ECONOMIC ANALYSIS OF DIFFERENT APPLICATIONS OF COMPOSTS OBTAINED FROM SOLID WASTES OF ROSE OIL PROCESSING IN ORGANIC APPLE NURSERY TREE GROWING

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Abstract

In this study, it was aimed to carry out an economic analysis of different applications of composts obtained from solid wastes of rose oil processing (RC) applications in organic apple nursery growing. The data used in the study were obtained from the experiments carried out in the Directorate of Fruit Research Institute of the Ministry of Food, Agriculture and Livestock. According to the results of the research, it was determined that the lowest cultivation cost per apple nursery tree was determined for ERC (50%) (Half dosage of the enriched RC) application and the highest one was for ST (standard application: 50% commercial solid organic manure +50% commercial liquid manure). The cultivation cost per nursery tree was determined as 2.64TL for ERC (50%) application and 3.04 TL for ST application. When a comparison was made in terms of net profit, it was determined that the most advantageous application was RC and ERC (100%). Furthermore, the net profit for the RC and ERC (100%) applications was 7333.9 TL and 7317.9 TL, respectively, and the net profits per nursery tree was 1.87 TL, respectively. In the control application (No nutrient application), net profit per decare was 5434 TL and net profit per nursery tree was 1.64 TL (1 USD=3.02 TL in 2016, average).

Key words: organic nursery tree, compost, rose oil processing wastes, cost, profitability

The climate characteristics and soil structure that Turkey possesses enable many fruit species to be cultivated. The increase in exports have played an important role in the spread of commercial fruit plants. The fruit orchards that are established with healthy nursery trees obtained from standard grafted rootstocks that have adapted to the regional conditions in line with market demands constitute the first step of assurance of efficient and high quality product. Especially, important problems in terms of yield and quality in the following years (Ergun M.E. *et al*, 2000) are encountered in the orchards established with the nursery trees with unknown sources. Fruit growing begins with fruit nursery production. The activities in which all the operations related to the production of fruit nursery trees are performed are called nursery. The nursery trees to be used in fruit orchards for a profitable and economical fruit-growing need to be correct, healthy and standard (Yapıcı M., 1992).

Certified and virus-free fruit nursery trees in Turkey started for the first time in public nursery establishments. The first certified nursery tree production was made in 1991 and the first virus-free nursery tree production in 1994. Until recent years, a considerable part of fruit nursery tree and grapevine sapling production in Turkey has been carried out by public sector enterprises. Today, private sector was in charge of majority of fruit nursery tree production (Gençtan T. *et al*, 2005).

In Turkey, certified fruit nursery tree and grapevine sapling production amounted to 63 842 803 (MFAL, 2017) in 2015 with an increase of about 18 times from 3 513 230 in 2002. According to the data of 2012, apple nursery tree was in the first place with approximately 37% share in certified fruit nursery production. Apple nursery tree are followed by peach with an 8% share and walnut and wine with a 7% share (MFAL, 2014).

The aim of this study is to perform an economic analysis of different composts obtained from solid wastes of rose oil processing (RC) applications in the growing of organic apple nursery tree. For this purpose, it has been determined which application is more profitable by determining the inputs, costs and incomes used in

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the organic apple nursery tree produced according to different RC applications in the study. It is expected that this study will provide information to policy makers, producers of organic apples, and institutions that conduct agricultural publishing work in this regard.

MATERIAL AND METHOD

The study was carried out in Fruit Research Institute located in Eğirdir District of Isparta province. In the study, MM111 apple rootstock and Granny Smith variety grafted in this rootstock were used as plant material. The characteristics of the plant nutrient materials used in the experiment are given in Table 1. Azadirachtin (Neem Azale) and Sulfur (Microthiol Disperss), which is chemicals for pesticide application, were used. The plant nutrients and chemicals for plant protection are in compliance with the Regulation on the Principles of Organic Agriculture and its Implementation (Anonymous, 2010). The experiment was carried out with a total of 6 applications consisting of 5 different nutritional applications and 1 control as specified in Table 2 in organic agriculture. The experiment was run on one decare field with 4000 apple nursery trees. T-grafting technique was used in the production of apple nursery trees and the production took place in 2 years (2015-2016).

