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CONSTRUCTION OF A HILLY SIDE SOIL CONSERVATION AND WASTE ERADICATOR FACILITY

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Abstract

One of the adverse effects of technology advances is the inability of nature to decompose substances humans create. Tons of non-biodegradable materials that can no longer be collected and not correctly disposed may pose adverse effects on living organisms' health and the environment in the whole world. To reduce and prevent non-biodegradable waste pollution, the proponents used the Nylon net as one of the major components used to materialize the project by cutting into exact sizes to make net bags loaded with non-biodegradable waste materials. The filled nylon net bag was used as a soil supporter, tied up to a Madre de Cacao post as a support peg. It is also desired to help farmers farming on the hilly side by preventing soil erosion in their respective areas.Results showed that the respondents' socio-demographic profile as to age, 43.67 years was the mean age of the farmers. As to farm location, 73.33% of farmers planted their crops in the hilly side and most of the farmers were elementary graduates only. The respondents were fairly not aware of the proper waste disposal as perceived by the respondents. The technology adopted by the farmers farming their land, particularly planting in hilly side areas were traditional contour technology. The respondents mostly preferred the level of preference in adopting constructed contour technology in controlling soil erosion and producing healthy crop production. Moreover, statistics showed a significant difference in the level of preference between the two different contour technologies (Traditional contour technology and Constructed contour technology) as perceived by the respondents

Keywords *: Waste, eradicator, contour, facility, net bag*

Introduction

Waste products are considered the most unwanted substances and toxic materials, expelled from different people everywhere. The composition of waste has varied over time and location, with industrial development and innovation; other various beings are directly linked to waste materials.

Environmental contamination due to mismanagement of a different kind of waste is one of the very significant concerns around the globe when a massive waste of waste without proper segregation will lead to economic and environmental sufferings.

The event happens in Luzon, there are mounds of uncollected garbage or wastes in communities badly-hit by the floods brought by the onslaught of typhoons On doy and Pepeng and super typhoon Yolanda and even landslide along hilly side area wherein its position did not hold the soils because some residents in the area were cutting trees. It destroyed coconut farms all over the islands. The concerned officials are now facing another garbage crisis. Urban areas in the Philippines generated wastes and have accelerated recently due to fast pace industrialization, urbanization, and population growth. An estimated generation of Thirty-five thousand five hundred eighty (35, 580) tons of garbage everyday. Due to its more modernized Metro Manila

style, an estimation of 8,636 tons of waste per day is generated (Castillo and Otomo 2013).

Without its earlier commitment to collect the garbage, it may lead to a severe threat to the residents' health.

With the rapid increase of waste material, whether biodegradable or non-biodegradable materials, proponents desired to eliminate these perennial problems of constructing waste eradicator facility. The research's primary concern would lessen waste materials by using them as primary tools to produce a waste eradicator facility of which serves as a contour facility to hold the soil along with hilly side areas and propagate additional nutrient of the soil due to additional of biodegradable materials. This research was conducted to determine whether the newly constructed waste eradicator facility will be preferable compared to the traditional contour technology facility. The project was limited to the construction of traditional contour technology using renzone's shrubs in the hilly side areas and the construction of a waste eradicator facility as contour facility with Madre de Cacao shrubs and nylon net bags.

MATERIALS AND METHODS

This research study was composed of three phases: Phase I – Preparation of Contour Facility, Phase II – Contour Facility Experimentation, and Phase III – Data Collection and Analysis. All experimental procedures were done in the hilly side school area of Barangay Little Baguio, Malita, Davao Occidental.

PHASE I - Preparation of Contour Facility

A. Traditional Contour Facility

A.1. Materials Used

The raw materials used in constructing the traditional contour facility were: 60 cm Renzone's Shrubs, Shovel (Pala), cutting tools.

A.2. Construction of Contour Facility (Traditional Facility)

The sixty (60) centimeter long of Renzone's Shrubs was placed in the hilly side area and buried about twenty (20) cm deep and it was covered with top soil to be able for the tree to produce roots as ridges supporting the soil. The distance of the contour facility was five (5) meters wide and poured with soil to elevate the top area (See Figure 1).

