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Economic considerations of using different types of organic manure on sweet pepper yield under protected cultivation

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ABSTRACT: An experiment was conducted at El-Bossily Protected Cultivation Experimental Farm, Central Laboratory for Agricultural Climate (CLAC), Agricultural Research Center (ARC), at Behaira Governorate, Egypt, *during the* autumn seasons of 2010/2011 and 2011/2012 to study the Economic considerations of using different types of organic manure on sweet pepper yield under protected cultivation (Vermicompost, compost and Cattle manure at the rates of 2, 4 and 6% (1.8, 3.6 and 5.4 m^3/plastic house of 540m^2) were the organic fertilizer treatments. The study aimed to investigate increasing organic soil matter content in sandy soil via different rates and types of soil amendments as well as investigate their effects on vegetative growth and yield of sweet pepper using a split plot design with three replicates. Results obtained indicate that the increasing rate of the different soil amendments from 1.8 to 5.4 m^3/plastic houses led to increase in vegetative growth and significantly enhanced early and total yield of sweet pepper. The benefit cost ratio (BCR) was maximum (1.67) in the treatment of vermicompost (4%), whereas the minimum (1.23) benefit cost ratio was obtained from cattle manure (2%) treatment in the first season. The benefit cost ratio (BCR) was maximum (1.72) in the treatment of vermicompost (4%), whereas the minimum (1.16) benefit cost ratio was obtained from compost (2%) treatment in the second season.

KEYWORDS: Benefit Costs ratio, Compost, Gross margin, Sweet paper, Vermicompost, Yield.

1 INTRODUCTION

Presented studies on sweet pepper plants grown under polyethylene tunnel and supplied with cattle, pigeon, chicken manure and town refuse at 3-levels of each; 2, 4 or 6 m^3/house (540 m^2/ house) combined with or without the addition of chemical fertilizers. Results showed that, addition of pigeon or chicken manure increased plant vegetative growth; plant height, number of leaves, total leaf area, chlorophyll content, fresh and dry weight of whole plant and its organs. All vegetative growth parameters were increased with increasing the level of organic manure (from 2 up to 6 m^3.

Vermicompost is also thought to be more pathogen free than compost (Szczech, 1999) and has the ability to suppress plant disease (Szczech, 1993). Studies at the Ohio Agricultural Research and Development Center on soils under strawberries and grapes observed a larger population of fungivorous and bacterivorous nematodes in soils where vermicompost was applied than in soils with inorganic fertilizer treatments (Arancon et al., 2002).

Nevertheless, the most remarkable differences among compost and vermicompost are related to their biological properties. Composting and vermicomposting are two rather different biological processes which strongly condition the biological properties of the final substrate resulting in important differences among compost and vermicompost both in the bacterial community composition (Vivas et al., 2009)

Sustainable agriculture needs sustained support of organic fertilizers and good practices of organic wastes. Vermicomposting and composting secure friendly environment, recycling of organic wastes and creates the base for offering high nutrients value compost for sustainable agriculture. The main objective of this study is to assess the economic considerations of using different types of organic manure on some vegetable crops yield under protected cultivation.

2 MATERIAL AND METHOD

The study was conducted out in two successive autumn seasons of 2010/2011 and 2011/2012 at El-Bossily Protected Cultivation Experimental Farm, Central Laboratory for Agricultural Climate (CLAC), Agricultural Research Center (ARC), at Behaira Governorate, Egypt. The location of the experimental site was at 31° 40' N; 30° 40' E longitudes with an elevation of three meters from the sea level. Soil of the study site was sandy soil. After vermicomposting and composting processes were done, field experiment was carried out in sandy soil under unheated single span plastic house to investigate the effect of different types of organic fertilizers (vermicompost, compost and cattle manure and rates (1.8, 3.6 and 5.4 m^3/plastic house) compared to cattle manure (3.6 m^3/plastic house as a control) on soil organic matter content, vegetative growth and yield of sweet pepper. The different rates of vermicompost, compost and cattle manure were applied to the soil two weeks before the cultivation of the summer sweet pepper (to prevent any damage or burning to the plants) through the preparation of soil as a base fertilizer. Sweet pepper (*Capsicum annum* L.), cv. Godion F1 seeds were sown on 2^{th} and 6^{th} July 2010 and 2011 respectively, in polystyrene trays. After the fifth true leaf stage, the transplants were planted in an unheated single span plastic house (9 m width, 60m length and 3.5m height). Sweet pepper seedlings were placed in double rows. The final plant spacing was 50 cm in the row, 60 cm between the rows and 70 cm in between the beds.

