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Economic Efficiency of Broccoli Production Depending on Sowing and Planting Dates

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Abstract

An experiment was set up to study the economic effect of different sowing and planting dates. The field trial was conducted in the experimental garden of the Institute of Agriculture - Kyustendil over the period 2008-2011 via the block method in four replications. Three sowing and six planting dates were examined for the four broccoli hybrids used: Fiesta F1, Coronado F1, Marathon F1 and Parthenon F1. The plants were grown according to the adopted methodology for late field production. The flower heads were harvested at the most proper stage of development.The production costs of broccoli growing are within the range 400.5 to 795 lv/da and depend on the different volume of agro technical practices undertaken over the years and the resulting output. The highest net income of the studied hybrids is obtained by Parthenon F1 in all variants, which is due to the higher yields obtained by the plants of this hybrid.The most efficient for the region of Kyustendil broccoli sowing date is 15 - 16.06. and planting of the 30-day seedlings on 15-16.07.

Keywords: Broccoli, gross production, net income, rate of profitability

Introduction

In recent years, broccoli has gained popularity not only because of its excellent dietary and taste, but also due to its easy cultivation in comparison with cauliflower, and a longer period of harvesting. Generally, broccoli is less demanding than cauliflower in terms of growing conditions. There are no major requirements for the heat, but at a temperature higher than 25 ° C and lower than 10° C, the yield and the quality of production is decreased.

Production of broccoli is cost effective and can be applied as an alternative to the traditional field production of late cabbage. The high cost of realization shows that there is a niche market for cabbage crops (Mihov et al., 2001).

Sowing dates are a subject to extensive research, as experiments have been made not only for broccoli. Most experiments on sowing dates were conducted in soybean (*Glicine max* L.) and onion (*Allium cepa* L.). Relationships have been established between the sowing date and the reproductive plant characteristics (Babic, 2000; Damato, 2000; Damato et al., 1994; Diputado and Nichols, 1989).

In examining the effect of sowing dates on the yield of broccoli and size of flower heads, five sowing were tested dates in Turkey: from mid- June to mid- August , in 15 - day intervals in two early (Sultan and SG1) and a late hybrid (Marathon). It was found that the most suitable time for sowing is from mid June to early July , and planting - in August , under irrigation. The yields obtained in compliance with such terms sowing are about 1 kg/plant and 40 t/ha, at a density rate of 4 plant/m^2. While the central head give 20-25 % yield of the total, the remaining 75-80 % is obtained from the side heads (Sari et al., 2000).

In order to establish the influence of planting time on the yield of broccoli an experiment was carried out in Thailand with three varieties - Top Green, Beijing and Kuan-im and three periods of planting block method. The results showed that planting in the period from September to November, characterized by high rainfall, contributed to lower yields due to damage from diseases, pests and weather. No significant differences were detected between the productive features of the varieties (Pornsuriya and Teeraskulchon, 1998).

Yield and quality are important for the producers and the variety and sowing date can affect the standard yield. Better knowledge of the genotype and its interaction with the environment can help farmers optimize yield and quality of broccoli by combining varieties with the sowing time (Tan et al., 1999).

In a study in the Kyustendil region of Bulgaria, Todorova (2011) found that the highest

central flower heads yield, 2546.7 kg/da on average over three years, and better indices directly influencing its formation (size and weight of the product part) were obtained by Parthenon F1 hybrids when planting 30-day seedlings.

Broccoli productivity is strongly influenced by the choice of system for feeding plants as significant prevail of conventional farming method (Borisov and Dincheva, 2014).

The aim of this study is to establish the productive capacity and economic impact of growing broccoli depending on the timing of sowing and planting.

Materials and Methods

A field experiment was conducted in the experimental garden of the Institute of Agriculture, Kyustendil during the period 2008-2011 to determine the optimal for the region time for broccoli sowing and planting as well as the most suitable varieties. The study was carried out with four broccoli hybrids: Fiesta F1, Coronado F1, Marathon F1 and Parthenon F1. Plant genotypes were grown according to a technology for late field production with three sowing and six planting dates depending on the age of the seedlings. The plants were planted at a furrow 80/50 cm, which corresponds to 2500 plants per da.