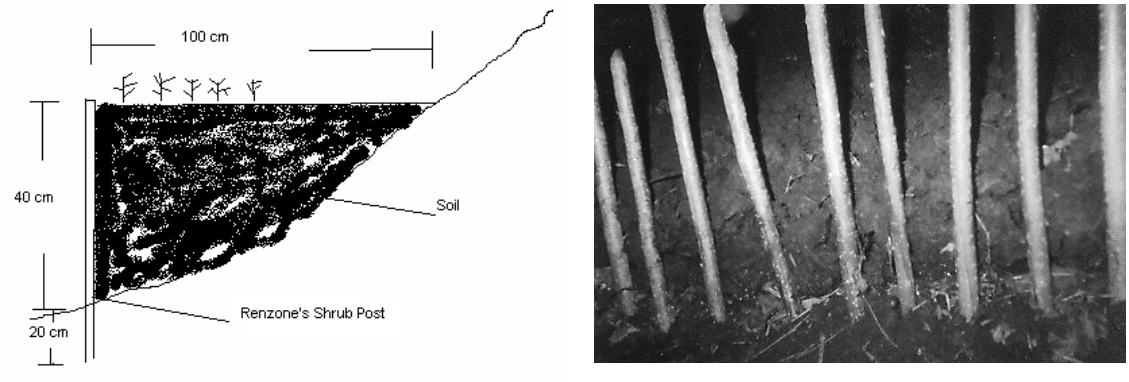

Figure 1. The constructed contour facility with Renzone's shrubs as post.

B. Waste Eradicator Facility

B.1. Materials Used

The raw materials used in constructing the traditional contour facility were: 60 cm Madre de Cacao Tree, Shovel (Pala), cutting tools, nylon net bag, nylon strand #16, non-biodegradable materials (i. e., diapers, assorted cellophanes, food wrappers, foils, Styrofoam, straw, plastic cups, old clothes, used umbrellas, old cups, old sacks, old mosquito nets, plastic mats, old blanket, used shoes and slippers, broken headband, comb, old stuff toys, etc.), biodegradable materials (i.e., decomposed leaves and woods, peeled fruits, etc.).

B.2. Construction of Waste Eradicator Facility (Improvised Contour Facility)

The sixty (60) centimeter long of Madre de Cacao tree was placed in the hilly side area and buried about twenty (20) cm deep and it was covered with tap soil to be able for the tree to produce roots as ridges supporting the soil. The distance of the contour facility was five (5) meters wide and twenty (20) cm apart between trees. An improvised nylon net bag were placed between post and tied up using nylon strand to hold the net bags in Madre de Cacao post. The filled nylon net bag was then placed on the prepared facility. The Madre de Cacao was placed in support for the bags of waste not to be twisted. After it was done, the prepared facility was then added by a biodegradable waste as additional nutrients of the soil. After this, the area was planted by a sweet potato as a selected crop grown in the area. The non-biodegradable materials were poured in the second layer of the soil and poured a tap soil above on it to elevate the top area (See Figure 2).

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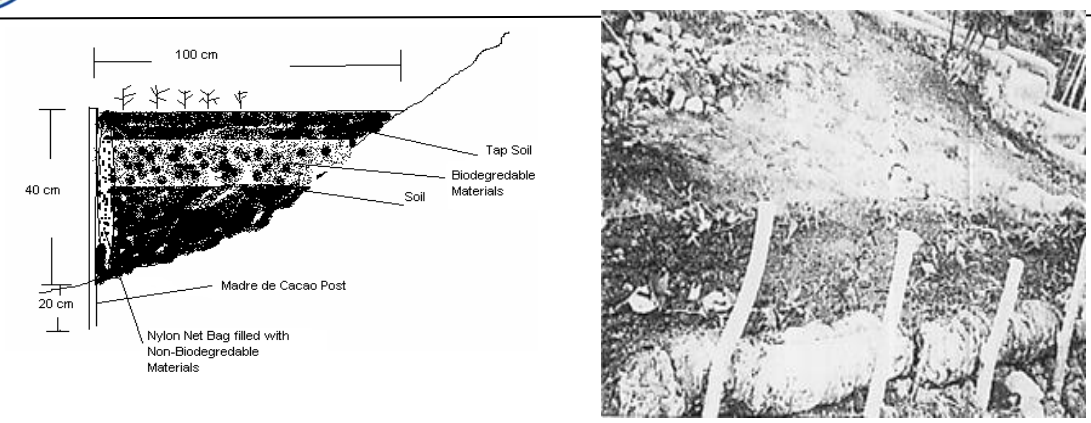

