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COMPARISON OF COST AND PROFITABILITY OF ORGANIC AND CONVENTIONAL STRAWBERRY SEEDLING GROWING MEDIA

Vecdi DEMIRCAN[1], Nurgul F. TUREMIS[2], Hulya SAYGI[3], Aysegul BURGUT[2], Kamil EKINCI[1]

[1]Suleyman Demirel University, Agriculture Faculty, Department of Agricultural Economics, Agricultural Machinery and Technologies Engineering, Isparta-Turkey, Email: vecdidemircan@sdu.edu.tr
[2]Cukurova University, Agriculture Faculty, Department of Horticulture Science, Adana-Turkey
[3]Cukurova UniversityVocational School of Yumurtalık, Adana- Turkey

Corresponding author: vecdidemircan@sdu.edu.tr

Abstract

In this study, it was aimed to compare organic and conventional strawberry seedling cultivation media in terms of cost and profitability. This study was carried out in the Apricot Research Institute in Malatya province, Turkey. Albion and Sweet Charlie varieties were used in the experiment. The production costs of Albion and Sweet Charlie strawberry varieties were calculated in different growing media. Calculation of the production costs of the fresh plug strawberry seedlings was done in two steps. First, the production costs of strawberry runner plants were calculated, then the production costs of fresh plug strawberry seedlings were found. According to the results of the research, the cost of a runner plant was found to be the highest for the Albian Biodecal application, while the lowest was detected for Sweet Charlie Control application. According to different applications, the cost of strawberry branch plant was determined as 0.376, 0.341, 0.273, and 0.235 TL/unit for Albian Biodecal, Albian Control, Sweet Charlie Biodecal and Sweet Charlie Control applications, respectively(1 USD=3.02 TL in 2016, average). When the production costs of Albion and Sweet Charlie strawberry seedling obtained from Biodecal application were compared with the sale price, it can be said that production cost was lower than sale price for all the organic growing media (except for IT (Imported Turf) growing medium for Albion strawberry seedling obtained from Biodecal application), but in the conventional growing media, production costs was found to be higher than the sale price. Similar results have been found for the strawberry seedlings obtained from the control application. When organic applications were compared with each other, it was determined that KP (1:1 ratio local turf: perlite) was the growing medium which had the lowest production cost for Albion strawberry seedling obtained from Biodecal application, OE (1:1 ratio local turf: perlite + ecoflora providing 50 mg kg^{-1} potassium) for Sweet Charlie strawberry seedling obtained from Biodecal application, KP for Albion strawberry seedling obtained from control application and OE for Sweet Charlie strawberry seedling obtained from control application.

Key words**:** *strawberry seedling, organic, conventional, cost, profit margin*

INTRODUCTION

Organic agriculture is a production system that sustains the health of soils, ecosystems and people. It relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of inputs with adverse effects. Organic agriculture combines tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved (IFOAM,2017) [5].

Organic agriculture has been spreading rapidly in the world in recent years and global organic food market is also growing. Turkey is a typical example to countries that develop their organic agriculture based on export potential. Majority of the organic agriculture in Turkey is exported. Domestic market is also growing rapidly. The share of Turkey in the world organic food market is quite low even though it has proper ecological conditions for organic production and high export potential (Demiryurek, 2011) [2].

Organic agriculture in Turkey started unsystematically during 1985-1986 based on the development of organic agriculture in the world and the organic product demand from abroad after which it developed parallel to the developments in the world related with the

consumption of healthy foods as well as the issuing of the "Organic Agriculture Law" in 2004. In 2014, the number of organic production plants reached to 71,472, cultivation area reached to 842,216 (350,239 hectares of natural collection area) hectares, number of products reached to 208 and annual production reached about 1,642,235 tons. However, the inputs used in production are completely foreign country based. Turkey holds an important place especially in the production and foreign trade of healthy goods for the restructuring world food conjuncture. However, continuity of production depends on the more effective use of domestic resources for the development of technique and technologies used for the inputs of production. This is possible via the sustainment of the cooperation between university and the private sector as well as investments in R&D. The fact that inputs used in organic agriculture in Turkey are dependent on foreign countries is the main factor that limits the development and popularization of production (GTHB, 2017a; GTHB, 2017b) [3, 4].