Table 1

Properties of plant nutrients used in the trial

	Solid organic manure (Biofarm)	Solid organic manure (Ferbio)	Liquid manure- (Botanica)	Liquid manure (AKC)	Azotobacter (AB)	Enriched RC (solid)	RC (solid)	Solid Organic fertilizer (Karden)	Phosphate rock
pH	6.4-8.5	8.0	3.5-5.5	4.5-6.5	-	9.10	9.10	6-8	-
Organic matter (%)	50	85.8	50	35	-	72.03	72.03	5	-
Total nitrogen (%)	2	2.1	5	4	-	2.52	2.52	-	
Total P_2O_5 (%)	2	0.68	0.1	2	-	1.22	1.22	-	30-32
Water-soluble K_2O (%)	2	1.1	2.3	3	-	2.31	2.31	25	-
The number of Azotobacter sp (number/g)	-	-	-	-	$1x10^{10}$	$1x10^{10}$	-	-	-
$ZnSO_4$ (%)	-	-	-	-	-	0.2	-		-
$FeSO_4$ (%)	-	-	-	-	-	0.2	-	-	-

Table 2

Treatments in the trial

1. AB: Azotobacter application (the whole nitrogen requirement of the plant was planned to be met by a diluted mixture containing $1x10^{10}$/g of azobacter. The missing phosphor was met by phosphofat and the potassium was supplied by organic certified solid organic fertilizer- Karden.
2. ERC (%50): Half dosage of ERC. (It should be noted that RC was enriched with azotobacter, Cu and Fe to obtain ERC). (Half of the nitrogen requirement of the plant was targeted to meet from ERC. The missing phosphor was met by phosphofat and the potassium was supplied by organic certified solid organic fertilizer- Karden.
3. ERC (%100): Full dosage of ERC. (It should be noted that RC was enriched with azotobacter, Cu and Fe to obtain ERC). The requirement of the plant's nitrogen and other nutrients were targeted to meet from the ERC.
4. RC: RC application (The plant's nitrogen and other nutrients were targeted to meet the non-enriched RC
5. ST: Standard application (50% Solid organic manure (the mixture of Biofarm and Ferbio)+50% Liquid manure (the mixture of Botanica and AKC). This was taken into account in the study because it was identified as the most advantageous application in the previous study (Demircan V. *et al,* 2016).
6. Control: No nutrient application

In economic analysis; production costs and indicators of profitability were calculated for five different and control applications in one decare. The data used in the study covered the sum of two years and the production costs were calculated taking into account the physical and monetary amounts of inputs.

Cost elements are grouped into the fixed and variable costs. The variable costs are the costs that depend on the production volume. It emerges as production takes place. Fixed costs do not depend on the amount of production. Such costs arise irrespective of the production. Hereby study takes into account local leasing cost for calculation of machinery expenses used in operations such as ploughing, hoeing, fertilizer and pesticide application. Wages paid to workers in the region have been taken into account in the calculation of labor costs such as fertilization, pesticide application, irrigation, hoeing, planting clone rootstock and grafting. Market values were taken in the calculation of materials such as farmyard manure, drip irrigation material, clone rootstock, graft set, irrigation water and agrochemicals. The market values served as basis for the calculation of cost of materials Interest rate was assumed to be half of the rate employed by Agricultural Bank of the Republic of Turkey for plant cultivation credits (10%). 3% of the total variable costs are considered as general administrative expenses. 5% of net land value was considered as land rent. The interest expense was calculated by taking 1.65% (real interest rate) of the value of irrigation machinery/equipment, which is among the fixed cost elements. As for annual amortization, the rates of 10% and 6.66% were employed for drip irrigation facility and portable pumps, respectively (MF 2014). By means of this calculation, the cost of organic apple nursery trees, which were cultivated on an area of one decare for two years, was determined per decare and per nursery tree.

Gross Production Value (GPV) was found by the multiplication of obtained amount of apple nursery trees with market price. Gross profit was calculated by deduction of variable costs from gross production value, while net profit (per decare and per nursery tree) was calculated though subtraction of cultivation costs from GPV. Since there is no current nursery tree price for organic method in the market to serve as a basis for calculation, conventional cultivation prices were accepted as market price of nursery trees, and the prices were determined depending on quality categories of nursery trees on the market.

RESULTS AND DISCUSSIONS

Quality and healthy nursery tree production is of great importance. The fact that the nursery tree are high quality, healthy and in compliance to the standards is also important in terms of yield and fruit quality. The quality classes and characteristics of the apple nursery tree grown at outdoor conditions are given in Table 3. As Table 3 shows, quality categories of one year-old apple nursery trees are divided in four class as 1st class branched nursery tree, 2nd class branched nursery tree, 1st class whip nursery tree and 2nd class whip nursery tree according to their diameter, height, the number of sub-branches and root structure. The common features of all these classes are as follows: (1) graft location has to be well-integrated, (2) there should be no clamp on graft site, (3) the grafting should be carried out at least 10 cm above soil level (root collar level), and (4) there should be no bulge or disease symptom on graft site.