The benefit cost analysis (BCA), as an economic analysis tool for decision making project evaluation, was chosen as the most appropriate economic method to use. BCA is a widely used tool for comparing alternative courses of action by reference to the net benefits that they produce, and comparing a base case (no change) with the proposed option.

BCR's for multiple projects can be compared to determine which project has a higher economic return relative to the others with higher BCR's indicating higher return.

3 RESULTS AND DISCUSSION

THE EFFECT OF DIFFERENT TYPES AND RATES OF SOIL AMENDMENTS ON YIELD

The results of implementing different soil amendments types and rates on early and total yield (kg/plant) of sweet pepper are presented in Table (1). There were significant differences among soil amendments treatments. Vermicompost recorded the highest values of early and total yield in both seasons while there is no significant difference between compost and cattle manure applications.

However, increasing the rate of different soil amendments from 2 to 4 % led to significant increase in early and total yield of sweet pepper while increasing the rate from 4 to 6 % did not have the same effect on early and total yield of sweet pepper as illustrated in Table (1). These results could create a good recommendation increasing organic soil matter; it's not an open operation for increasing the yield. Increasing the organic soil matter could had a negative economic impact through the cost of organic fertilizer and the economic impact of the increasing the rate of organic fertilizers.

The results of Table (1) showed the interaction effect of organic fertilizer types and rates on early and total yield of sweet pepper. The data indicated that the treatment of vermicompost at the rate 4% recorded the highest values of early and total yield of sweet pepper followed by vermicompost at the rate 6 % while the lowest results gave by compost at 2%.

Table 1. Effect of organic fertilizer treatments and rates on early and total yield (kg/plant) of sweet pepper

Treatment	Organic rate	First season		Second season	
		Early yield (kg / plant)	Total yield (kg / plant)	Early yield (kg / plant)	Total yield (kg / plant)
Vermicompost	2 %	0.96 b	3.84 b	1.04 b	4.14 b
	4 %	1.14 a	4.57 a	1.34 a	5.38 a
	6 %	1.03 b	4.11 b	1.14 ab	4.58 ab
Compost	2 %	0.87 c	3.48 c	0.91 c	3.66 c
	4 %	0.94 bc	3.76 bc	1.01 b	4.04 b
	6 %	0.98 b	3.92 b	1.15 ab	4.59 ab
Cattle manure	2 %	0.87 c	3.46 c	0.95 c	3.78 c
	4 %	0.92 bc	3.69 bc	0.99 bc	3.94 bc
	6 %	0.97 b	3.87 b	1.05 b	4.21

Source: (Abul-Soud M. et al., 2014)

Table 2 shows the total cost of production per greenhouse (540m^2) of sweet pepper in current prices, during the first season.

- The value of plastic reached the first place of the cost structure for all treatment, with relative importance of about 23.58% in vermicompost treatment, 22.91% in compost treatment and 22.66% in the cattle manure treatment of the total cost for the greenhouse. Whilst the value of soil sterilization and transplants in second place at a rate of about 22.11% in vermicompost treatment, 21.47% in compost treatment and 21.25% in the cattle manure treatment of the total cost for the greenhouse during the same period. The costs of temporary labor came in the third place at the rate around 10.32% in vermicompost treatment, 11.45% in compost treatment and 14.16% in the cattle manure treatment, of total cost per greenhouse.

Table 3 shows the total cost of production per greenhouse (540m^2) of sweet pepper in current prices, during the second season.

- The value of plastic and transplanting came in the first place of the cost structure for the treatment of vermicompost, which amounted to the relative importance of about 22.79%, 22.16% in compost treatment and 21.93% in the cattle manure treatment of the total cost for the greenhouse, while the value of soil sterilization in the second place at the rate of 21.37% in vermicompost treatment, 20.78% in compost treatment and 20.56% in the cattle manure treatment from the total cost for the greenhouse. The costs of temporary labor came in the third place at the rate around 10.68% in vermicompost treatment, 11.77% in compost treatment and 14.39% in the cattle manure treatment of total cost per greenhouse.

