Coconut Fiber Geo-Textile Net As Shading Material for Anthurium

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Abstract

Plastic net is commonly used as shading material for anthurium because it is readily available in the market though it is synthetic, expensive, and non-biodegradable. Geo-textile net on the other hand, is a recycled waste product from coconut, used for erosion control and bio-engineering needs known for high strength, and bio-degradable and ornamental plant growers are interested to use this as natural shade for anthurium. In this paper we determine the effect of Coconut fiber geo-textile net as shading material for anthurium, by looking into its economic viability and anthurium life span vis-à-vis the effect of plastic net in the same environment. Baguio Red anthuriums were planted in plastic bags using chopped coconut husk as soil medium. Randomized Complete Block Design was used; it was replicated three times with 10 plants per treatment. Results show that the number of suckers, leaves and flowers produced, width of the flowers and the temperature received by the plants, are comparable when both materials were used, this inform us that geo-textile can replace plastic net. However, the geo-textile net has lower return of investment (ROI) than plastic net. In terms of life span of the materials, the plastic net has longer life duration than the geo-textile net. This result may suggest to the horticulturist to use geo-textile net for the shade it offers is comparable to plastic net.

Keywords: coconut fiber, geo-textile net, plastic net

Anthurium (Anthurium andreanum Lind.) is traditionally grown under natural shade like banana plantation, trees and forest canopy. The disadvantage of natural shade is light heterogeneity that for it damages the growth of the leaves and the flowers, and pests and diseases harbor in the canopy (Dufour & Guerin, 2003). Artificial shade has been developed for the past years, but the choice of the shade net remains empirical; the physiological attributes to the plants is quite uncertain. Only can shade promote vigorous growth and flowering of anthurium, (Sunday Times, 2010). Further, the ideal flower characteristics, long stalk length, and large spathe can be obtained when the anthurium is grown in the shade. The light requirement for anthurium ranges from 60-75% shade or three to four layers of plastic net (Bureau of Agricultural Research, 2012) and a relative humidity requirement of 60-80% (Indian Council of Agricultural Research (ICAR), 2013).

Anthurium is a shade loving plant; thus, proper provision of light and shade is very important. Plastic net is quite expensive and the life span of the net is 2-3 years. As an alternative to plastic net as shading material for Anthurium, geo-textile net as one of the by-product of coconut is beneficial.

The University Extension and Development Center (UEDC) conducts research funded by World Bank on coconut by-products. The geo-textile net is owned by the cooperative of small farmers in Tubungan, Iloilo. The result of this study will benefit the small coconut farmers in Region VI.

Coco coir is a coarse, short fiber extracted from outer shell of coconuts. It has low decomposition which is a key advantage for making it into durable geo-textile. When woven into geo-textiles and placed on areas in need of erosion control, it promotes new vegetation by absorbing water and preventing top soil from drying out. Coir geo-textiles have a natural ability to retain moisture and protect the plants from the sun's radiation just like natural soil (Food and Agriculture Organization of the United States, 2015).

Geo-textile derived its name from two words "geo" and "textiles", therefore, the term means the use of fabric in association with the earth (Waldron, 2014). It is made of natural coco fiber and used for revegetation, and all soil bio-engineering needs such as slope stabilization, soil conditioning, soil erosion prevention, and hydroseeding.

Geo-textiles made from coco coir are durable, water absorbent, sunlight resistant, pro-seed germination and 100% biodegradable. They provide heavy duty performance for 3-5 years (Coir-Green, 2013).