Table 3

Quality class of one-year-old apple nursery trees grown in the open

Quality class	Nursery tree diameter (Measured 5 cm above the grafting point)	Nursery tree height (Measured the level of the root collar)	Number of Lateral shoots (Between 50-90 cm from the level of root collar)	Root structure
1st class branched nursery tree	$\geq$14 mm	$\geq$150 cm	At least 40 cm long and 6 branches, which is not vertically developed at different directions	At least 20 cm in length and healthy-plenty of branched roots
2nd class branched nursery tree	$\geq$ 12 mm	$\geq$120 cm	At least 35 cm long and 6 branches, which is not vertically developed at different directions	At least 15 cm in length and healthy-plenty of branched roots
1st class whip nursery tree	$\geq$ 12 mm	$\geq$120 cm	Does not include branched nursery tree class in terms of number of lateral shoots	At least 15 cm in length and healthy-plenty of branched roots
2nd class whip nursery tree	$\geq$ 10 mm	80-119 cm	Does not include branched nursery tree class in terms of number of lateral shoots	At least 10 cm in length and healthy-sufficient amount of branched roots

The classification of nursery tree quality according to different plant nutritional applications are given in Table 4. There is no 1st class branched nursery tree among obtained samples; therefore, this category is not shown in Table 4. Besides, in the table, scrap (%) was used in order to show the rates of plants without qualities of nursery tree (plants that do not take graft, that are too small etc.). Data in Table 4 revealed that ST application yielded the highest share of 2nd class branched nursery trees. In ST application, the share of 2nd class branched nursery trees was 13.75%. This was followed by ERC (100%) with share of 12.50%. The application, which generates the highest amount of 1st class whip nursery trees, was ST application with 77.50% and followed by RC application with 76.75% and ERC (100%) application with 75.75% applications. ERC (%50) application yielded the highest amount of 2nd class whip nursery tree with 17.75%. Control group also provided the highest share of scraps, which were excluded from nursery tree classification with 17%.

Table 4

Classification of nursery tree quality based on different treatments

Treatments	2nd class branched nursery tree (%)	1st class whip nursery tree (%)	2nd class whip nursery tree (%)	Scrap (%)
AB	4.00	67.75	13.25	15.00
ERC (%50)	6.25	73.50	17.75	2.50
ERC (%100)	12.50	75.75	9.50	2.25
RC	10.50	76.75	11.00	1.75
ST	13.75	77.50	7.50	1.25
Control	4.50	66.50	12.00	17.00

Table 5 shows cultivation costs of apple nursery trees for different applications. Results showed that Control application provided the lowest total cultivation cost per decare, while ST (solid organic fertilizer + liquid organic fertilizer) leaded to the highest costs, with regard to organic apple nursery tree cultivation. Cultivation cost per decare was found as 9383 TL for Control application and 12042.3 TL for ST application. In ERC (50%) and ERC (100%) applications, nursery tree production costs were determined as 10309.7 TL/da and 10897.1 TL/da, respectively. When the cultivation cost per nursery tree was examined, it was determined that the lowest cultivation cost was ERC (50%) application and the highest production cost was ST application. Production cost per nursery tree was determined as 2.64TL for ERC (50%) application and 3.04 TL for ST application. Similarly, while Tapkı N. *et al*, (2015) determined the cultivation cost as 1.87 TL per fruit nursery tree, Büyükarıkan U. and Gül M., (2014) determined as 2.20 TL per fruit nursery tree. Potted grapevine sapling cultivation cost per nursery tree was determined 1.93 TL by Uysal H. and Ateş F., (2014). Savaş Y., (2013) found cultivation cost as 0.94 TL per grafted grapevine sapling and 0.41 TL per non-grafted grapevine sapling. According to aforementioned findings, the costs per decare and per nursery tree were lower in Control application than in all organic applications. This was primarily because the manure and agrochemicals used in organic practices were more expensive.

Table 6 shows profitability indicators regarding organic apple nursery tree cultivation. As seen in the Table 6, the profitability indicators were calculated per decare and per nursery tree. Multiplication of nursery tree prices with the number of cultivated nursery trees gives GPV. The market price of 2nd class branched nursery trees was taken as 6 TL, while the same for 1st and 2nd class whip nursery trees were priced as 4.5 TL and 3.5 TL, respectively. The highest and the lowest GPV per decare were obtained from ST application and Control applications, respectively. GPV per decare in organic apple nursery tree cultivation was found as 18575 TL for ST and 14820 TL for Control application. The value emerged as 18085 TL/da and 18215 TL/da for RC and ERC (100%) application, respectively. The highest GPV per nursery tree was determined for ST application while that of the lowest was determined for AB application.

