

EFFECT OF PRE-WINTER SOWING ON EARLINESS AND YIELD OF SPINACH

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Abstract: The paper deals with the effect of pre-winter sowing on earliness and yield of spinach. Sowing was conducted late in the autumn (November-December), i.e. before harsh frosts. Spring sowing served as the control. It was established that pre-winter sowing significantly increased the earliness of spinach and decreased its yield. Due to favourable effect on earliness, pre-winter sowing should be applied in the production of this vegetable. Early spinach is a commodity which is highly requested on the market and is placed on the market at a high price.

Key words: pre-winter sowing, yield, earliness, spinach.

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

Spinach is a plant of cold areas. The optimum temperature of growth is 12-15°C. It is resistant to low temperatures and endures our winters successfully. It needs a lot of moisture during the entire vegetation period. High temperature and draught reduce its yield and deteriorate its quality. Spinach is a typical long-day plant, which should be kept in mind and the sowing should not be conducted late in the spring.

Pre-winter sowing is a sowing which is conducted immediately before frosts start. The crop should not sprout before the earl spring, otherwise the young shoots would freeze. This sowing is applied successfully with the species which have no specific needs for warmth. Sowing standard in the pre-winter sowing should be by around 30% greater in comparison with the spring sowing, since a part of seed and germs is usually ruined during the winter. In our climatic conditions the use of pre-winter sowing has not been studied sufficiently.

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Spinach is grown as an autumn and spring crop. It is sown at the end of August and in September or late in the autumn as a pre-winter crop and early in the spring. As a plant of cold areas it stands pre-winter sowing well. Then spinach is ripe for picking 3-4 weeks earlier than the spring sowing. Early spinach is a highly appreciated product which can be placed easily and at a high price.

Many authors have studied pre-winter sowing of spinach. These are foreign authors. Its earliness has been studied most frequently (Andrejev and Dimov, 1978; Fenel and Li, 1987; Pleasant, 2001), but some authors also studied its productivity (Aleksašin et al., 1984; Mešćerjakova, 1976). The obtained results mostly justify the use of pre-winter sowing in the production of spinach.

We have set an assignment to study how pre-winter sowing reflects on spinach in our agroecological conditions. Spring sowing was taken as the control.

Material and Method

Spinach was tested in field experiments, conducted in the Belgrade region (Radmilovac). The studies lasted from 1994/95 to 1996/97. The type of soil was eutric cambisol. "Matador" cultivar was used.

The main soil cultivation was conducted in autumn at the depth of 30-35cm. The experiments were fertilized with 400kg/ha NPK fertilizer (15:15:15). Pre-sowing soil cultivation consisted of chopping up and flattening of surface.

Sowing was conducted manually, in rows, between November 24 and December 11 (pre-winter sowing), i.e. between March 14 and 23 (spring sowing). On 1m² 4g of seed was sown (40kg/ha). The sowing depth was around 2cm. Crop tending consisted of two loosening of soils, weeding (several times) and one top dressing (KAN).

The experiments were finished when spinach had approximately 10 leaves. Plants were pruned with the knife and cleaned of soil. They were counted and measured, which served to determine the yield of spinach (t/ha).

The split-plot method was used. Each plot was divided in two parts, one part of which was used for pre-winter and the other for spring sowing. The size of each plot was 4m² (2x2m). The experiments were conducted in four repetitions. The results were processed by variance analysis, and the evaluation of statistical significance was made with LSD test.

Weather conditions

In 1994/95 spinach had excellent conditions for growing (tab.1). There were no serious autumn and winter frosts, which made the crops from pre-

winter sowing (November 24) start sprouting already in December. Although the sprouting lasted quite long, spinach sprouted well.

Spring period was even more favourable, which enabled to obtain excellent results. Spinach grew early and produced high yield.

T a b. 1. - Data on average monthly air temperatures and precipitation sum during the investigation period

Months	Temperatures (°C)			Precipitation (mm)		
	1994/95	1995/96	1996/97	1994/95	1995/96	1996/97
December	4.0	4.0	4.4	32	33	88
January	1.3	0.3	0.6	82	42	33
February	8.7	0.1	5.7	44	62	48
March	7.8	3.3	6.9	37	41	10
April	12.9	12.1	8.3	60	52	87
May	17.0	19.8	18.7	81	108	51
Average/Sum	8.6	6.6	7.4	336	338	317

The year 1995/96 was worse than the previous one. Winter was long and cold, so that the crop from pre-winter sowing started to sprout only in late March the following year. Sprouting was poor, so the crop did not achieve the necessary thickness. Spring spinach sprouted well.