Figure 2. The Waste Eradicator Facility (Improvised Contour Facility)

B.3. Construction of Nylon Net Bag

Nylon net is one of the major components used to materialize the project by cutting into exact sizes for the making of net bags. The one (1) meter nylon net was sewed using nylon strands. The makings of nylon net bag are illustrated in figure 3A and figure 3B.

The finished product was loaded with non-biodegradable waste materials. For compatibility of the bag, it was compressed with solid materials like a piece of wood or timber and tied up with nylon strands.

The filled nylon net bag was the materials used as a soil supporter, tied up to a Madre de Cacao post as a support peg while waiting for the tree to produce trunks or branches. The grown Madre de Cacao post trunks are trimmed and cut every month to give way to a new plant to grow in the contour area (see Figure 3).

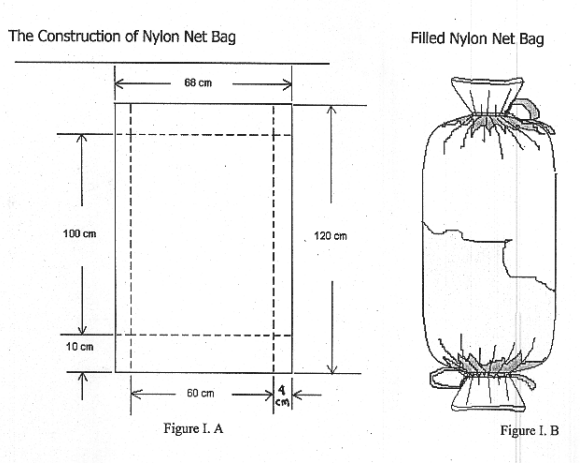

Figure 3. Construction of Nylon Net bag

PHASE II: Contour

Facility Experimentation

Height of the Plant

After the contour was made, sweet potato plants were planted in the area. After planting, the height of the sweet potato plant was monitored using transparent ruler every five (5) days of interval, then, the data was recorded.

Volume of Soil Removed

When the contour facilities were installed, the proponents wait a time till rain is coming. After the rain, the area was observed if there were some soils removed in the area. When there were some soils removed in the area, it was replaced and poured some amounts of soil (in volume) so that the percentage of removal of soil in the area must be monitored. The calculation of percentage of soil removed (in volume) was calculated using the formula:

$$\% \text{ of soil removed (in volume)} = \frac{V_r}{V_p} x100$$

Where:

V_r - Volume of Soil poured in the removed Area

V_p - Volume of Soil poured in the Area

PHASE III – Data Collection and Analysis

Respondents of the study were the responsible to assess the level of preferences of the two different contour facilities installed in the study area. The respondents were the residence of Little Baguio, Malita, Occidental. T-Test was used to determine if there was significant difference on the level of preferences as perceived by the respondents in adopting new technology and traditional technology.

RESULTS AND DISCUSSION

Socio-Demographic Profile of the Respondents

Table 1 showed the Socio-Demographic Profile of the respondents. Results showed that the age range was 34-56 years, 43.67% was the farmers' mean age. As to sex, 100% of the farmers were all male. As to farm location, 73.32% found on the hilly side, and only 26.67% were in the flattened area. As to the number of years in farming, ranging from 4-35 years, 12.2 years was the mean number of years in agriculture. And as to educational attainment, it shows that 13.33% were elementary level, 20% high school level, and college graduate, 33.33% were elementary graduates, 6.67% were high school level, and college level.