When a comparison was made in terms of net profit, it was determined that the most advantageous application was RC and ERC (100%). As a matter of fact, the net profit for the RC and ERC (100%) applications was 7333.9 TL and 7317.9 TL, respectively, and the net profits per nursery tree was 1.87 TL. In the Control application, net profit per decare was 5437 TL and net profit per nursery tree was 1.64 TL. According to these results, it is necessary to support the organic nursery tree producers for the spread of organic apple cultivation. It can be said that the production of organic nursery tree will come to a more advantageous position if the support is given to the producers.

Table 5

Production costs of organic apple nursery tree for different plant nutrition treatments

Cost items (TL/da)	Treatments					
	AB	ERC (%50)	ERC (%100)	RC	ST	Control
Deep plowing	80	80	80	80	80	80
Hoeing (crash of clods)	80	80	80	80	80	80
Rootstock price	3600	3600	3600	3600	3600	3600
Rootstock planting	180	180	180	180	180	180
Fertilizer	331.1	806.8	1350	1215	2389.3	0
Fertilization labor	50	50	50	50	50	0
Hoeing by machine (for weed)	480	480	480	480	480	480
Hoeing by hand (for weed)	720	720	720	720	720	720
Pesticide (sulphur+ neemazal)	456	456	456	456	456	456
Pesticide application labor	112	112	112	112	112	112
Grafting rope	36	36	36	36	36	36
Graft	800	800	800	800	800	800
Water	240	240	240	240	240	240
Irrigation	192	192	192	192	192	192
Electricity	115.2	115.2	115.2	115.2	115.2	115.2
Pinching off	40	40	40	40	40	40
Pull nursery tree up (machine+worker)	495	495	495	495	495	495
Certification fee	25	25	25	25	25	25
Revolving fund interest	401.6	425.4	452.6	445.8	504.5	382.6
A. Total variable costs	8433.9	8933.4	9503.8	9362.0	10595.0	8033.8
Administrative costs	253.0	268.0	285.1	280.9	317.9	241.0
Land rent	770	770	770	770	770	770
The interest of irrigation machines	23.57	23.57	23.57	23.57	24.04	23.57
Depreciation of irrigation machines	314.7	314.7	314.7	314.7	317.4	314.7
B. Total fixed costs	1361.3	1376.3	1393.4	1389.1	1429.3	1349.3
C. Total production costs (A+B) (TL/da)	9795.2	10309.7	10897.1	10751.1	12024.3	9383.0

(1 USD=3.02 TL in 2016, average).

Table 6

Profitability indicators of organic apple nursery tree for different plant nutrition treatments

Profitability indicators (TL/da)	Applications					
	AB	ERC (%50)	ERC (%100)	RC	ST	Control
Nursery tree production (number/da)	3400	3900	3910	3930	3950	3320
Gross production value (TL/da)	15090	17340	18215	18085	18575	14820
Total variable costs (TL/da)	8433.9	8933.4	9503.8	9362.0	10595.0	8033.8
Total production costs (TL/da)	9795.2	10309.7	10897.1	10751.1	12024.3	9383.0
Gross profit (TL/da)	6656.1	8406.6	8711.2	8723.0	7980.0	6786.2
Net profit (TL/da)	5294.8	7030.3	7317.9	7333.9	6550.7	5437.0
Profitability indicators (TL/number)						
Gross production value (TL/number)	4.44	4.45	4.66	4.60	4.70	4.46
Total variable costs (TL/number)	2.48	2.29	2.43	2.38	2.68	2.42
Total production costs (TL/number)	2.88	2.64	2.79	2.74	3.04	2.83
Gross profit (TL/number)	1.96	2.16	2.23	2.22	2.02	2.04
Net profit (TL/number)	1.56	1.80	1.87	1.87	1.66	1.64

CONCLUSIONS

As a result, the highest share of 2nd class branched nursery and 1th class whip nursery tree was determined for ST application. Control group also provided the highest share of scraps, which were excluded from nursery tree classification with 17%. When the cultivation cost per nursery tree was examined, it was determined that the lowest cultivation cost was ERC (50%) application and the highest cultivation cost was ST application. When a comparison was made in terms of net profit, it was determined that the most advantageous application was ERC (100%) and RC. To promote organic apple growing, it is necessary to support the organic nursery tree producers and to educate and publish about the apple nursery tree growing. It can be said that the production of organic nursery tree will be more advantageous if they are supported by incentive mechanisms by Ministry of Food, Agriculture and Livestock.

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