In 1996/97 spinach had mediocre conditions. Although it was rather cold, it stood the cold quite well. Sprouting started late and lasted long. Pre-winter sowing was a great failure. Spring spinach produced much better results, which is attributed to favourable climatic conditions.

Results and Discussion

Pre-winter sowing increased the earliness of spinach (tab. 2). This was especially prominent in 1994/95 (mild winter), where the pre-winter spinach was earlier by 24 days. That year was followed by 1996/97, with 18 days difference. In 1995/96 pre-winter sowing was more successful by only 6 days. This was not a random case, since this was the year not particularly favourable for spinach (cold and humid weather). In general, pre-winter sowing increased the earliness of spinach by 16 days.

Our results have high correspondence with the results of Mešćerjakova (1976), where pre-winter sowing had the advantage of 23 days. A somewhat smaller advantage (16 days) was obtained by Andrejev and Dimov (1978). According to Aleksašin et al., (1984) this advantage was only 9 days. Bjelić and Moravčević (2004) obtained the earliness of

29 days for carrot. Evidently, pre-winter sowing was highly efficient to that respect.

T a b. 2. - Effect of pre-winter sowing on earliness of spinach

Trial variants	Spinach harvesting - dates		
	1994/95	1995/96	1996/97
Pre-winter sowing	18 April	5 May	29 April
Spring sowing	12 May	11 May	17 May

Pre-winter sowing had negative effect on the yield of spinach (tab. 3). This was most prominent in 1995/96 which was not favourable for crops (spinach) from the pre-winter sowing. Long and cold winter destroyed a part of the seed in soil and sprouting of spinach was delayed until March. This had a negative influence on the thickness of crops and consequently on the yield itself. Spring spinach used much favourable conditions, which gave the advantage of as much as 7.92t/ha. April and May rains were most favourable. In 1996/97 pre-winter sowing was much more successful. Its delay was only 2.08t/ha. This is attributed to relatively mild winter and rather warm and humid spring. In 1994/95 spinach gave excellent results. Pre-winter sowing did not prevent it and was almost even with the spring sowing. The difference in the yield was only 1.12t/ha (statistically insignificant). The success of pre-winter sowing proved to be rather variable, according to the conditions. Spinach stands cold and humid weather extremely hard.

T a b. 3. - Effect of pre-winter sowing on spinach yield

Trial variants	Yield (t/ha)			Average
	1994/95	1995/96	1996/97	
Pre-winter sowing	13.03	7.27	11.18	10.49
Spring sowing	14.15	15.19	13.26	14.20
Average	13.59	11.23	12.22	12.35
LSD 0.05	0.74	3.91	1.62	-
0.01	1.08	6.14	2.46	-

These results are confirmed by many authors. So Andrejev and Dimov (1978) established that pre-winter sowing decreases the yield of spinach by as much as 4.28t/ha. Its effect was demonstrated most in cold and unstable years. Pleasant (2001) also demonstrated that pre-winter sowing disturbs spinach, but to a relatively small degree (it decreased yield by 2.16t/ha). According to Aleksašin et al., (1984) spinach stood pre-winter sowing excellent, i.e. it increases its yield. This was obtained in the regions with moderate climate.

Conclusion

Pre-winter sowing increased the earliness of spinach by 16 days on average. It had negative effect on the yield, i.e. it decreased it. The yield was decreased by 3.71 t/ha on average. Pre-winter sowing should be used in the production of spinach (earliness was increased). It is especially efficient in the years with short and mild winters. Such was the year of 1994/95.

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UTICAJ PREDZIMSKE SETVE NA RANOSTASNOST I PRINOS SPANAĆA

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Re z i m e

Spanać je ispitivan u rejonu Beograda (Radmilovac). Ispitivanja su trajala od 1994/95. do 1996/97. godine. Korišćena je predzimska i prolećna setva (kontrola).

Predzimska setva je značajno povećavala ranostasnost spanaća. To se najviše ispoljilo u 1994/95. godini (blaga zima), gde je predzimski spanać bio

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ranostasniji za 24 dana. Na drugom mestu je 1996/97. godina, sa ostvarenom razlikom od 18 dana. U 1996/97. godini predzimski spanać je bio uspešniji za samo 6 dana. To nije slučajno, jer se radi o godini koja nije bila naklonjena spanaću (hladno i vlažno vreme). U celini gledano, predzimska setva je povećala ranostasnost spanaća za 16 dana.

Spanać je davao dobar prinos. Prolećna setva je bila osetno uspešnija, a razlika iznosi 3,7t/ha. Prinos je u proseku dostigao 12,35t/ha (10,49 i 14,20t/ha).

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