Table 1. The demographic profile of the respondents

PARTICULAR	RANGE	FREQUENCY	MEAN	PERCENTAGE
Age	34-56 yrs old		43.67 yrs old	
Sex:				
Male		15		100%
Female		0		
Farm Location:				
Flattened		4		26.67%
Hilly Side		11		73.33%
No. of years in Farming	7 – 35 yrs		12.2 years	
Educational Attainment				
Elem. Level		2		13.33%
Elem. Graduate		5		33.33%
High Sch. Level		3		20%
High Sch. Grad		1		6.67%
College Level		1		6.67%
College Grad		3		20%

Awareness of the Proper Waste Disposal

Table 2 shows the level of awareness on the proper waste disposal as perceived by the respondents. It is shown that the mean rating for reading books or articles related to solid waste disposal, adequate segregation of solid waste materials, 3 R's (Reduce, Recycle, Reuse), solid waste management act 2006 implemented were 2.07, 2.6, 2.93, and 2.67 with a descriptive rating of "Fairly Not Aware".

Mean rating of 3.2 or biodegradable and non-biodegradable waste materials with a descriptive rating of "Aware." The grand mean rating was 2.69, with a descriptive rating of "Fairly Not Aware." This indicates that the farmers were fairly not aware of the proper waste disposal management.

Table 2. Level of awareness on the proper waste disposal as perceived by the respondents

PARTICULAR	MEAN	DESCRIPTION
1. Read books or articles related in Solid Waste Disposal management.	2.07	Fairly not Aware
2. Proper segregation of solid waste materials.		
3. 3 R's (Reduce Recycle Reuse)	2.6	Fairly not Aware
4. Solid Waste Management Act 2006 implemented.	2.93	
5. Biodegradable and non-biodegradable waste materials.	2.67	Fairly not Aware
	3.2	Fairly not Aware
		Aware
Grand Mean	**2.69**	**Fairly not Aware**

Technology Adopted by the Farmers

Table 3 shows the responses of respondents on the technology adopted in farming. It shows that 93.33% were using specific land technology in agriculture, and 6.67% were not. 66.67% says that it's advantageous to use that land technology in their hinterland areas, and 33.33% were not. 13.33% says the technology helps a lot to avoid landslide, and 86.67% were not. 20% says the technology allows in the production of crops, and 80% were not. 26.67% preferred to have that technology in their farming areas, and 63.33% were not.

Based on the interviews, some of the respondents adopted traditional framings, that means that that the usual farming methods they have done in their farms were usually used "Bolo's," "Lagaraw" as a raw material in cleaning and cutting plants in the farming areas mainly along the hilly side areas or even burning some plants live in the room without knowing some effects in their land or even known that landslide might have happened after sometimes mainly if there will be heavy rains coming.

Table 3. Responses by the respondents on the technology adopted

PARTICULAR	YES	%	NO	%
1. Are you using specific land technology in	14	93.33	1	6.67

	farming?	10	66.67	5	33.33
2.	Is it an advantage to have it in your hinterland areas?	2	13.33	13	86.67
3.	Is the technology your using helps a lot to avoid landslide?	3	20	12	80
4.	Is technology allows in the production of crops?	4	26.67	11	63.33
5.	Do you prefer to have that technology in your farming area?				

Level of Preference in Adopting Traditional Contour Farming Technology

Table 4 shows the level of preference in adopting traditional contour technology as perceived by the respondents. It is shown in table 4 that the mean rating for farming facilities are adequate for the areas was 1.6; 1.4 mean rating for planting facilities of farmers may keep the soil fertile and productive; 1.6 mean rating for farming facilities produce large and healthy crops; 1.53 mean rating for farming facilities helps lessen the soil erosion, and 1.33 mean rating for planting facilities may conserve the soil. Each had a descriptive rating of "Fairly Not Preferred" the grand mean rating was 1.49 with a descriptive rating of "Fairly Not Preferred." This means that the respondents were "Fairly Not Preferred" in adopting traditional contour farming technology.

These results implied that the respondents fairly not preferred the traditional technology because they have already observed and even applied in their farm that traditional contour farming technology can help to prevent in their land for any soil erosion happened, however, it could not sustain in a more extended period mainly if series of rains happened, it was still have occurred that the soil was eroded.

