Agrovoc Descriptors: Asparagus officinalis, mulches, crop yield, crop management, varieties

Agris Category Codes: F01, F08

COBISS Code 1.01

Comparison of asparagus (*Asparagus officinalis* L.) cultivars and the effect of covering beds

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Received October 10, 2005, accepted October 14, 2005
Delo je prispelo 10. oktobra 2005, sprejeto 14. oktobra 2005

ABSTRACT

Five hybrid cultivars ('Boonlim', 'Cipres', 'Dariana', 'Franklim' in 'Steline') of white asparagus were tested on 4 locations in Slovenia (Celje, Logarovci, Nova Gorica and Novo mesto). The plantations were 7 years old when some of the raised beds were covered with black PE mulch and the yield was compared to the yield of uncovered beds. The planting space was 2.2 m between rows and 0.33 m between crowns in the row. Each cultivar had 2 covered and 2 uncovered repetitions with 15 plants (11 m^2). The yield and number of spears were measured. For 6 days, white spears were divided into 4 groups based on their thickness (4-8 mm; 8-12 mm; 12-16 mm; over 16 mm), counted and weighed in order to determine the proportion and quality of marketable yield. 'Steline' (3.44 t/ha) had the lowest average yield and 'Boonlim' (6.78 t/ha), which was the best performing cultivar in Logarovci and Nova Gorica, the best. In Novo mesto there were no significant differences among cultivars and in Celje, earlier cultivars 'Franklim', 'Cipres' and 'Dariana' performed better. 'Franklim' had more spears on average but the weight of the spears was best with 'Boonlim' (46.24 g) and worst with 'Steline' (32.03 g). The mulch influenced the yield, which was 5.27 t/ha on uncovered beds and 6.25 t/ha on covered ones. It also influenced the average weight of spears, which increased from 38.15 g to 40.88 g. The mulch did not increase either the number of spears or their thickness.

Key words: white asparagus, *Asparagus officinalis*, cultivars, black PE mulch

IZVLEČEK

PRIMERJAVA SORT ŠPARGLJA (*Asparagus officinalis* L.) IN UČINEK PREKRIVANJA GREBENOV

Testirali smo 5 hibridnih sort obeljenega šparglja ('Boonlim', 'Cipres', 'Dariana', 'Franklim' in 'Steline') na 4 lokacijah po Sloveniji (Celje, Logarovci, Nova Gorica in Novo mesto). Nasadi so bili v 7. letu rasti, ko smo del grebenov prekrili s črno PE zastirko in primerjali pridelke na pokritih in neprekritih grebenih. Razdalje med rastlinami so bile 33 cm v vrsti in 2,2 m med vrstami. Pri vsaki sorti smo imeli 2 ponovitvi po 15 rastlin (11 m^2) brez zastirke in 2 z zastirko. Merili smo maso in število poganjkov v času 6 tedenskega pobiranja. V 6 zaporednih dneh smo poganjke še razporedili v 4 razrede glede na premer poganjkov: 4-8

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mm debeline, 8-12 mm, 12-16 mm in nad 16 mm. Kot najslabša sorta se je izkazala 'Steline' (3,44 t/ha), najboljši pridelek pa je v povprečju dosegla 'Boonlim' (6,78 t/ha), ki je imela tudi največji pridelek v Logarovcih in Novi Gorici. V Novem mestu ni bilo signifikantnih razlik med sortami, v Celju pa so bile boljše zgodnejše sorte 'Franklim', 'Cipres' in 'Dariana'. 'Franklim' je imela v povprečju največ poganjkov. Največjo maso so imeli poganjki pri sorti 'Boonlim' (46,24 g), najmanjšo pa 'Steline' (32,03 g). Zastirka je signifikantno povečala povprečni pridelek od 5,27 t/ha na 6,25 t/ha. Povečala se je tudi povprečna masa poganjka iz 38,15 g na grebenih brez zastirke na 40,88 g pri grebenih z zastirko. Zastirka ni signifikantno vplivala na število ne na delež debelih poganjkov.

Ključne besede: obeljeni špargelj, *Asparagus officinalis,* sorte, črna PE zastirka

INTRODUCTION

Growing asparagus as a market product is fairly new in Slovenia. Until 1998, asparagus was cultivated only by a few growers in the littoral part of Slovenia. Today the area under asparagus has risen from 4 ha in 1997 to more than 40 ha, which represents about 2% of land under vegetable market production.

