BIBLIOGRAPHY

INUMPA, ROBERT S. JR. APRIL 2009. Seedling Emergence and Growth of Rice as Influenced by Organic Fertilizers and Covering Materials Under Wet-Bed Method. Benguet State University, La Trinidad, Benguet.

Adviser: Danilo P. Padua, Ph.D

ABSTRACT

This study was conducted to determine the effect of organic fertilizers on the emergence and growth of rice seedlings, determine the effect of covering materials on the emergence and growth of rice seedlings, and determine the best combination of using organic fertilizers and covering materials on the emergence and growth of rice seedlings.

Organic fertilizers significantly affected seed emergence and seedling growth. Seedlings applied with sunflower had longer roots, higher dry weight, more vigorous and dark green leaves. Likewise, application of alnus produces rice seedlings which are resistant to blast and stem borer.

Covering materials made the rice seedlings dark green in color. Covering with black polyethylene made the seeds earlier to emerge, vigorous, and resistant to blast and insects.

Application of sunflower in combination with black polyethylene produced the best rice seedlings.

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INTRODUCTION

Rice (*Oryza sativa I.*) is the world's most valuable cereal grain which constitutes about one quarter of the world's total grain production (PhilRice, 1996).

In the Philippines, rice is the staple food of every Filipino and the livelihood of the Nation. It is also the main source of carbohydrates and protein. Its production is predominantly in the hand of small farmer. To then rice provides their main source of income, food and employment. But still there's a deficient to sustain the rapidly increasing population. Hence, ways to improve rice production must be encouraged and one of the ways is to search and identify the different source of organic fertilizer adaptable to specific environmental condition prevailing in cool, elevated area of the cordillera region (PhilRice, 1996).

The effect of inorganic fertilizers application is immediate, readily providing nutrients to plants where as organic fertilizers, although slow-acting, keep intact the physical properties of the soil. Use of chemical fertilizer could destroy soil properties which will eventually lead to reduced production in the long term. But farmers are not aware that continuous application of inorganic fertilizer can destroy the physical structure of the soil and thus destruction may eventually decrease yield.

Shortage of rice makes the price increase so higher production of rice production is needed in order to prevent this problem. One way of increasing rice production is by producing good quality seedlings. Farmers harvested low yield of rice because of the quality of seedlings they have transplanted. Farmers must not rely on the high yielding .varieties of rice to produce high yield, they must also consider the seedling quality. This

study can help farmers to have a basis and guide in producing or raising rice seedlings especially farmers here in our locality.

One way of producing good quality seedling is by covering the soil, which prevents erosion by absorbing the impact of raindrops and irrigation water, and conserve soil moisture by acting as a barrier against evaporation. It is useful to the seeds to minimize the loss of soil moisture.

Moreover, use of organic fertilizer will eventually result to improve soil properties which lead to increase production of rice on the long term. The uses of organic fertilizers are less expensive since they just abound in the localities.

The objectives of the study are to:

1. determine the effect of organic fertilizers on the seedling growth and emergence of rice;

2. determine the effect of covering materials on the seedling emergence and growth of rice; and

3. determine the combination of covering materials and organic fertilizers on the seed emergence and seed growth of rice.

The study was conducted at the Benguet State University Experimental Area from November 2008 to March 2009.

REVIEW OF LITERATURE

Benefits from using Organic Fertilizers

Application of organic fertilizer helps conserve the soil, maintain and sustain crop quality and productivity and protects the environment. It also maintain if not increase the organic matter level in the soil; aid in the formation of organo-metallic complexes; increase soil cation exchange capacity and served as soil conditioner. The addition of organic matter in the soil increases the soil ability to hold water preventing erosion and cracking. It loosens the soil resulting in better aeration, root growth, drainage, improved tillage, improved soil property and increased compaction resistance. Organic fertilizer also improves the biological activities of the soil as it enhances rapid multiplication of fungi, bacteria, actinomycetes and other soil organisms according to PCARRD (2006).