The typical life span for the entire coconut fiber product is from 2 to 5 years. Life span may vary slightly depending on location. The use of natural coconut fiber has grown rapidly over the past decade due to the effectiveness and 100% biodegradable rate. Unlike synthetic material, coconut fiber will not harm wildlife or surrounding ecosystem (Granite Environmental, Inc., 2015)

As improved technology increases production, industry groups and government agencies are actively promoting new uses of coir fiber. Geo-textile is one promising area. The Indian State of Kerala designated 2000 as Coir Geo-textile Year, which was observed by increasing marketing efforts and supporting research to improve production. Preferences for natural products and return to nature movement opened new opportunities for natural fiber-based geo-textiles including coir. Coir is chosen because it has properties that are superior among others. Coir geo-textiles are 100% natural and biodegradable. They have ability to adjust to specific requirements, high tensile strength, and to protect the surface from heavy objects flowing movements (World COIR the Eco-Friendly Product, 2010).

The Department of Public Works and Highways (DPWH) (2011) started promoting "green" engineering using environment- friendly indigenous materials and bio-engineering technology. DPWH Sec. Singson ordered the conduct of the training to teach DPWH project engineers on the use of coconut fibres/coconet erosion control materials as bio-engineering measure to properly apply this new technology in government on-going and future projects. Singson said coco-fiber products can be used as coconut fiber materials or coconet for soil conditioning and erosion control waste protection and forestry re-vegetation, ultraviolet (UV) protection for underground crops, rooftop landscaping, protection from wing erosion and wetland environment, plants and tree protective systems, etc. Coir geo-textiles are currently used in erosion control measures such as growing of vegetation on highway shoulders and embankments and in protecting the bank of lakes, canals and rivers (Maxima, 2006).

The great important contribution of using geo-textile net in this study is that it is organic and not harmful to the environment. It is well suited to the world demand for an environment friendly product (Charankattu Coir Mfg Co P Ltd, 2009).

Today our climate is very unpredictable. Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) declared early El Nino starting October 2015 to May 2016. El Niño occurs due to climate change. Our ozone layers are already affected by improper burning of non-biodegradable or synthetic materials. At present there is a need to return to the use of organic materials like geo-textile net.

The use of geo-textile net will benefit the ornamental plant growers for having an alternative material made from waste material of coconut husk which is natural, biodegradable, environmental, and friendly (JMJ Traders, 2015) and will benefit the coconut farmers in Tubungan, Iloilo in terms of economic gains. Geo-textile net will be supplied by Small Coconut Growers Multi-Purpose Cooperative in Tubungan, Iloilo for they have Coco Fiber factory that started in 2007 and where West Visayas State University had a project on Coco Fiber Production funded by UNDP-PATLEPAM. During the conduct of the study, the Coco Fiber factory in Tubungan is the sole supplier of geo-textile net here in Region VI, thus the price is not regulated. So, geo-textile net used by landscapers, in landscaping the coal fired power plant vicinity are bought from Cebu.

The University Extension and Development Center (UEDC) display and sell products developed by coconut farmers through the Technology Promotion Center. From the different products developed, it has been observed that a number of ornamental plant growers are interested in the geo-textile net, and they are considering it as a shading material for ornamental plants. The WVSU Ornamental garden is presently using 2-3 layers of plastic net as sun-breaker to the shade loving plants, specifically Anthurium although it is quite expensive and replaceable every 2-3 years. Plastic nets are commonly used by ornamental plant growers as shading materials for anthurium because it is readily available in the market, but it is quite expensive, synthetic, and hazardous to health. The low cost of natural fibres, and the growing concern over the impact of the use and disposal of synthetic materials have recently led to a renowned interest in the possible advantages of natural geo-textiles (Babu & Beena, 2007).

Considering the potential of this coconut by-product and in collaboration with the UEDC, the paper aims to determine the effect of Coconut Fiber Geo-textile net and plastic net as shading material of Anthurium in terms of: flower production, length and width of flower, size of flower and sucker production, and the economic viability of geo-textile net compared to plastic net in terms of the life span of the two shading materials.

Methodology

This study was conducted in the existing university ornamental garden covering about 110 square meters.