Asparagus is a perennial and a plantation is usually exploited for 8-12 years. Selection of the right cultivar for a specific growing area is essential for maximizing the returns of a crop. Adaptation of cultivars to a specific cultivation area can make a significant difference, especially in a country with great relief diversity. Asparagus cultivar trials are very common in countries with an asparagus growing tradition. In addition to a large number of smaller cultivar trials in different countries, 3 international asparagus cultivar trials (IACT) have been conducted to establish a systematic evaluation for yield, spear quality and disease tolerances of commercially available cultivars. The first IACT started in 1985, the second in 1993 and the third in 2001 (Benson, 2002). Each of those trials included 21 trials sites in 11 different countries and a total of 41 cultivars. The first results of the third IACT were already presented at the 11th International Asparagus Symposium in The Netherlands this year (Mulder and Lavrijsen, 2005; Gonzales, 2005; Jinsong, 2005).

In Slovenia, five field trials in different Slovene regions were organised in 1997. The main purpose of the trials was not only to test new hybrid cultivars, which have better characteristics than old cultivars such as 'Argenteuil' and 'Mary Washington', that are listed in our national list of varieties, but also to spread knowledge about this delicious vegetable, which was not very well known to either producers or consumers. Three field trials were located within secondary schools of agricultural (Vrtnarska šola Celje, Srednja kmetijska šola Grm pri Novem mestu, Poklicna in tehniška kmetijsko - živilska šola v Šempetru pri Gorici), one at Logarovci (Prlekija) and one at Bertoki near Koper. For the first 3 years (1997-99), the development of the plants and their resistance to rust (*Puccinia asparagi* D.C.) were observed and spears were not harvested, but the yield was evaluated in 2000, 2001 and 2002 (Jakše, 2002; Jakše and Kacjan Maršić, in print) .

In 2003, when the asparagus plants were in their 7th growth season, we decided to evaluate the effect on the yield and quality of spears of covering raised beds with

polyethylene (PE) black plastic mulch. The results obtained by the covering are discussed in this paper.

MATERIALS AND METHODS

Field trials were located in 2 regions with a mediterranean climate (Bertoki near Koper, Nova Gorica) and 3 regions with a more continental climate (Novo mesto, Logarovci, Celje). Cultivars were chosen from different European countries: 'Boonlim' (NL), 'Cipres' (Spain), 'Dariana' (France), 'Franklim' (NL), 'Steline' (France) and were planted in all 5 locations. The location in Bertoki was not included in this trial because of the poor condition of the plants, caused by several frost injury during the past few years.

Soils in Nova Gorica and Celje are lighter and sandier than those at Logarovci and Novo mesto. The soil reaction (pH) was neutral at 3 locations (pH 6.6-7.3), which is suitable for asparagus according to Adam and Stengel (1999), but not at Logarovci, where the soil reaction was more acid (pH 5.6). Fertilizing was adjusted to soil analyses at particular locations.

The essential trial design was the same at all locations:

- planting space 2.2 m between rows and 0.33 m between crowns in the row (13,600 plants/ha);
- planting depth 20 cm;
- 15 plants by repetition (11 m^2);
- uncovered raised beds and raised beds covered with black PE mulch;
- 2 repetitions;
- no irrigation.

The yield of white spears was measured throughout the harvesting season, which lasted approximately 6 weeks. Harvesting took place each day or every second day (Table 1). Spears were counted, trimmed to 23 cm and weighed. In the middle of the harvest period, for 6 days, the white spears were divided into 4 groups according to their thickness (4-8 mm; 8-12 mm; 12-16 mm; over 16 mm), counted and weighed in order to determine the portion and the quality of marketable yield.

Table 1: Duration of harvesting season at different locations

Location	Dates of first and last harvest	Harvest duration	Number of pickings
Nova Gorica	7 April – 23 May 2003	46 days	24
Novo mesto	16 April – 23 May 2003	38 days	29
Logarovci	10 April – 21 May 2003	41 days	31
Celje	20 April – 5 June 2003	46 days	24

All measured data were analysed by analyses of variance (ANOVA) using Statgraphic Plus for the Windows 4.0 program. Means were separated by Duncan's multiple range test at $P \leq 0.05$.