The objective of this study was to compare organic and conventional strawberry seedlings growing media in terms of production cost and profit margin. To this end, the inputs, costs and seedling prices used in organic and conventional strawberry seedling cultivation were determined after which it was examined which production system is more profitable. It is expected that the study could provide valuable data to policy makers, producers who makes organic strawberry production and institutions that make publications on agriculture in this subject. In addition, the fact that there is no previous study comparing organic and conventional strawberry seedling growing media with regard to cost and profit margin.

MATERIALS AND METHODS

Two different strawberry varieties (Sweet Charlie and Albion) were used in the study (Figure 1). Production costs in different growing media for the Albion and Sweet Charlie strawberry varieties were calculated in the experiment area. The production costs for fresh plug strawberry seedlings were calculated in two stages. Firstly, the production costs for strawberry runner plants were calculated. A greenhouse area of 30 m^2 was used for each application. Afterwards, the production costs were calculated for fresh plug strawberry seedlings according to different growing media. An experiment area of 1 m^2 was used for each medium. A total of 84 plants were planted for Albion-Biodecal, Albion-Control, Sweet Charlie-Biodecal and Sweet Charlie-Control applications for each medium.

The production of strawberry runner plants was carried out at the Çukurova University Department of Horticulture, Application and Research Field. Strawberry main plants were planted in March as frigo seedlings. The medium for planting was comprised of 9:9:1 ratio of Local Turf: Perlite: Ecoflora fertilizer compost (Figure 2). In addition to, T-22 application was made for each area.

The experiment was set up as 5 repetitions with 25 plants in each repetition. Bacteria based Biodecal fertilizer and pure water as its control was used in the trials. Biodecal application: the plants were left to wait for 15 minutes in Biodecal solution during planting after which they were planted. Afterwards, it was applied once every 15-20 days. Control application: the main plants were left to wait in pure water for 15 minutes after which they were planted.

Fresh plug strawberry seedling was produced following the production of strawberry runner plants. Fresh plug strawberry seedling production was carried out via the trials at the Ministry of Food, Agriculture and Livestock Fruit Growing Research Institute Directorate. The trial was carried out in organic cultivation with a total of 6 applications comprised of 5 different medium and 1 control specified in Table 1. The abbreviation for the growing media is given in Table 1.

Sweet Charlie is a short-day variety which is early fruiting and sweet. This variety that is suited for summer planting is also resistant against anthracnose. The outer color of the fruit is brick red, whereas the interior is red. The fruits are average in size, fruit shape is

cylindrical, flat conical or conical (Aybak,2000; Turemis and Agaoglu, 2013) [1,6]. Albion is a day-neutral variety that is well adapted to cool and temperate regions. Its most important property is the extraordinary fruit quality and the fruit size is the same in all seasons. Albion variety is a mixture comprised of the fine properties of Aromas and Diamente varieties. Post-harvest fruit strength is longer than those of both varieties. Its fruit structure is suited well to fruit picking (Turemis and Agaoglu,2013).

Fig. 1. A view of Albion and Sweet Charlie strawberry varieties

Fig.2. A view of planting

The cost factors were grouped as variable and fixed costs. Variable costs are those that depend on the production volume. They occur as production continues. Fixed costs do not depend on production amount. These costs will remain regardless of whether the production is continued or not. The costs for the materials used were calculated by taking the market prices into consideration. Daily wages paid to workers in the region were taken into consideration when calculating the labor costs. Capital interest was calculated by applying half of the interest rate (8%) applied by TR. Ziraat Bank to agricultural production credits. General administrative expenses were calculated as 3% of the total variable costs.

