at the temperature of constant 20<sup>0</sup>C. Counting and evaluation of results was carried out according to 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 of the following mathematical form:

$$y_{ij} = \mu + \alpha_i + \beta_j + (\alpha\beta)_{ij} + \varepsilon_{ijk} \quad (i=1,2,3,4; j=1,2; k=1,2,3,4)$$

All evaluations of significance were carried out based on F-test and LSD-test for threshold of significance of 5% and 1% (M a l e t i ć, 2005).

## Results and Discussion

Average values of obtained yield of anise seed under the influence of different fertilization variants, obtained from four repetitions in both experimental groups are presented in table 1.

The obtained results indicate high influence of investigated fertilization variants in production of anise seed (tab. 1). On average, the highest yield of seed was produced, in both experimental years, in fertilization variant with Baktofil (in the first year 887.5 kg/ha and 655.5 kg/ha in the second year). Slightly lower yield was registered in fertilization variant with organic fertilizer (820.50 kg/ha, i.e. 314.50 kg/ha), and significantly lower in fertilization variant with Fertikare (532.75, i.e. 427.50 kg/ha). The lowest yield was achieved on unfertilized soil (control) 397.5 kg/ha in the first, and 377 kg/ha in the second year of investigation. Therefore, registered differences in yield of anise seed obtained from soil lots fertilized with Baktofil and soils treated with other investigated fertilizer types are statistically highly significant, table 1 ( $P < 0.01$ ). All other differences in seed yield (II, III and IV fertilization variant) showed no statistical significance ( $P > 0.05$ ). The achieved yields are in accordance with literature data, Pavlović and Jevdović, 2002, as well as Štepanović, 1998.

Tab. 1. - Average yield of anise seed in different fertilization variants

Year	Stat. indic	Fertilizer type			
		Baktofil	Fertikare	Ecological manure	Control
2004	$\bar{x}$	887.50	532.75	820.50	397.50
	Sd	231.484	397.749	282.1270	49.0884
	Cv (%)	26.08	74.66	34.38	12.35
2005	$\bar{x}$	655.50	427.50	314.50	377.00
	Sd	87.1837	88.2478	111.7303	39.3446
	Cv (%)	13.30	20.64	35.53	10.44
	$\bar{x}$	771.5	480.125	567.50	387.25
	Sd	203.9629	272.5884	335.5826	42.6171

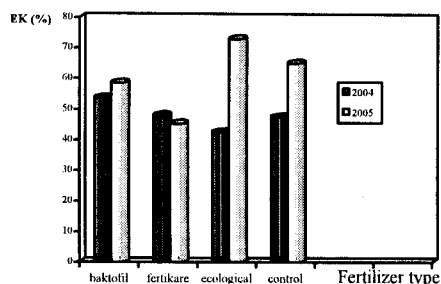
	Fertilizer types	Year	Interaction
F-vrednost	5.3284**	9.2330**	2.2250 <sup>NZ</sup>
p-level	0.00588	0.00566	0.1112

For difference in total yield of anise seed between experimental years (2004 and 2005), statistical significance ( $P < 0.01$ ) was established, whereas the interaction of investigated factors showed no significance, tab. 1.

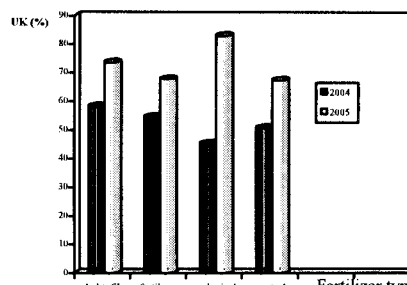
Germination energy of anise seed differed significantly between seeds obtained from soil treated with investigated fertilizers and years (graph. 1).

Seed samples obtained in the second study year (2005), in all investigated fertilization variants have exhibited better germination energy which was

statistically significantly different from the germination energy determined in the previous year, 2004 ( $P < 0.01$ ).



Graph 1. - Germination energy of anise seeds



Graph 2. - Total germination energy of anise seeds

Seed obtained from soil treated with fertilizer Fertikare had the lowest germination energy, which was statistically considerably different from germination energy determined for seed obtained from soils treated with other investigated fertilizer types (Baktofil, ecological manure and control).

Germination energy of seed obtained from soil treated with fertilizer Fertikare had similar value in both study years (48% and 45.25% respectively), whereas germination energy of anise seed obtained from soils treated with other fertilizer variants showed greater dispersion and absence of uniformity/equality in both study years.

Total germination of anise seed exhibited the same variability and regularity as the previous indicator, germination energy (graph. 2), which was expected. So, in regard to total germination of anise seed between experimental years statistically significant difference was established, tab. 2.