March was extremely dry in 2003 and spears did not emerge, even though temperatures were high enough. At the begining of April, there was a cool spell with some rain, followed by warmer weather. Spears emerged mainly in the second ten days of April. The rest of the spring was dry, with temperatures above the average, which caused a rather low asparagus yield, especially at locations with more sandy soil, like Nova Gorica and Celje.

RESULTS AND DISCUSSION

Yield

The average yield from all locations obtained on covered beds (6.25 t/ha) was statistically higher than the yield on uncovered beds (5.27 t/ha). 'Steline' had the significantly lowest yield on covered and uncovered beds. There were no significant differences among yields of 'Boonlim', 'Franklim' and 'Dariana' (Table 2).

Table 2: The average yield in t/ha on covered and uncovered beds from 4 locations.

Cultivar	Yield in t/ha and stat. significance					
	Without mulch		With mulch		Average	
Boonlim	6.35	c*	7.21	b	6.78	c
Cipres	4.72	b	5.99	b	5.35	b
Dariana	5.92	c	7.06	b	6.49	c
Franklim	6.42	c	7.03	b	6.72	c
Steline	2.93	a	3.94	a	3.44	a
Average	5.27		6.25		5.76	

*Means in the same column followed by the same letter are not significantly different (P≤0.05) according to Duncan's multiple range test

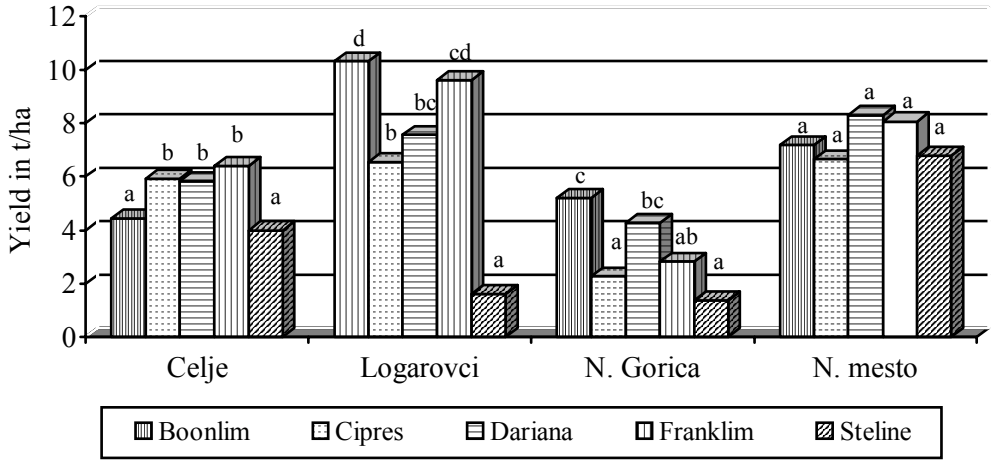

Figure 1: The average yield of each cultivar at different locations. Means in the same location followed by the same letter are not significantly different (P≤0.05) according to Duncan's multiple range test.

Significant differences among cultivar yields were noticed at each location (Fig. 1). 'Franklim', which gave the best average yield, had good results at all locations except Nova Gorica. 'Boonlim', which is stated to be a late cultivar, did not perform well in Celje, which is the location with the latest harvesting date (Table 1). 'Steline' was the

least productive cultivar at all locations. In Novo mesto, no significant differences among cultivars were detected.

Number of spears

There were no statistically significant differences between the average number of spears harvested on covered and on uncovered beds. Some difference were shown among cultivars, with 'Steline' having the lowest number of spears, and 'Franklim' the highest (Table 3).

Table 3: The average number of harvested spears per repetition on covered and uncovered beds from 4 locations.

Cultivar	Number of harvested spears per repetition (11 m^2) and stat. significance					
	Without mulch		With mulch		Average	
Boonlim	155	b*	168	b	161	ab
Cipres	139	b	159	b	149	b
Dariana	164	b	186	b	175	bc
Franklim	203	c	194	b	198	c
Steline	101	a	117	a	109	a
Average	152		165		158	

*Means in the same column followed by the same letter are not significantly different (P≤0.05) according to Duncan's multiple range test

Figure 2 shows the average number of harvested spears at different locations. In Nova Gorica and Novo mesto, there were no significant differences among cultivars, in Celje and Logarovci 'Franklim' had the highest number of spears (Figure 2).

