

Growing Broccoli without Chemicals

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Abstract. The experiment took place in the spring of 2012, in a polyethylene tunnel from the University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca. There were three hybrids used and the culture has started with small seedlings. The technology applied was the one recommended by the literature. During experimental period growing measurements were made and total yields were determined. Most important was that no chemicals were used to produce this broccoli, no fertilizers, no herbicides and no pesticides. The obtained production was above average.

Keywords: chemicals, early spring, growth, hybrids, production

INTRODUCTION

The word broccoli, from the Italian plural of broccolo, refers to "the flowering top of a cabbage" (Dixon, 2007). Broccoli has large flower heads, usually green in color, arranged in a tree-like fashion on branches sprouting from a thick, edible stalk (Holly, 2002). It has medium demands on water, especially during warm days. The climate in Romania is very suitable for broccoli growing. It likes loose soil and it does not have high problems with diseases (Giorgotă, 2010). The optimum temperature for broccoli is between 15-20⁰C, a minimum of 2-3⁰C and a maximum of 30⁰C (Stan, 2001). Broccoli is very healthy, high in vitamin C, soluble fibers and nutrients, the most important being selenium (Kirsh, 2007) which has strong anti-cancer effect. Broccoli started to become well known to Romanian consumers due to anti-cancerous properties, that is why more and more people started to consume it. Broccoli can be eaten raw, boiled or cooked but by cooking, it loses some of the properties. It can be grown in early spring or autumn culture with small seedlings or by direct sowing. Early spring yields are between 10-12 t/ha (Ciofu, 2003).

This experiment can prove that good broccoli yields can be obtained without using chemicals (fertilizers, herbicides and pesticides). It can also prove to Romanian farmers that broccoli can be grown, here in Romania, in spring.

MATERIALS AND METHODS

The research has been carried out at the University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, in the spring of 2012, in a polyethylene tunnel. For the experiment, three early broccoli hybrids (Belstar, Marathon and Fiesta) were used.

Belstar hybrid is recommended for spring and summer culture. It reaches maturity after 80 days from sowing. It prefers rich and moist soil. The inflorescence is compact and heavy, dark green in colour. It is resistant to *Fusarium oxysporum* and the inflorescences are easy to store.

Marathon hybrid is recommended for spring culture and it can adapt easily to various climates. It reaches maturity after 90 days from sowing. The inflorescences are big, heavy and compact, green in color. It is resistant to *Fusarium oxysporum* and suitable for freezing.

Fiesta hybrid is recommended for spring and summer growing. It reaches maturity after 80 days from sowing. It is recommended for dens culture and for harvest only the main inflorescence, without the secondary shoots. The harvest is obtained in a week. The main inflorescence is compact, dark green in color and it is resistant to *Fusarium oxysporum*.

The seeds were sown in 26.01.2012, in small alveolar trays. Emergence percent was between 98-99%. After one month from sowing, the seeds were transplanted in bigger pots, so plants could develop better. In 27.03.2012, the seedlings were planted in the polyethylene tunnel. The land was shaped into stratum of 1.5 m wide, and seedlings were planted at a distance of 25 cm between plants and 75 cm between rows. On the margins of the culture, there was a row of broccoli plants used for protection against pests.

Seedlings were measured before planting and plants were measured before harvesting to determine growth differences between hybrids. There were no problems with diseases and pests and the weeds were destroyed manually.

Harvest started in 21.05.2012 and ended on 20.06.2012.

RESULTS AND DISCUSSIONS

Growth measurements were done, before planting, to see if there are differences between the hybrids. Five random plants, from each hybrid, were measured and an average was calculated. Measurements regarding seedlings height, rosette diameter and number of leaves were done (Tab. 1). The results, presented in the table below, show that there are not any notable differences between hybrids growth, before planting. The hybrid Fiesta is less developed, with a plant height of 15.67 cm, a rosette diameter of 19 cm and an average of 4 leaves/plant. The hybrid Belstar is the most developed of them all, with a plant height of 17.25 cm, a rosette diameter of 21 cm and an average of 4.67 leaves/plant.