Experimental Treatment and Design

The treatments involved the number of layers of geo-textile net and plastic net as shading materials for Anthurium. One hundred fifty (150) established plants of Baguio Red anthurium were planted in plastic bags measuring 18 cm x 18 cm x 25 cm x 0.05 cm filled with chopped coconut husk.

The treatments were:

T1 = Geo-textile net (1 layer); T2 = Plastic net (1 layer); T3 = Geo-textile net (2 layers); T4 = Plastic net (2 layers; net (1 layer each); T5 = Geo-textile net and plastic

The experimental area was laid out in a Randomized Complete Block Design (RCBD) with 5 treatments replicated 3 times with 10 sample plants per treatment per replicate. Bags were spaced 50 cm x 50 cm x 100 cm apart in an experimental area of 110 sq m.

Preparation of the Experimental Area

The experimental area was cleared with other ornamental plants. Steel bars were used for the attachment of plastic net for roofing. Geo-textile net and plastic net were attached to the chicken wire in a flat position in order to have an equal chance of sunlight exposure.

Care and Maintenance of the Plants

Established anthurium plants were grown under the shade using geo-textile net and plastic net according to the different treatments used to protect the plants from direct sunlight. To maximize the limited area, each treatment was measured 3 m x 1 m per treatment.

Watering was done twice a day during sunny days to keep the plants from rooting medium moist. Anthurium requires a high relative humidity and plenty of water.

Desuckering was done every month to maintain single stem of the mother plant. Leaves were pruned leaving four fully expanded leaves to keep disease and insect damage to a minimum, and to induce the plant to flower.

All experimental plants were applied with fertilizer using triple 14 (14-14-14) and Urea (46-0-0) every 45 days at the rate of 5 grams per plant.

The data gathered were length and width of leaves, number of leaves produced, number of cutflowers, length and width of flowers, number of suckers produced, number of growing and flowering cycles/years the net is usable, temperature data, cost and return analysis.

Results and Discussion

This study on coconut fiber geo-textile net as shading material for anthurium was determined utilizing the following parameters.

Length of Leaves

The length of leaves, measured lengthwise (with a reference on the longest leaves) and gathered every two months using the second last opened leaves, is presented in Table 1. The average length of leaves of Anthurium is at 12MAP (month after planting) or Year 1 and shows no significant differences among the treatment means, same as with the 24MAP or year 2, however there are highly significant differences on the means at 34MAP or Year 3. Computing the 3-year period T_3 (Geo-textile net 2 layers) and T_4 (2 layers of plastic net) numerically have the longest leaves (21.41 cm and 21.2 cm, respectively, followed by T_5 (Geo-textile net and Plastic net), 19.84 cm. At 34 months, the geo-textile net got torn; this affected the size of the leaves. The result of blocking is highly significant because year 3 resulted to a highly significant differences with different treatments used.

Table 1

Average Length (cm) of Leaves of Anthurium per Plant per Year Starting from Two Months to 34 Months

Treatment	Age of the Plants				
	Year 1[a]	Year 2[a]	Year 3[b]	Total	Mean
T_1 = Geo-Textile net (1 layer)	18.30	19.29	19.28	56.87	18.96
T_2 = Plastic net (1 layer)	17.49	19.58	19.42	56.48	18.83
T_3 = Geo-Textile net (2 layers)	17.96	23.23	23.04	64.23	21.41
T_4 = Plastic net (2 layers)	17.50	20.66	25.65	63.81	21.27
T_5 = Geo-Textile net and Plastic Net (1 layer each)	18.92	20.00	20.61	59.53	19.84

Note: Values with the same superscript are not significantly different.
C. V. = 11.59%.

Width of Leaves

The widest point of the second last opened leaves is the reference in measuring the width. The result of the width of leaves is almost the same as to the length of leaves. The treatment means are not statistically different from each other in year 1 and 2 but in year 3 the treatments with widest leaves are T_4 (Plastic net 2 layers), T_3 (Geo-textile net 2 layers) and T_5 (Geo-textile net and plastic net 1 layer each) with 12.88 cm, 12.66 cm and 11.98 cm, respectively.