The following five variants were tested:

I - Sowing on 01.06. and planting of 30-day seedlings on 01.07.

II - Sowing on 01.06. and planting of 45-day seedlings on 16.07.

III - Sowing on 16.06. and planting of 30-day seedlings on 16.07.

IV - Sowing on 16.06. and planting of 45-day seedlings on 01.08.

V - Sowing of 02.07. and planting of 30-day seedlings on 01.08.

The experiment was set via the block method in four replications with 20 plants in each replication, the area of the experimental plot was 7.2 m².

During the study period the main economic indicators were calculated: gross production, lv/da; production costs, lv/da; net income, lv/da; prime cost, lv/kg; rate of profitability, %. Valuation of labor costs is done on the basis of the existing at the Institute norms and tariff rates for manual work. The calculation of the study was performed at delivery (retail) prices level. Yields are recorded by years, and the production value is determined by stock prices.

The significance of the difference between the results was determined using the Duncan's test at levels of p=0.05%; 0.01% and 0.001%.

Results and Discussion

The gross production value at different variants fluctuates widely from year to year and is dependent on the biological characteristics of the studied broccoli hybrids and as value- expressed follows the trend of change in average yield. In 2008 the values of this indicator in almost all versions are the lowest, whereas in 2011 they are the highest. Average for the period 2008-2011, the received gross output is significant and is within the range of 1713 - 3822 lv/da (Fig. 1). The highest value per hectare for hybrid Fiesta F1 is obtained from variant III - 2511 lv/da, followed by variant II - 2243 lv/da, variant I - 2219 lv/da, variant V - 1804 lv/da and lowest for variant IV - 1713 lv/da. Marathon F1 hybrid this index values are within the interval 2088-2595 lv/da. Gross production was the highest under Variant I, Variant II exceeding 24.3 % variant III 5.7 %, Variant IV with 16.6 % and Variant V 8.7 %. In Coronado F1 the differences in values are 138 to 550 lv/da, Variant III taking the place as leading. In Parthenon F1 the resulting gross output is significantly higher compared to that of other hybrids. Most appropriate for this hybrid turns out to be Variant II with 3822 lv/da

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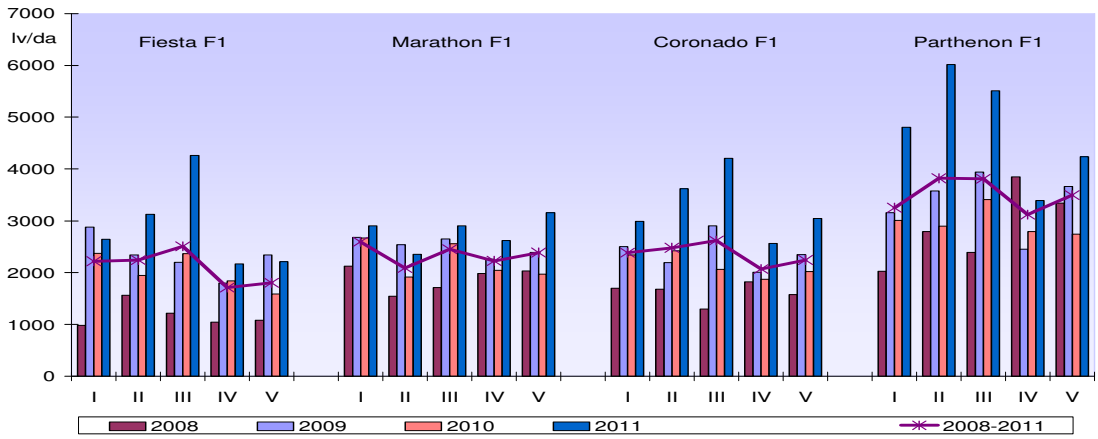

Figure1. Gross production, lv/da

The production costs of these variants range from 400.5 lv/da hybrid Fiesta F1 in 2008 to 795 lv/da at Parthenon F1 in 2011 (Table 1). The average annual production costs are the highest for Variant III of the Parthenon F1 - 663 lv/da, and Variant IV of Fiesta F1 are the lowest - 482 lv/da.