T a b. 2. - Indices of descriptive statistics of germination and mass of anise seeds

Fertilizer type	Indices	Germination energy		Total germination Year		Mass of 100 seeds (g)	
		2004	2005	2004	2005	2004	2005
Baktofil	$\bar{x}$	53.70	58.50	58.25	73.50	0.243	0.247
	Sd	121484	10.3440	13.6718	6.6081	0.0307	0.0229
	Cv (%)	22.62	17.68	23.47	8.99	12.65	9.27
Fertikare	$\bar{x}$	48.00	45.25	54.50	67.75	0.238	0.261
	Sd	6.3770	12.9711	5.0662	5.3151	0.0110	0.0168
	Cv (%)	13.28	28.66	9.30	7.84	4.62	6.43
Ecological manure	$\bar{x}$	42.50	73.00	45.25	83.00	0.214	0.262
	Sd	8.4262	5.4772	8.9954	2.7080	0.0183	0.0175
	Cv (%)	19.83	7.50	19.88	3.26	8.56	6.68
Control	$\bar{x}$	47.50	65.00	50.75	67.25	0.2205	0.254
	Sd	8.7369	4.3205	9.6739	4.0311	0.0123	0.0117
	Cv (%)	18.39	6.65	19.06	5.99	5.56	4.60

Seed produced on soil treated with ecological manure in the first year had the lowest total germination in the first study year (45.25%), and in the next year the highest (83%). Seed from locations treated with other investigated fertilizer types (Fertikare, Baktofil), as well as control variant, had similar values. Therefore, differences in total germination of anise seed obtained from lots fertilized with different fertilizer types weren't statistically significant ( $P>0.05$ ), tab. 3. However, interaction of investigated factors exhibited statistical significance which confirmed that investigated factors were mutually determined.

T a b. 3.- F-test and LSD-test values of the analyzed factors

Sources of variation	Germination energy			Total germination			Mass of 100 seeds (g)		
	F <sub>exp</sub>	LSD		F <sub>exp</sub>	LSD		F <sub>exp</sub>	LSD	
		0.05	0.01		0.05	0.01		0.05	0.01
Fertilizer type	2.520 <sup>NS</sup>	9.370	12.698	1.245 <sup>NS</sup>	8.015	10.862	0.827 <sup>NS</sup>	0.015	0.026
Year	15.163**	6.626	8.979	56.758**	5.668	7.681	16.772**	0.014	0.019
Interaction	5.189**	13.251	17.957	4.349*	11.335	15.361	1.981 <sup>NS</sup>	0.027	0.037

Mass of anise seed exhibited very significant statistical differences between years ( $P<0.01$ ), but not between applied fertilizer types (tab. 3). In the second year of investigations, seed mass was considerably higher compared to 2004 in all investigated fertilization variants. First fertilization variant (Baktofil) resulted in seed of equal mass in both years (approximately 0.243 g), whereas in the case of other variants variability was registered. However, achieved results indicate that there was no statistically significant difference in seed mass between investigated fertilization variants as well as the control ( $P>0.05$ ), tab. 3. Interaction of factors also had no statistical significance.

## C o n c l u s i o n

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

% Fertilization using in investigated fertilizer types considerably increased the yield of anise seed;

% Higher moisture/humidity during vegetation season along with fertilization considerably improved the yield;

% Quality of obtained seed was poorer in the year with higher precipitation regardless of the fertilizer type;

% Fertilization of anise crops with fertilizer Baktofil can be recommended as well as fertilization using of ecological manure with irrigation for higher yield of seed.

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## UTICAJ PRIMENE NEKIH TIPOVA DJUBRIVA NA PRINOS I KVALITET SEMENA ANISA

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### R e z i m e

U radu su analizirani rezultati dvogodišnjeg istraživanja uticaja primene nekoliko tipova đubriva na prinos i kvalitet semena anisa.

Primena đubriva značajno je uticala na prinos, te je u obe godine istraživanja (2004, 2005) najveći prinos ostvaren u varijanti đubrenja Baktofil-om 80 l/ha.

Godina kao faktor (u ovom slučaju verovatno veća količina padavina u 2004 godini za 127 mm) značajno je uticala na prinos semena anisa te je u svim varijantama (pa i u varijanti nedjubreno-kontrola) prinos semena bio veći u 2004 godini.

Kvalitet semena (EK, UK) nije pratio prinos, jer je kvalitet u svim varijantama bio bolji u drugoj godini istraživanja (2005 god) kada je prinos bio manji. Najbolji kvalitet semena ostvaren je u drugoj godini istraživanja u varijanti đubrenja organskim đubrivom (ekološki stajnjak) 10 t/ha.

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