Table 2

Average Width (cm) of Leaves of Anthurium per Plant per Year Starting Two (2) Months to 34 Months from Planting

Treatment	Year 1[a]	Year 2[a]	Year 3[b]	Total	Mean
T_1 = Geo-Textile net (1 layer)	11.03	12.22	11.64	34.89	11.63[b]
T_2 = Plastic net (1 layer)	11.08	11.86	11.85	34.79	11.60[b]
T_3 = Geo-Textile net (2 layers)	11.49	12. 60	13.90	37.99	12.66[a]
T_4 = Plastic net (2 layers	11.53	13.08	14.04	38.65	12.88[a]
T_5 = Geo-Textile net and Plastic Net (1 layer each)	11.23	12.42	12.30	35.95	11.98[ab]

Note: Values with the same superscript are not significantly different.
C. V. = 4.20%.

Number of Leaves Produced

Leaves were gathered every 2 months. Last opened leaves were marked with paint to avoid double counting. Results shown in Table 3, reveal that the average number of leaves is increasing from first year to second year; however, in the third year, in T_1 (Geo-textile net 1 layer) and T_2 (Plastic net 1 layer), the number of leaves slightly decreased. Maybe, the one layer of net used affected the production of leaves. However, for T_4 (Plastic net 2 layers), T_3 (Geo-textile net 2 layers) and T_5 (Geo-textile net and plastic net 1 layers each) the production of leaves increased, statistically higher compared to the other treatments with 5.27, 5.08 and 5.05 leaves produced per plant per year, respectively.

Table 3

Average Number of Leaves Produced per Plant per Year of Anthurium from Two Months to 34 Months Old

Treatment	Year 1[a]	Year 2[a]	Year 3[b]	Total	Mean
T_1 = Geo-Textile net (1 layer)	4.98	5.00	4.96	14.94	4.98[b]
T_2 = Plastic net (1 layer)	4.35	4.73	4.70	13.78	4.59[c]
T_3 = Geo-Textile net (2 layers)	5.03	5.14	5.08	15.25	5.08[ab]
T_4 = Plastic Net (2 layers)	5.14	5.17	5.50	15.81	5.27[a]
T_5 = Geo-Textile net and Plastic Net (1 layer each)	4.97	5.07	5.11	15.15	5.05[ab]

Note: Values with the same superscript are not significantly different.
C. V. = 6.10%.

Number of Flowers

Flower production is an indicator how effective is the treatment used in the research study. Each treatment started to produce flowers at 13 months after planting (MAP). The flowers are harvested weekly in each treatment. Flower produced per plant per year ranges from 3.56 to 6.04 (in Table 4). T_3 (Geo-textile net 2 layers) and T_4 (Plastic net 2 layers) got the highest number of flowers 6.04 and 5.80 respectively. A minimum of 6 flowers per plant per year of Anthurium is acceptable to commercial cut flower production (PinoyBisnes Ideas, 2013). But the results are not significantly different from T_5 (geo-textile net and plastic net 1 layer each) and T_2 (Plastic net 1 layer). T_1 (Geo-textile net 1 layer) produced the lowest number of flowers. In this study the life span of geo-textile net is up to 34 months only.

Table 4

Average Number of Flowers of Anthurium Produced per Plant per Year Starting from 13 Months

Treatment	Year 2[a]	Year 3[c]	Total	Mean
T_1 = Geo-Textile net (1 layer)	3.13	3.99	7.12	3.56[b]
T_2 = Plastic net (1 layer)	4.36	4.40	8.76	4.38[ab]
T_3 = Geo-Textile net (2 layers)	5.83	6.25	12.08	6.04[a]
T_4 = Plastic net (2 layers)	4.76	6.84	11.60	5.80[a]
T_5 = Geo-Textile net and Plastic Net (1 layer each)	3.97	4.94	8.91	4.46[ab]

Note: Values with the same superscript are not significantly different.
C. V. = 12.88%.