The analysis of the production costs indicates that the value of the cost of labor is greater than that of the raw materials for all variants. This difference depends on the different volume of practices undertaken over the years (plant protection, cultivation, fertilization, irrigation, and the resulting output).

Table 1. Production costs, lv/da

Hybrid broccoli	Variant	2008	2009	2010	2011	2008-2011
Fiesta F1	I	400.45	596.64	567.40	546.27	527.69
	II	450.17	542.67	530.11	581.60	526.14
	III	420.65	528.61	566.42	664.02	544.92
	IV	405.63	488.05	520.95	511.93	481.64
	V	408.74	542.67	498.71	514.87	491.25
Marathon F1	I	499.48	577.34	592.91	565.19	558.73
	II	449.50	562.62	527.50	524.96	516.14
	III	463.74	573.75	583.43	564.86	546.44
	IV	487.30	534.82	538.62	544.26	526.25
	V	491.45	547.91	532.07	583.51	538.73
Coronado F1	I	462.34	559.35	564.46	571.79	539.48
	II	460.53	528.28	571.65	617.58	544.51
	III	427.64	599.58	540.25	660.10	556.89
	IV	472.70	509.64	523.90	540.71	511.74
	V	451.47	543.33	536.33	575.38	526.63
Parthenon F1	I	494.70	628.72	626.63	706.85	614.22
	II	560.99	670.91	616.82	794.84	660.89
	III	526.03	707.22	661.30	757.87	663.11
	IV	651.89	557.74	607.34	603.82	605.20
	V	607.86	679.42	603.08	665.31	638.92

Average for the study period Parthenon F1 hybrids formed the highest material costs amounting to 175 lv/da, 67% of which are for irrigation, 22% for fertilizers, for seeds - 7% and 4% for crop protection (Fig. 2). In other hybrids the cost of buying seeds was with a lower value.

The structure of labor costs indicates that they are the highest in 2011 under variant II hybrid Parthenon F1 - 612.5 lv/da. The quantity of production is highest and expenses incurred in its collection are the highest - 71.4 percent of the total funds spent on labor. Manual activities related to planting, fertilizing, hoeing and plant protection products are 25.3%. Mechanization expenses including tillage were 1.9% and growing seedlings was 1.4% (Fig. 3).

The size of the average yield has had a substantial impact on the amount of net income. Average for the period of study in the three hybrids, the variants with 30-day seedlings form a higher amount of net profit compared to that by the 45-day seedlings. The values of the indicator for the four hybrids tested are better when the planting was done in July. Parthenon F1 hybrid formed the highest net income compared to the other hybrids in all investigated variants. Under variant I the average difference from the other hybrids is 779 lv/da, for variant II - 1420 lv/da, variant III - 1170 lv/da, variant IV - 1019 lv/da, and for variant V - 1129 lv/da.