Table 4. Level of preference in adopting contour technology as perceived by the respondents

PARTICULAR	MEAN	DESCRIPTION
1. Farming facilities are adequate for the area.	1.6	Fairly not Preferred
2. Farming facilities of farmers may keep the soil fertile and productive.	1.4	Fairly not Preferred
3. Farming facilities produce large and healthy crop s.	1.6	Fairly not Preferred
	1.53	Fairly not Preferred
4. Farming facilities helps lessen soil erosion.	1.33	Fairly not Preferred
5. Farming facilities may conserve the soil.		

Grand Mean	**1.49**	Fairly not Preferred

Level of Preference in Adopting Constructed Contour Farming Technology

Table 5 shows the level of preference in adopting constructed contour farming technology as perceived by the respondents. It's shown in the table that the mean rating for the farming facilities are adequate for the areas was 4.13; 4.26 mean rating for farming facilities of farmers may keep the soil fertile and productive; 4.2 mean rating for farming facilities produce large and healthy crops; 4.46 mean rating for farming facilities helps lessen the soil erosion, and 4.6 for mean rating for planting facilities may conserve the soil. Each had a descriptive rating of "Most Preferred." This means that the respondents were "Most Preferred" in adopting constructed contour farming technology.

Based on the interviews, the respondents do not know the importance of other waste materials in their backyard or even do not know what other alternative uses of these waste materials might help their hilly side farms. As they observed the newly constructed technology presented "Waste Eradicator Facility," it triggered their mind. It appreciated the new technology and other waste materials as protectors of the soil in the hilly side areas. Thus, the results cohered the responses of the respondents that they mostly preferred the technology.

Table 5. Level of preference in adopting contour technology as perceived by the respondents

PARTICULAR	MEAN	DESCRIPTION
1. Farming facilities are adequate for the area.	4.13	Most Preferred
2. Farming facilities of farmers may keep the soil fertile and productive.	4.26	Most Preferred
3. Farming facilities produce large and healthy crop s.	4.2	Most Preferred
	4.46	Most Preferred
4. Farming facilities helps lessen soil erosion.	4.6	Most Preferred
5. Farming facilities may conserve the soil.		
Grand Mean	**4.304**	**Most Preferred**

Volume of Soil Lost

Table 6 shows the percent level of soil lost (in volume) after the rain has occurred. The prepared two contour farming areas have the same volume of the soil before it rain; it was measured one

cubic meter (1 m3) (i.e., 5 meters wide, 0.40 meters height, and 1 meter wide). After the rain has occurred, the volume of soil lost on the newly constructed technology was measured 0.025 m3 or 2.5% of the total soil lost, while the volume of soil lost in traditional technology was 0.125 m3 or 12.5% measured of the total soil lost. This means that the soil in newly constructed technology almost remained intact and it shows that it was only compressed a little due to the water brought by rain. On the other hand, soil in the traditional technology became eroded passing through distance slit per shrubs that were seeded during the construction of it.

During the time of rain, a massive rain occurred since the rain lasted about 8 hours and it happened in the evening. In the morning, the respondents observed the areas that there was a difference between the two technologies.

The traditional technology was lost some soil and eroded while the newly constructed technology was not somehow deformed its physical appearance. This indicates that the waste eradicator facility helps a lot to hold the soil because of adding some waste materials filled in nylon net bags that hold the soil and the compactness of the soil.

Table 6. Percent level of soil lost (in volume) after the rain has occurred

TECHNOLOGY	VOLUME OF SOIL LOST AFTER THE RAIN	VOLUME OF SOIL LOST AFTER THE RAIN	PERCENT OF SOIL LOST
A. Traditional Contour Technology	1 m^3	0.125 m^3	12.5%
B. Constructed Contour Technology	1 m^3	0.025 m^3	2.5%

Height of Planted Crops

Table 7 shows the height increment and the percentage of the threshold increased of planted crops (sweet potato). It was found out that the height of planted crops has increased size after five days. In traditional technology, it grows 5 cm and 66.6% threshold while in constructed technology it increases 9 cm and 200% threshold. After ten days, it was measured again, and it was found out that the height of planted crops in constructed technology increases of 14 cm and about 366.67% threshold increased while in traditional technology it measured only 9 cm and only 200% threshold increased.