Tab. 1

Growth measurements done before planting in the polyethylene tunnel

Hybrid	Plant height (cm)	Rosette diameter (cm)	Number of leaves
Belstar	17.25	21.0	4.67
Marathon	16.0	19.33	4.33
Fiesta	15.67	19.0	4.00

Regarding growth measurements done before harvesting, noticeable differences between hybrids appeared. Five random plants, from each hybrid, were measured and an average for each hybrid was made. The hybrid Belstar is no more the most vigorous of them all, now, before harvest. Marathon hybrid is the most vigorous with a height of 83.5 cm, a rosette diameter of 81 cm and an average of 20 leaves/plant. The less vigorous hybrid is no longer Fiesta, because now, it can be said that Belstar is the less vigorous hybrid of them all, with a plant height of only 70.5 cm, a rosette diameter of 79.5 cm, and an average of 17.5 leaves/plant (Tab. 2).

Tab. 2

Growth measurements done before harvesting in the polyethylene tunnel

Hybrid	Plant height (cm)		Number of leaves
Belstar	70.5		17.5
Marathon	83.5		20.0
Fiesta	81.5		17.5

Harvesting the main inflorescence started in 21.05.2012 and finished in 30.05.2012. It can be seen that the hybrid Marathon is a bit delayed then the others. The hybrids Belstar and Fiesta obtain most of their yields (37.2% and 40.5%) on 28.05.2012, towards the end of harvest period, compared to Marathon, that obtains most of its yields (50.5%) at the beginning of the harvest period, on 25.05.2012. Fiesta is the only hybrid that continues to make inflorescences throughout harvesting period.

Tab. 3

Harvesting dates for the main broccoli inflorescence

Hybrid	Period/Date								Total yields (t/ha)
	21.05		25.05		28.05		30.05		
	t/ha	%	t/ha	%	t/ha	%	t/ha	%	
Belstar	7.3	37.1	5.07	25.7	7.33	37.2	-	-	19.7
Marathon	-	-	11.5	50.5	8.5	37.3	2.7	12.2	22.7
Fiesta	6.5	30.3	3.5	16.4	8.7	40.5	2.9	12.8	21.6

Regarding hybrid influence upon main inflorescences production, it can be seen from the table below (Tab. 4), when the average is taken as control, that the lowest yield was obtained at Belstar hybrid, and it was of 19.7 t/ha and the highest production was obtained at Marathon hybrid, with 22.7 t/ha. At Marathon hybrid, the difference in production compared to control is very significant positive. Hybrid Belstar has a lower yield, and the difference in production compared to control is very significant negative.

Tab. 4

Hybrid influence upon main inflorescences production at early broccoli

Hybrid	Production		Difference (t/ha)	Significance
	t/ha	%		
Average	21.33	100.0	0,00	-
Belstar	19.70	94.70	-1,63	000
Marathon	22.70	105.70	1,40	***
Fiesta	21.60	99.60	0,27	-
DL (p 5%)			0,31	
DL (p 1%)			0,51	
DL (p 0.1%)			0,95	

Regarding hybrid influence upon main inflorescences production, when hybrid Belstar is taken as control, it can be seen from the table below (Tab. 5), that broccoli production is directly influenced by the hybrid. The differences in production obtained by hybrids Marathon and Fiesta compared to Belstar are very significant positive from the statistics point of view.

Tab. 5

Hybrid influence upon main inflorescences production at early broccoli

Hybrid	Production		Difference (t/ha)	Significance
	t/ha	%		
Belstar	19.7	100	0.00	000
Marathon	22.7	111.7	3.00	***
Fiesta	21.6	105.3	1.90	***
DL (p 5%)			0,31	
DL (p 1%)			0,51	
DL (p 0.1%)			0,95	

CONCLUSIONS

There is no major difference in the seedlings development before planting, regardless of the hybrid.

Before harvesting, from the measurements that were done, results that the hybrid Marathon is the most vigorous of the three and Belstar is the less vigorous of the three studied hybrids.

Regarding the harvest period, results that the hybrid Marathon is a bit latter than the others. All of the hybrids obtain most of their production harvested from the main inflorescences, in the middle of the harvesting period.

Hybrid Marathon has the higher production from the main inflorescences, compared to the other hybrids and Belstar had the lowest production of the three hybrids

Good broccoli yields can be obtained, without using chemicals (fertilizers, herbicides and pesticides), only with some plants used as protection around the plot, as it can be seen from the obtained yields in this experiment, compared to the yields mentioned in the literature.

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