Length of Flowers

The length of flowers is measured lengthwise before harvesting the flowers. T_3 (Geo-textile net 2 layers) got the longest flowers, 9.06 cm followed by T_4 (Plastic net 2 layers) 8.65 cm. T_2 (Plastic net 1 layer) each produced the shortest flower with 7.87 and T_1 (Geo-textile net 1 layer) 8.06 cm.

Table 5

Average Length (cm) of Flowers of Anthurium Produced per Plant per Year Starting from 13 to 34 Months

Treatment	Year 1[a]	Year 2[c]	Total	Mean
T_1 = Geo-Textile net (1 layer)	7.54	8.58	16.12	8.06[cd]
T_2 = Plastic net (1 layer)	7.43	8.26	15.69	7.87[d]
T_3 = Geo-Textile net (2 layers)	8.60	9.51	18.11	9.06[a]
T_4 = Plastic net (2 layers)	7.96	9.34	17.30	8.65[b]
T_5 = Geo-Textile net and Plastic Net (2 layers each)	7.76	8.67	16.43	8.22[c]

Note: Values with the same superscript are not significantly different.
C. V. = 2.7%.

Width of Flowers

The average width of flowers was computed by year (Table 6 and Table 7). The result shows that T_3 (Geo-textile net 2 layers) produced the widest flowers but it is comparable to T_4 (2 layers of plastic net) and T_5 (Geo-textile net and plastic net 2 layers each).

Table 6

Average Width of Flowers of Anthurium Produced per Plant per Year for the Period of May 2013 – April 2014 (2nd year from Planting, 13 to 24 Months)

Treatment	Replication			Total	Mean
	I	II	III		
T_1 = Geo-Textile net (1 layer)	6.51	7.41	6.30	20.22	6.74
T_2 = Plastic Net (1 layer)	5.75	7.20	5.91	18.86	6.29
T_3 = Geo-Textile Net (2 layers)	7.00	7.64	7.27	21.91	7.30
T_4 = Plastic Net (2 layers)	6.81	6.73	6.74	20.28	6.76
T_5 = Geo-Textile Net and Plastic (1 layer each)	7.23	6.98	7.13	21.34	7.11

Note: C. V. = 5.85%.

Table 7

Average Width of Flowers of Anthurium Produced per Plant per Year for the Period May 2014– February 2015 (3rd year from Planting (25 to 34 Months)

Treatment	Replication			Total	Mean
	I	II	III		
T_1 = Geo-Textile net (1 layer)	7.76	7.82	7.40	22.76	7.59^{bc}
T_2 = Plastic Net (1 layer)	7.08	7.76	6.84	21.68	7.23^{c}
T_3 = Geo-Textile Net (2 layers)	8.31	8.58	8.92	25.81	8.68^{a}
T_4 = Plastic Net (2 layers)	7.42	8.10	8.73	24.25	8.08^{ab}
T_5 = Geo-Textile Net and Plastic Net (1 layer each)	8.10	7.87	8.04	24.03	8.01^{abc}

Note: Values with the same superscript are not significantly different.
C. V. = 5.38%.

It took one year after planting for anthurium to produce suckers. The data gathered monthly, one year after planting up to 34 months old is in Table 8. The number of suckers produced per plant per year ranges from 2.03 to 4.00. Highly significant results were noted both in block and treatments. T_4 (plastic net 2 layers) and T_3 (geo-textile net 2 layers) are not significantly different from each other. According to PinoyBisnes Ideas (2013), a good commercial cultivar produced suckers freely. But too many suckers are an undesirable trait because they affect flower production.