Table 1. Potted fresh seedling media

1. KP medium (1:1 ratio local turf: perlite)
2. KK medium (1:1 ratio local turf: clinoptilolite)
3. IT medium (Import turf)
4. OB medium (1:1 ratio local turf: clinoptilolite + biofarm providing 50 mg kg^{-1} potassium)
5. OE medium (1:1 ratio local turf: perlite + ecoflora providing 50 mg kg^{-1} potassium)
6. Cnv medium (Import turf + N containing chemical fertilizer)

RESULTS AND DISCUSSIONS

Strawberry runner plant production costs for Albian-Biodecal, Albian-Control, Sweet Charlie-Biodecal and Sweet Charlie-Control applications are given in Table 2. It was determined as a result of the calculations carried out that the highest cost for a runner plant was for the Albian-Biodecal application whereas the lowest cost was determined for the Sweet Charlie-Control application. Indeed, the strawberry runner plant cost with regard to different applications were determined as 0.376,0.341,0.273, and 0.235 TL/unit for Albian-Biodecal, Albian-Control, Sweet Charlie-Biodecal and Sweet Charlie-Control applications, respectively. The reason why production cost was lower for the Sweet Charlie-Control application was that the number of runner plants was greater in comparison with other applications. Runner plant production amounts were determined as 1100, 1152, 1516, and 1672 for Albian-Biodecal, Albian-Control, Sweet Charlie-Biodecal and Sweet Charlie-Control applications, respectively (Table 2).

After the production costs for runner plants were calculated for Albian-Biodecal, Albian-Control, Sweet Charlie-Biodecal and Sweet Charlie-Control applications, production costs for fresh plug strawberry seedlings were calculated for six different media.

Table 2. Strawberry runner plant production costs

Cost items (TL)	Applications			
	Albian Biodecal	Albian Control	Sweet Charlie Biodecal	Sweet Charlie Control
Ecoflora	50.00	50.00	50.00	50.00
Perlite	70.00	70.00	70.00	70.00
Turf	55.17	55.17	55.17	55.17
Medium preparing labor	25.00	25.00	25.00	25.00
Main plant cost	68.75	68.75	68.75	68.75
Main plant planting labor	12.50	12.50	12.50	12.50
Bacteria fertilizer	10.35	0.00	10.35	0.00
Biodecal application labor	10.00	0.00	10.00	0.00
Liquid manure	0.21	0.21	0.21	0.21
Liquid manure application labor	10.00	10.00	10.00	10.00
Runner plant cut labor for main plant	25.00	25.00	25.00	25.00
Greenhouse rent	60.00	60.00	60.00	60.00
Electricity	9.00	9.00	9.00	9.00
Water	7.50	7.50	7.50	7.50
Total production costs	413.48	393.13	413.48	393.13
Runner plant production (number)	1100	1152	1516	1672
Runner plant production cost (TL/number)	0.376	0.341	0.273	0.235

1 USD=3.02 TL in 2016 (average)

Production costs obtained via Biodecal application for the Albion strawberry seedling in different media are given in Table 3. As can be seen from the Table, whereas the medium with the lowest production cost was KP, the medium with the highest cost was IT. Fresh plug strawberry seedling cost was 0.73TL/unit for KP medium, 0.74TL/unit for OE medium, 0.85 TL/unit for OB medium,0.86 TL/unit for KK medium,0.95 TL/unit for Cnv medium and 1.12 TL/unit for IT medium. The reason why the costs for the seedlings produced in IT medium was greater might be due to the lower efficiency in comparison with other media. When seedling production costs and seedling sales prices were compared according to different media, it was observed that seedling production costs were lower than the seedling sales prices in all media except Cnv and IT. Organic strawberry seedling sales price was taken as 1 TL/unit and conventional seedling sales price was taken as 0.6 TL/unit. Since the price of conventional seedling sales price was lower in comparison with those of the organic seedlings, cost was determined to be greater than sales price. However, it was observed that the organic seedlings produced in KP medium were more advantageous than seedlings produced in other media. Indeed, the profit margin or the strawberry seedling produced in KP medium was determined as 0.27 TL/unit and the ratio of the profit margin to the sales price was determined as 27 %.