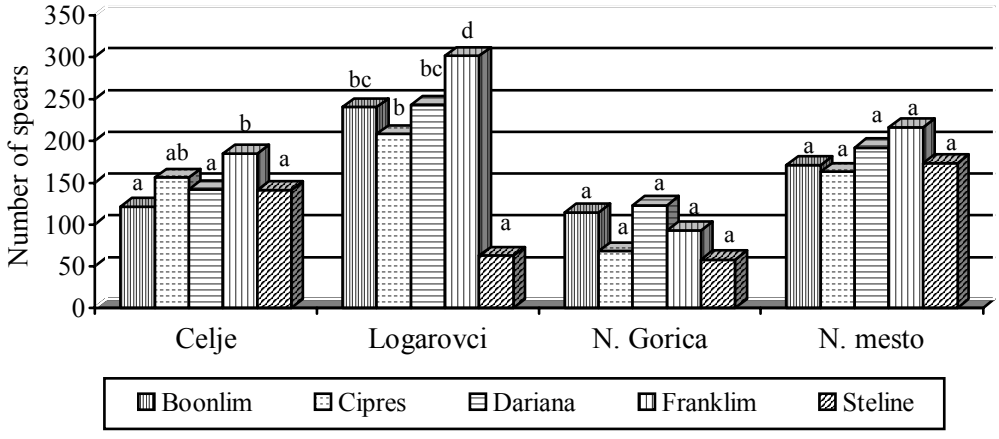

Figure 2: Average number of harvested spears on a repetition (11 m^2) at different locations. Means in the same location followed by the same letter are not significantly different (P≤0.05) according to Duncan's multiple range test.

Weight of spears

The spears harvested on covered beds were significantly heavier than spears from uncovered beds. 'Boonlim' had the heaviest spears, on covered and uncovered beds, followed by 'Dariana'. The lightest were spears of 'Steline' (Table 4).

Table 4: The average weight of spears (g) harvested on covered and uncovered beds from 4 locations.

Cultivar	Spear weight in g and stat. significance					
	Without mulch		With mulch		Average	
Boonlim	45.80	d*	46.69	c	46.24	d
Cipres	38.05	bc	41.67	bc	39.86	bc
Dariana	40.57	c	43.56	bc	42.07	c
Franklim	35.67	b	39.05	ab	37.36	b
Steline	30.65	a	33.42	a	32.03	a
Average	38.15		40.88		39.51	

*Means in the same column followed by the same letter are not significantly different (P≤0.05) according to Duncan's multiple range test

The performance of cultivars at the tested locations was different. 'Boonlim' had significantly heavier spears than other cultivars in Logarovci and Nova Gorica, at other locations the differences were smaller (Figure 3).

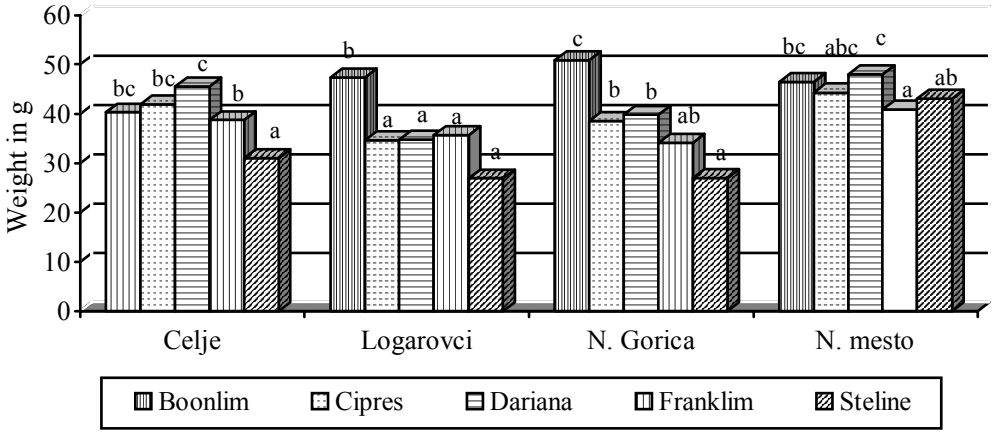

Figure 3: Average weight of a spear at different locations. Means in the same location followed by the same letter are not significantly different (P≤0.05) according to Duncan's multiple range test.