Table 8

Average Number of Suckers Produced per Plant per Year of Anthurium 13 Months after Planting to 34 Months

Treatment	Year 2[a]	Year 3 [b]	Total	Mean
T_1 = Geo-Textile net (1 layer)	2.10	2.63	4.73	2.37[b]
T_2 = Plastic net (1 layer)	2.03	2.93	4.96	2.48[b]
T_3 = Geo- Textile net (2 layers)	2.60	3.97	6.57	3.29[a]
T_4 = Plastic net (2 layers)	2.93	4.00	6.93	3.47[a]
T_5 = Geo-Textile net and Plastic Net (1 layer each)	2.27	3.00	5.27	2.64[b]

Note: Values with the same superscript are not significantly different.
C. V. = 6.08%.

The growth and flower production of Anthurium depend on many factors of which are potting medium, fertilizer and light levels (Henny, Chase, & Obsone, No Date). Temperature is the second most important factor influencing plant growth (Pennisi, 2006). In this study, the temperatures were gathered 3 times a day, (9:00 AM, 12:00 Noon and 3:00 PM). Thermometers were placed on the center of each treatment which used the different shading materials. T_2 (plastic net 1 layer), T_1 (geo-textile net layer), and T_5 (geo-textile and plastic net 1 layer each) are not significantly different from each other with temperature from 31.29^{O}C, 31.36^{O}C and 31.57^{O}C, respectively. T_3 (2 layers geo-textile net) and T_4 (2 layers plastic net) are cooler with a temperature of 30.54^{O}C and 30.35^{O}C, respectively. For good growth and flower production of Anthurium, the best day temperature ranges from 27^{O}C to 30^{O}C and the night temperature of 18^{O}C to 20^{O}C (Rosario, 1998).

Table 9

Average Yearly Temperature, Daily Gathering, 3 Times a Day 9:00 AM, 12:00 Noon and 3:00 P.M.

Treatment	Year 1[a]	Year 2 [b]	Year 3[a]	Total	Mean
T_1 = Geo-Textile net (1 layer)	30.81	31.44	31.82	94.07	31.36[a]
T_2 = Plastic net (1 layer)	31.17	31.04	31.67	93.88	31.29[a]
T_3= Geo-Textile net (2 layers)	30.18	30.54	30.90	91.62	30.54[b]
T_4 = Plastic net (2 layers)	30.37	30.10	30.59	91.06	30.35[b]
T_5 = Geo-Textile net and Plastic Net (1 layer each)	31.25	31.64	31.82	94.71	31.57[a]

Note: Values with the same superscript are not significantly different.
C. V. = 4.20%.

Data on the cost and return analysis of 10 potted Anthurium for a period of 3 years from a 3sq. m. lot are presented in Table 10. The growing of Anthurium for 3 years is quite profitable with Return on Investment (ROI) ranging from 43.92% to 79.12%. The estimated income came from the sales of flowers, mother plants and suckers. The highest cost of production was attributed by high cost of mother plants followed by labor expenses such expenses like watering. For T_3 (Geo-textile net 2 layers) the high price of Geo-textile net at 83.00/meter gave the lower return on investment. Although, T_3 (treatment using geo-textile net) results showed that the parameters like number of flowers produced, number of suckers, and width of flowers are comparable to T_4 (Plastic net 2 layers), T_4 (Plastic net 2 layers) obtained the highest ROI of 79.12% while T_3 (Geo-textile net 2 layers) is 48.93% only. Furthermore, the life span of Geo-textile net is only 34 months. However, DPWH Sec. Rogelio Singson said the use of Coco-fiber products such as geo-textile net in the engineering industry will be beneficial to the environment and will support the Aquino Administration's poverty alleviation program. He said further, that the use of coco fibers products such as geo-textile net aims to provide employment opportunities to coconut farmers in rural areas (VVP, 2011).

Cost and return analysis was determined based on the average of 2 year production period, because the plants started to bear flowers after 1 year of planting.