The production costs for Albion strawberry seedling obtained via control application are in Table 4. When the seedling production costs for different media were examined, it was observed that the lowest cost was obtained from the KP medium (0.66 TL/unit), whereas the highest production cost was obtained from the Cnv and OB media (0.84 TL/unit). It was determined that the production costs for the Albion strawberry seedling obtained via control application was lower in comparison with seedling prices for all media, however it was determined that the production cost for the seedling produced in the conventional media was greater than the seedling sales price. Therefore, it was determined that KP was the most advantageous medium with regard to profit margin.

Production costs for Sweet Charlie strawberry seedling obtained via Biodecal application are given in Table 5. As can be seen from the table, whereas the medium with the lowest seedling production cost was OE, the medium with the highest production cost was determined as OB. Seedling production cost was determined as 0.63 TL/unit for OE medium, 0.67 TL/unit for KP medium, 0.74 TL/unit for IT medium, 0.79 TL/unit for Cnv medium, 0.81 TL/unit for KK medium and 0.87 TL/unit for OB medium. When the seedling production costs for different media were compared with seedling sales prices, it was determined that seedling production cost was lower in comparison with the seedling sales price in all media except Cnv medium. It

was determined that the profit margin was the highest for Sweet Charlie strawberry seedlings produced via Biodecal application, whereas the medium with the lowest profit margin was determined as OB.

The production costs for the Sweet Charlie strawberry seedlings obtained via the control application with regard to different media have been given in Table 6. Whereas the seedling production cost produced in all media excluding the conventional media were lower than the sales cost, it was calculated that the seedling production cost was greater than the seedling sales price for the conventional media.

Table 3. The production costs of Albion strawberry seedling in different growing media obtained by Biodecal application

Cost item (TL)	**Media**					
	KP	KK	IT	OB	OE	Cnv
Runner plant production cost	31.58	31.58	31.58	31.58	31.58	31.58
Local turf	1.23	1.23	0.00	1.23	1.23	0.00
Import turf	-	-	12.00	-	-	12.00
Clinoptilolite	-	12.00	-	12.00	-	-
Perlite	1.75	-	-	-	1.75	-
Chemical fertilizer	-	-	-	-	-	3.00
Biofarm	-	-	-	0.013	-	-
Ecoflora	-	-	-	-	0.017	-
T22	2.00	2.00	2.00	2.00	2.00	2.00
Mycorrhiza	1.00	1.00	1.00	1.00	1.00	1.00
Medium preparing in viols	2.00	2.00	2.00	2.00	2.00	2.00
Runner plants planting	5.00	5.00	5.00	5.00	5.00	5.00
Viol costs	5.25	5.25	5.25	5.25	5.25	5.25
Bacteria fertilizer	0.72	0.72	0.72	0.72	0.72	0.72
Bacteria fertilizer application labor	2.00	2.00	2.00	2.00	2.00	2.00
Water	0.22	0.22	0.22	0.22	0.22	0.22
Irrigation labor	2.00	2.00	2.00	2.00	2.00	2.00
Electricity	0.27	0.27	0.27	0.27	0.27	0.27
Revolving fund interest	2.20	2.61	2.56	2.61	2.20	2.68
A. Total variable costs	57.22	67.88	66.60	67.89	57.24	69.72
Administrative costs	1.72	2.04	2.00	2.04	1.72	2.09
Greenhouse rent	1.00	1.00	1.00	1.00	1.00	1.00
B. Total fixed costs	2.72	3.04	3.00	3.04	2.72	3.09
C. Total production costs (A+B)	59.94	70.92	69.60	70.93	59.96	72.81
Potted seedling production (number)	82	82	62	83	81	77
Potted seedling production costs (TL/number)	0.73	0.86	1.12	0.85	0.74	0.95
Potted seedling price (TL/number)	1.00	1.00	1.00	1.00	1.00	0.60
Profit margin (TL/number)	0.27	0.14	-0.12	0.15	0.26	-0.35
Profit margin/seedling price*100 (%)	27.00	14.00	-12.00	15.00	26.00	-58.33

Table 4. The production costs of Albion strawberry seedling in different growing media obtained by Control application