The results showed a highly positive exponential increased the height of the crops planted, a positive indication that the biodegradable waste materials help additional nutrients of the soil.

Table 7. Height increment and percentage of threshold increased of planted crops (Sweet Potato)

PARTICULAR	TECHNOLOGY	
	TRADITIONAL CONTOUR FARMING TECHNOLOGY	WASTE ERADICATOR FACILITY
Height of Planted Crops (Initial)	3 cm	3 cm
Height of Planted Crops After 5 Days	5 cm	9 cm
Height Increment	2 cm	6 cm
% of Threshold Increase	66.67%	200%
Height of Planted Crops After 10 Days	9 cm	14 cm
Height Increment	6 cm	11 cm
% of Threshold Increase	200%	366.67%

Comparative Analysis between the Traditional Contour Technology and Constructed Contour Technology as to Level of Preference

Table 8 shows the comparison on the level of preference between the traditional contour technology and constructed contour technology as perceived by the respondents.

The mean preference, as perceived by the respondents to the traditional technology was 1.52 indicates "Not Preferred", while the newly constructed technology was 4.33 indicates "Most Preferred".

Moreover, t-test showed that the t-value of 12.57 was higher than the t-tabular value at 5% level of significance, revealed that there was a significant difference between the two technologies constructed as to the level of preference by the respondents. This further indicates that the respondents preferred the new technology constructed (Waste Eradicator Facility).

Table 8. Comparative Analysis Between Traditional Contour farming Technology and Waste Eradicator Facility as perceived by the respondents

TECHNOLOGY	N	MEAN	VARIANCE	t-VAL	t-TAB @ 5%
Traditional Contour farming Technology	15	1.52	0.398	12.57*	2.048
Waste Eradicator Facility	15	4.33	0.352		

* - Significant @ 5% level of Significance

Conclusion

Based on the findings and objective of the study, it was found out that the respondent's socio-demographic profile, as to age, 43.67 years was the mean age of the farmers. As to sex, 100% of farmers were all male. As to farm location, 73.33% of farmers planted their crops in the hilly side. As to the number of years in farming, 12.2 years was the mean years of farming. Most farmers were elementary graduate only. The respondents were fairly not aware of the proper waste disposal as perceived by the respondents. The technology adopted by the farmers farming their land, mainly farming in hilly side areas were traditional contour technology. The volume of soil lost in the traditional contour technology was 12.5% while in the constructed contour technology was only 2.5%. The percentage increase of crops planted (Height of the crops) after five days in traditional technology it increases 5 cm and 66.6% threshold while in constructed technology it increases 9 cm and 200% threshold. And after ten days of cropping, the height of planted crops in constructed technology increases of 14 cm and about 366.67% threshold increased while in traditional technology it measured only 9 cm and only 200% threshold increased. The level of preference in adopting traditional contour technology in controlling soil erosion and producing healthy crop production was fairly not preferred by the respondents. The respondents most preferred the level of preference in adopting constructed contour technology in controlling soil erosion and producing healthy crop production respondents most preferred the level of preference in adopting constructed contour technology in controlling soil erosion and producing healthy crop production. There is a significant difference in the level of preference between the two different contour technologies (Traditional contour technology and Constructed contour technology) as perceived by the respondents.

Recommendation

After the construction of the two different contour facilities and thorough assessment and evaluation of the facilities, the following are highly recommended:

1. Waste eradicator facility must be adopted and implanted in the hilly side areas.
2. Local government unit looks into consideration and massive dissemination of this technology and must have direct implementation of the Solid Waste Management in their respective Barangay's mainly in the mountainous areas.

   The local government unit, particularly Barangay unit, must collect the segregated waste materials to their constituents so that it would be delivered to the hinterland for the construction of more facilities, especially the land abandoned by farmers.

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