Portion of large spears

Cultivars with larger spears are more desirable, because they have less fibre and the harvest is easier. Covering a bed did not significantly affect the percentage of large

spears. 'Boonlim' had significantly more spears with a diameter over 16 mm than 'Steline' (Table 5).

Table 5: Percentage of harvested spears larger than 16 mm on covered and uncovered beds from 4 locations.

Cultivar	% of spears with ϕ ≥16 mm and stat. significance					
	Without mulch		With mulch		Average	
Boonlim	57.36	c	51.29	b	54.32	c
Cipres	54.36	c	39.59	ab	46.97	bc
Dariana	46.04	bc	43.89	ab	44.97	bc
Franklim	37.31	ab	36.31	ab	36.81	ab
Steline	28.89	a	31.36	a	30.13	a
Average	44.79		40.49		42.64	

*Means in the same column followed by the same letter are not significantly different (P≤0.05) according to Duncan's multiple range test

In Logarevci and Nova Gorica, the % of spears larger than 16 mm was the highest with 'Boonlim', in Celje 'Dariana' had more large spears and in Novo mesto 'Cipres' (Figure 4). Since spears were classified according to their diameter only for 6 successive days in May 2003, the results obtained may not be as exact as if the spears had been classified during the whole harvest period. The variations among repetitions were too big to show clear significant differences among cultivars.

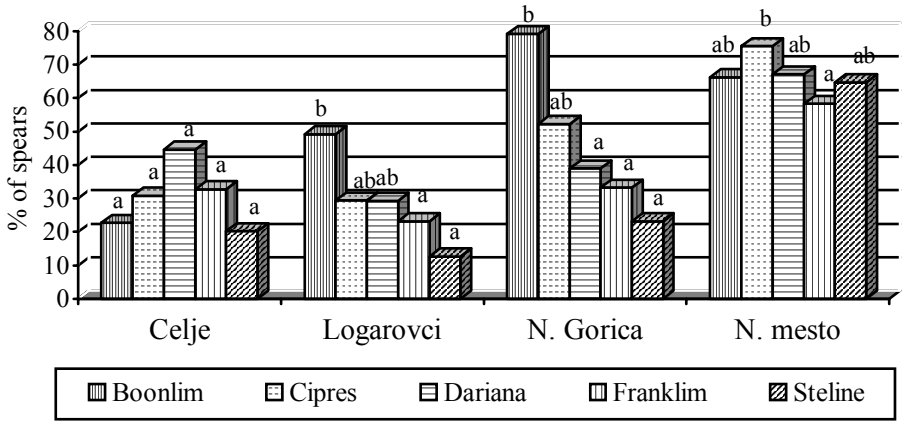

Figure 4: Portion of spears with a diameter ≥ 16 mm harvested at different locations. Means in the same location followed by the same letter are not significantly different (P≤0.05) according to Duncan's multiple range test.

CONCLUSIONS

Covering raised beds with black PE mulch resulted in a better yield of white spears and spears were heavier. The mulch did not significantly affect the number of spears and the proportion of large spears (Φ≥16 mm).

The least suitable of the tested cultivars for Slovenian climate conditions was 'Steline', which gave the lowest yields at all locations. All the other tested cultivars had better yields and numerous spears. 'Boonlim' had the heaviest spears and the highest proportion of spears with $\Phi \geq 16$ mm and it performed well especially in Logarovci and Nova Gorica. In Celje, where the beginning of harvest was later than at other locations, 'Franklim', 'Dariana' and 'Cipres' gave good results. In Novo mesto there were no significant differences among cultivars, but 'Dariana' gave better results.

ACKNOWLEDGEMENTS

The authors would like to thank Iztok Vidic, who was one of the initiators of asparagus cultivar trials in Slovenia, and all persons involved in harvesting and measuring the large number of spears.

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