Cost itam (TL)	**Media**					
	KP	KK	IT	OB	OE	Cnv
Runner plant production cost	28.64	28.64	28.64	28.64	28.64	28.64
Local turf	1.23	1.23	-	1.23	1.23	-
Import turf	-	-	12.00	-	-	12.00
Clinoptilolite	-	12.00	-	12.00	-	-
Perlite	1.75	-	-	-	1.75	-
Chemical fertilizer	-	-	-	-	-	3.00
Biofarm	-	-	-	0.013	-	-
Ecoflora	-	-	-	-	0.017	-
T22	2.00	2.00	2.00	2.00	2.00	2.00
Mycorrhiza	1.00	1.00	1.00	1.00	1.00	1.00
Medium preparing in viols	2.00	2.00	2.00	2.00	2.00	2.00
Runner plants planting	5.00	5.00	5.00	5.00	5.00	5.00
Viol costs	5.25	5.25	5.25	5.25	5.25	5.25
Bacteria fertilizer	-	-	-	-	-	-
Bacteria fertilizer application labor	-	-	-	-	-	-
Water	0.22	0.22	0.22	0.22	0.22	0.22
Irrigation labor	2.00	2.00	2.00	2.00	2.00	2.00
Electricity	0.27	0.27	0.27	0.27	0.27	0.27
Revolving fund interest	1.97	2.38	2.34	2.38	1.98	2.46
A. Total variable costs	51.33	61.99	60.72	62.01	51.35	63.84
Administrative costs	1.54	1.86	1.82	1.86	1.54	1.92
Greenhouse rent	1.00	1.00	1.00	1.00	1.00	1.00
B. Total fixed costs	2.54	2.86	2.82	2.86	2.54	2.92
C.Total production costs (A+B)	53.87	64.85	63.54	64.87	53.89	66.75
Potted seedling production (number)	82	82	81	77	80	79
Potted seedling production costs (TL/number)	0.66	0.79	0.78	0.84	0.67	0.84
Potted seedling price (TL/number)	1.00	1.00	1.00	1.00	1.00	0.60
Profit margin (TL/number)	0.34	0.21	0.22	0.16	0.33	-0.24
Profit margin/seedling price*100 (%)	34.00	21.00	22.00	16.00	33.00	-40.00

Table 5. The production costs of Sweet Charlie strawberry seedling in different growing media obtained by Biodecal application

Cost item (TL)	**Media**					
	KP	KK	IT	OB	OE	Cnv
Runner plant production cost	22.93	22.93	22.93	22.93	22.93	22.93
Local turf	1.23	1.23	-	1.23	1.23	-
Import turf	-	-	12.00	-	-	12.00
Clinoptilolite	-	12.00	-	12.00	-	-
Perlite	1.75	-	-	-	1.75	-
Chemical fertilizer	-	-	-	-	-	3.00
Biofarm	-	-	-	0.013	-	-
Ecoflora	-	-	-	-	0.017	-
T22	2.00	2.00	2.00	2.00	2.00	2.00
Mycorrhiza	1.00	1.00	1.00	1.00	1.00	1.00
Medium preparing in viols	2.00	2.00	2.00	2.00	2.00	2.00
Runner plants planting	5.00	5.00	5.00	5.00	5.00	5.00
Viol costs	5.25	5.25	5.25	5.25	5.25	5.25
Bacteria fertilizer	0.72	0.72	0.72	0.72	0.72	0.72
Bacteria fertilizer application labor	2.00	2.00	2.00	2.00	2.00	2.00
Water	0.22	0.22	0.22	0.22	0.22	0.22
Irrigation labor	2.00	2.00	2.00	2.00	2.00	2.00
Electricity	0.27	0.27	0.27	0.27	0.27	0.27
Revolving fund interest	1.85	2.26	2.22	2.27	1.86	2.34
A. Total variable costs	48.22	58.88	57.61	58.90	48.24	60.73
Administrative costs	1.45	1.77	1.73	1.77	1.45	1.82
Greenhouse rent	1.00	1.00	1.00	1.00	1.00	1.00
B. Total fixed costs	2.45	2.77	2.73	2.77	2.45	2.82
C. Total production costs (A+B)	50.67	61.65	60.33	61.67	50.69	63.55
Potted seedling production (number)	76	76	82	71	80	80
Potted seedling production costs (TL/number)	0.67	0.81	0.74	0.87	0.63	0.79
Potted seedling price (TL/number)	1.00	1.00	1.00	1.00	1.00	0.60
Profit margin (TL/number)	0.33	0.19	0.26	0.13	0.37	-0.19
Profit margin/seedling price*100 (%)	33.00	19.00	26.00	13.00	37.00	-31.67