Table 2. Total costs of production analysis of sweet pepper due to Vermicompost, compost, and cattle manure treatments First season (540m^2)

Treatment combination	Land preparation LE	Transplants LE	Irrigation LE	Chemicals LE	Manure LE	Insecticides LE	Labor LE	Threads and pillars LE	Plastic LE	Maintenance LE	Sterilization LE	T. variable costs LE
Vermicompost												
2 %	45	1500	190	450	100	450	700	150	1600	100	1500	6785
4 %					200							6885
6 %					300							6985
Compost												
2 %	45	1500	190	450	200	450	800	150	1600	100	1500	6985
4 %					400							7185
6 %					600							7385
Cattle manure												
2 %	45	1500	190	450	75	450	1000	150	1600	100	1500	7060
4 %					150							7135
6 %					225							7210

Table (3): Total costs of production analysis of sweet pepper due to Vermicompost, compost, and cattle manure treatments second season (540m^2)

<table>
<tr><th>Treatment combination</th><th>Land preparation LE</th><th>Transplants LE</th><th>Irrigation LE</th><th>Chemicals LE</th><th>Manure LE</th><th>Insecticides LE</th><th>Labor LE</th><th>Threads and pillars LE</th><th>Plastic LE</th><th>Maintenance LE</th><th>Sterilization LE</th><th>T. variable costs LE</th></tr>
<tr><td>Vermicompost</td><td rowspan="4">55</td><td rowspan="4">1600</td><td rowspan="4">190</td><td rowspan="4">480</td><td></td><td rowspan="4">475</td><td rowspan="4">750</td><td rowspan="4">170</td><td rowspan="4">1600</td><td rowspan="4">100</td><td rowspan="4">1500</td><td></td></tr>
<tr><td>2 %</td><td>100</td><td>7020</td></tr>
<tr><td>4 %</td><td>200</td><td>7120</td></tr>
<tr><td>6 %</td><td>300</td><td>7220</td></tr>
<tr><td>Compost</td><td>55</td><td>1600</td><td>190</td><td>480</td><td></td><td>475</td><td>850</td><td>170</td><td>1600</td><td>100</td><td>1500</td><td></td></tr>
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<tr><td>Cattle manure</td><td>55</td><td>1600</td><td>190</td><td>480</td><td></td><td>475</td><td>1050</td><td>170</td><td>1600</td><td>100</td><td>1500</td><td></td></tr>
<tr><td>2 %</td><td></td><td></td><td></td><td></td><td>75</td><td></td><td></td><td></td><td></td><td></td><td></td><td>7295</td></tr>
<tr><td>4 %</td><td></td><td></td><td></td><td></td><td>150</td><td></td><td></td><td></td><td></td><td></td><td></td><td>7370</td></tr>
<tr><td>6 %</td><td></td><td></td><td></td><td></td><td>225</td><td></td><td></td><td></td><td></td><td></td><td></td><td>7445</td></tr>
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TOTAL COST OF PRODUCTION:

The total cost of production for the sweet pepper under greenhouses in the first season ranged from 7385 to 6785 Egyptian pound (LE) per greenhouse among the different treatment combinations (Table 2). The variation was due to different cost of different types of organic manure and labour wages. The highest cost of production was involved in compost (6%) and the lowest cost of production was involved in vermicompost (2%).

The total cost of production for the sweet pepper under greenhouses in the second season ranged from 7620 to 7020 Egyptian pound per greenhouse among the different treatment combinations (Table 3). The variation was due to the different costs of different types of organic manure and labour wages. The highest cost of production was involved in compost (6%) and the lowest cost of production was involved in vermicompost (2%).

GROSS RETURN

The gross return from the different treatment combinations in the first season ranged between 11516 and 8719 Egyptian pound per greenhouse among the different treatment combinations (Table 4). The highest gross return 11516 Egyptian pound per greenhouse was involved in vermicompost (4%) and the lowest cost of production 8719 Egyptian pound per greenhouse was involved in cattle manure (2%).

The gross return from the different treatment combinations in the second season ranged between 12266 and 8345 Egyptian pound per greenhouse among the different treatment combinations (Table 4). The highest gross return 12266 Egyptian pound per greenhouse was involved in vermicompost (4%) and the lowest cost of production 8345 Egyptian pound per greenhouse was involved in compost (2%).