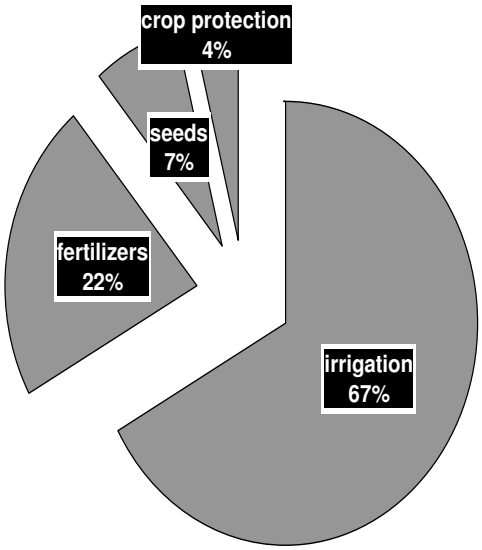

Figure 2. Material costs, %

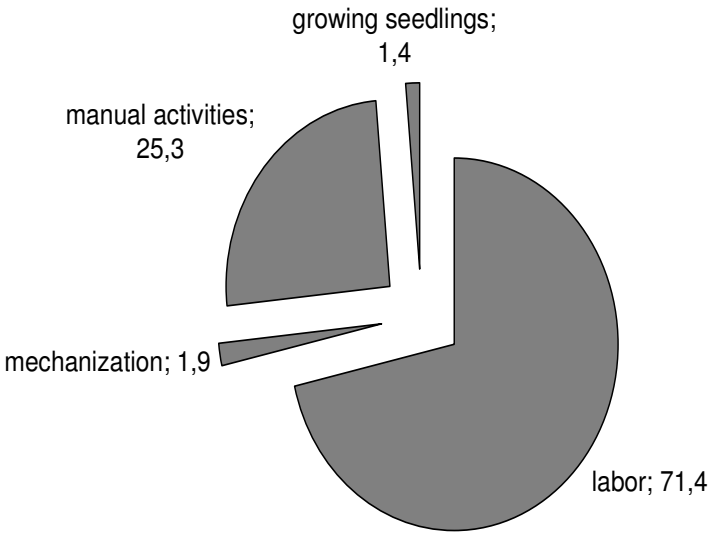

Figure 3. Labor costs, %

From an economic perspective, the most effective proved to be broccoli growing in the region of Kyustendil with sowing date on15-16.06. and date of planting the seedlings 30 days later - on 15-16.07. The resulting net income is 2771 lv / da, and the rate of profitability - 376% (Fig. 4).

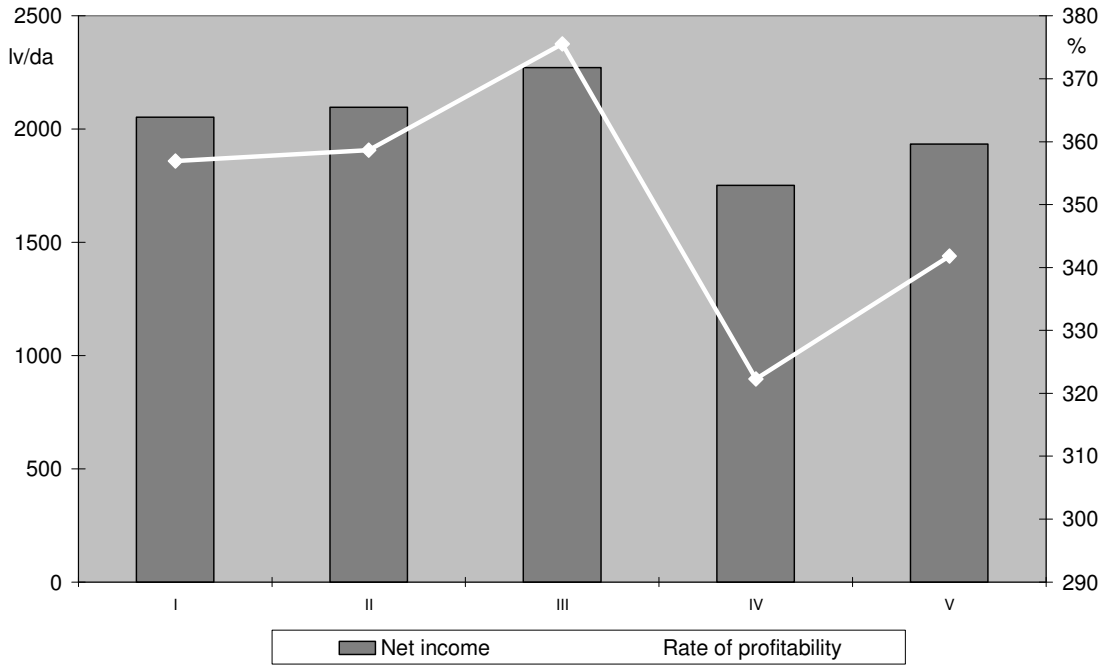

Figure 4. Net income and rate of profitability

Conclusion

Production costs for growing broccoli are within 400.5 to 795 lv/da and depend on various volume agro technical practices undertaken over the years and from the resulting output.

The net income of the studied hybrids with the highest value in all versions of Parthenon F1, which is a result from the higher yields obtained.

The most efficient, for the region of Kyustendil, is broccoli growing with sowing dates on 15 -16.06 and planting of the seedlings 30 days - on 15-16.07.

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