Table 6. The production costs of Sweet Charlie strawberry seedling in different growing media obtained by Control application

Cost item (TL)	**Media**					
	KP	KK	IT	OB	OE	Cnv
Runner plant production cost	19.74	19.74	19.74	19.74	19.74	19.74
Local turf	1.23	1.23	-	1.23	1.23	-
Import turf	-	-	12.00	-	-	12.00
Clinoptilolite	-	12.00	-	12.00	-	-
Perlite	1.75	-	-	-	1.75	-
Chemical fertilizer	-	-	-	-	-	3.00
Biofarm	-	-	-	0.013	-	-
Ecoflora	-	-	-	-	0.017	-
T22	2.00	2.00	2.00	2.00	2.00	2.00
Mycorrhiza	1.00	1.00	1.00	1.00	1.00	1.00
Medium preparing in viols	2.00	2.00	2.00	2.00	2.00	2.00
Runner plants planting	5.00	5.00	5.00	5.00	5.00	5.00
Viol costs	5.25	5.25	5.25	5.25	5.25	5.25
Bacteria fertilizer	-	-	-	-	-	-
Bacteria fertilizer application labor	-	-	-	-	-	-
Water	0.22	0.22	0.22	0.22	0.22	0.22
Irrigation labor	2.00	2.00	2.00	2.00	2.00	2.00
Electricity	0.27	0.27	0.27	0.27	0.27	0.27
Revolving fund interest	1.62	2.03	1.98	2.03	1.62	2.10
A. Total variable costs	42.08	52.74	51.46	52.75	42.10	54.58
Administrative costs	1.26	1.58	1.54	1.58	1.26	1.64
Greenhouse rent	1.00	1.00	1.00	1.00	1.00	1.00
B. Total fixed costs	2.26	2.58	2.54	2.58	2.26	2.64
C. Total production costs (A+B)	44.34	55.32	54.00	55.33	44.36	57.22
Potted seedling production (number)	81	83	81	79	84	81
Potted seedling production costs (TL/number)	0.55	0.67	0.67	0.70	0.53	0.71
Potted seedling price (TL/number)	1.00	1.00	1.00	1.00	1.00	0.60
Profit margin (TL/number)	0.45	0.33	0.33	0.3	0.47	-0.11
Profit margin/seedling price*100 (%)	45.00	33.00	33.00	30.00	47.00	-18.33

When the organic media were compared among themselves, OE medium was determined to be the most advantageous medium. Profit margin for the OE medium was determined as 0.47TL/unit,0.45TL/unit for the KP medium,0.33TL/unit for the KK and IT media,0.30TL/unit for the OB medium and -0.11TL/unit for the Cnv medium. The number of plants obtained was the maximum for the OE medium and minimum for the OB medium.

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CONCLUSIONS

In conclusion, it was determined that the cost for a strawberry runner plant was the highest for the Albian Biodecal application and lowest for the Sweet Charlie Control application. The reason why production cost was lower for the Sweet Charlie Control application was that the number of runner plants obtained from unit area was greater in comparison with other applications. Whereas the KP medium had the lowest production cost for the Albion strawberry seedling produced via Biodecal application, IT was determined as the medium with the highest production cost. When a comparison was made with regard to profit margin, KP was determined to have the highest profit margin (0.27TL/unit). The highest profit margin for the Albion strawberry seedling produced via control application was obtained from the KP medium. It was determined that OE was the medium with the highest profit margin for the Sweet Charlie strawberry seedlings produced in different media via Biodecal and control applications, whereas OB was determined as the medium with the lowest profit margin.

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