Table (4): Total cost of production and gross return analysis of sweet paper due to Vermicompost, compost, and cattle manure treatments (540 m^2)

	First season					second season				
Treatment combination	Total yield ton	Total V. cost of production LE	Gross return LE	Gross margin LE	BCR	Total yield ton	Total V. cost of production LE	Gross return LE	Gross margin LE	BCR
Vermicompost										
2 %	4.608	6785	9677	2892	1.43	4.968	7020	9439	2419	1.34
4 %	5.484	6885	11516	**4631**	**1.67**	6.456	7120	12266	**5146**	**1.72**
6 %	4.932	6985	10357	3372	1.48	5.496	7220	10442	3222	1.45
Compost										
2 %	4.176	6985	8770	1785	1.26	4.392	7220	8345	**1125**	1.16
4 %	4.512	7185	9475	2290	1.32	4.848	7420	9211	1791	1.24
6 %	4.704	7385	9878	2493	1.34	5.508	7620	10465	2845	1.37
Cattle manure										
2 %	4.152	7060	8719	**1659**	1.23	4.536	7295	8618	1323	1.18
4 %	4.428	7135	9299	2164	1.30	4.728	7370	8983	1613	1.22
6 %	4.644	7210	9752	2542	1.35	5.052	7445	9599	2154	1.29

Farm gate price per ton in the first season = 2100 Egyptian pound (LE)

Farm gate price per ton in the second season = 1900 Egyptian pound (LE)

GROSS MARGIN

The gross margin from the different treatment combinations in the first season ranged between 4631 and 1659 Egyptian pound per greenhouse (Table 4). The highest gross margin 4631 Egyptian pound per greenhouse was involved in vermicompost (4%) and the lowest gross margin 1659 Egyptian pound per greenhouse was involved in cattle manure (2%).

The gross return from the different treatment combinations in the second season ranged between 5146 and 1125 per greenhouse (Table 4). The highest gross margin 5146 Egyptian pound per greenhouse was involved in vermicompost (4%) and the lowest gross margin 1125 Egyptian pound per greenhouse was involved in compost (2%).

BENEFIT COST RATIO

The benefit cost ratio (BCR) from the different treatment combinations in the first season was found to be the highest (1.67) in the treatment combination vermicompost (4%) and the lowest BCR (1.23) was recorded from cattle manure (2%) combination.

The benefit cost ratio (BCR) from the different treatment combinations in the second season was found to be the highest (1.72) in the treatment combination vermicompost (4%) and the lowest BCR (1.16) was recorded from compost (2%) combination.

4 CONCLUSION

The yield was significantly influenced due to organic fertilizer treatments and rates. The highest marketable yield (4.57 kg/ plant in the first year and 5.38 kg/plant in second year) was found from the vermicompost (4%) treatment. The cost and return analysis indicated that the highest BCR (1.67) was obtained from vermicompost (4%) treatment in first year and (1.72) was obtained from the same treatment in the second season. Consequently, from the present study it may be suggested that the higher yield and economic return of sweet pepper could be obtained by cultivating the crop with vermicompost (4%).

REFERENCES

[1] Abul-Soud M.; M. A. Abdrabbo and A. A. Farag, 2014. Increasing soil organic matter content as a key factor for sustainable production of sweet pepper. International Journal of Plant & Soil Science 3(6): pp. 707-723.

[2] Arancon, N.Q., Edwards, C.A., Bierman, P., Metzger, J.D., Lee, S., Welch, C., 2003. Effects of vermicomposts on growth and marketable fruits of field-grown tomatoes, peppers and strawberries: The 7th international symposium on earthworm ecology, Cardiff, Wales, 2002. Pedobiologia 47, pp. 731-735.

[3] Douthwaite, B., Manyong, V.M., Keatinge, J.D.H., Chianu, J., 2002. The adoption of alley farming and Mucuna: lesson for research, development and extension. Agroforestry Systems 56, pp. 193-202.

[4] Saïdou, A., Kuyper, T.W., Kossou, D.K., Toussou, R., Richards, P., 2004. Sustainable soil fertility management in Benin: learning from farmers. NJASWageningen Journal of Life Sciences 52, pp. 349-369.

[5] Szczech, M., Rondomanski, W., Brzeski, M.W., Smolinska, U., Kotowski, J.F., 1993. Suppressive effect of commercial earthworm compost on some root infecting pathogens of cabbage and tomato. Biological Agriculture and Horticulture 10, 47-52.

[6] Szczech, M.M., 1999. Suppressiveness of vermicompost against Fusarium wilt of tomato. Journal of Phytopathology 147, pp. 155-161.

[7] Vivas A., Moreno B., García-Rodríguez S., Benítez, E., 2009. Assessing the impact of composting and vermicomposting on bacterial community size and structure, and microbial functional diversity of an olive mill waste. Bioresource Technol 100, 1319-1326.