Table 10

Cost and Return Analysis (in Pesos) of 10 Potted Anthurium

Item	T_1	T_2	T_3	T_4	T_5
I. Income					
A. Flower	249.20	306.60	422.80	406.00	312.20
B. Sucker	1,185.00	1,240.00	1,645.00	1,735.00	1,320.00
C. Mother Plant	1,500.00	1,500.00	1,500.00	1,500.00	1,500.00
Sub-Total	2,939.20	3,046.60	3,567.70	3,641.00	3,132.20
II. Less Expenses					
A. Material Inputs					
1. Plastic Bag					
a. Stock plant (mother plt.)	40.00	40.00	40.00	40.00	40.00
b. Suckers	94.80	99.20	131.60	138.80	106.60
2. Coconut husk (Sucker & Mother plant)	10.00	12.30	15.75	20.90	13.10
3. Thermometer	105.00	105.00	105.00	105.00	105.00
4. Fertilizer a) 14-14-14	33.00	33.00	33.00	33.00	33.00
b) 46-0-0	24.00	24.00	24.00	24.00	24.00
5. Streptomycin Sulfate	3.55	3.55	3.55	3.55	3.55
6. Stock plant (mother plant)	750.00	750.00	750.00	750.00	750.00
7. Geo-textile net	249.00		498.00		249.00
8. Plastic Net		90.00		180.00	90.00
9. Supplies and Materials					
a. Water container	100.00	100.00	100.00	100.00	100.00
b. Hose	40.00	40.00	40.00	40.00	40.00
c. Sprayer	50.00	50.00	50.00	50.00	50.00
B. Labor					
a. Watering	110.00	110.00	110.00	110.00	110.00
b. Spraying	15.00	15.00	15.00	15.00	15.00
c. Bagging	7.00	8.50	10.00	13.20	8.90
Sub-Total	1,631.35	1,480.55	1925.90	1,623.45	1,738.15
C. Interest on Capital (20%)	326.31	296.11	385.10	324.69	347.63
D. Rent, Lot	11.00	11.00	11.00	11.00	11.00
E. Depreciation Cost					
a. Lath house	15.00	15.00	15.00	15.00	15.00
b. Fence	10.00	10.00	10.00	10.00	10.00
c. Sprayer	25.00	25.00	25.00	25.00	25.00
d. Water Container	10.00	10.00	10.00	10.00	10.00
e. Water system	13.55	13.55	13.55	13.55	13.55
Sub-Total	84.55	380.66	469.65	324.69	432.18
Total Cost	2,042.21	1,861.21	2,395.55	2,032.69	2,170.33
Total Income	2,939.20	3,046.60	3,567.70	3,641.00	3,132.20
Return of Investment (%)	43.92%	63.66%	48.93%	79.12%	44.32%

Note: Imputed Cost: Flower PhP 7.0 Cost of suckers used at the start of the study = PhP 75.00 Mother plant = PhP 150.00 Life span of Geo-textile net = 34 months, Sucker = PhP 50.00

Conclusions and Recommendations

The use of two layers of Geo-textile net (T_3) and plastic net (T_4) as shading materials for anthurium showed comparable results in terms of number of suckers produced, flower production, width of flowers and number of leaves produced. Temperature under these treatments is suitable for the growth and the optimum shade requirement of Anthurium is 27^{O}C to 30^{O}C. The life span of Geo-textile net is shorter than plastic net regardless of the number of layers used. Once the geo-textile got torn, the temperature received by the plants became higher. The Return of Investment (ROI) using plastic net, 2 layers (T_4) and 1 layer (T_3) is higher than Geo-textile net.

However, the advantage of using geo-textile net, which is a recycled waste product, is biodegradable and environment friendly. Based on the result of the study, geo-textile net can be used as shading material for Anthurium if production will be increased. Today, geo-textile net is now produced commercially. More supply will be available; thus, prices per meter will decrease and a higher ROI may be obtained. Further, the study is recommended to be extended for another cycle of 3 years.

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