Organic materials when added to soil have numerous beneficial effects, which includes increased soil fertility, balance of nutrients and build up of organic matter(OM) as stated by PCARRD (2006) also stated that organic materials are known to improve rhizosphere ecosystem suppress soil-borne phytophathogens and promote root growth.

Effect of Sunflower

According to Adchak (1993), application of 60 kg N/ha in combination with 15 tons chopped fresh wild sunflower improve the growth and yield of cabbage plants. Likewise, it improved the physical and chemical properties of the soil.

Yango (1998) found that incorporation of chopped fresh sunflower was effective in improving the growth and yield of Bontoc rice when applied one week before planting time.

Algen (2006) seedlings applied with sunflower had higher percentage of plant survival having a mean of 81.50% and the unfertilized seedlings numerically gave the lower plant survival (65.33). This proved that statement of Mabazza (1997) as cited by Algen (2006) that application of organic fertilizer provides large quantities of nitrogen needed by the plants and release of nutrients present in the soil that can be absorb by the roots of plants and this microelements, both activates and promotes plant growth.

Effects of Alnus Compost

According to Balaoing (2006)Alnus compost contains 50.0% organic matter, 25% nitrogen (N), 7.0% phosphorous (P), 3-3.6% potassium and pH of 4.6%.

In 1998, a study conducted by Dida revealed that population and incidence of black scurf on potato decrease with increasing level of alnus compost. In like manner, Porocha (2001) revealed that application of 8.0 t/ha of alnus compost alone and 6.0 t/ha of Alnus compost + 90-120-50 kg N-P_2O_5-K_2O/ha had the lowest infection of leaves. Furthermore, Guerzon (2002) found that application of alnus compost + 50-120-50 kg N-P_2O_5-K_2O/ha on bush bean promotes a wider pod formation and increase number of pods form while the application of alnus compost alone promotes formation of long pods.

In addition, Ebbes (2000) found that application of 8 to 10 t/ha of alnus compost plus 140-140-140 N-P_2O_5-K_2O/ha had the highest number and weight of mean of super extra large potato tubers with 98 and 13 kg and 90 and 13 kg, respectively. As to the result of soil chemical properties analysis, application of 6 to 8 t/ha alnus compost + 140-140-140 N-P_2O_5-K_2O/ha promotes an increase on the potassium content.

Effect of Garden Soil

According to Hiscox (2005), soil contains various organic matter, including decayed plants and animals, nutrients and beneficial microorganisms that makes up the garden soil which helps plant growth.

The Micro-elements, dead organic matter and nitrogen present on the garden soil which enhances the more seeds to emerge as stated by Hiscox (2005).

Effect of (Covering Material) Plastic Polyethylene

According to Hanada (2007), plastic mulches have various beneficial effects on crop product in temperate regions, including an increase in soil temperature, the conservation of soil moisture, texture and fertility, and the control of weeds, pest and diseases. However, mulching with fresh leaves gave better yields than plastic films in summer in the subtropics, since plastic mulching produced a market increase in soil temperature.

Balaki (1992) reported that beds mulched with black plastic polyethylene on strawberry fields have a temperature of one degree Celcius higher at 2:00 PM. Potato beds mulched with rice straw had a 1.04 degree celcius reduction in soil temperature in the plots had a slightly higher day and night temperature.

Mulch also control weeds. Balaki (1992) reported that black polyethylene perfectly controlled annual weeds on strawberry, Bautista et.al. (1983) likewise stated that mulching minimizes growth of annual weeds.

According to Hanada (2007) Black Polyethylene film gives effective weed control down solar radiation by more than 90%, resulting in etiolated growth and the eventual death of weeds under the film.

According to Hanada (2007), row covers, using plastic nets and non-woven fabrics, also increased the yield of vegetables, especially that of leafy vegetables, in the tropics and the subtropics. The yield increase was the combined result of shading, suppression of soil temperature increase, conservation of soil moisture, and protection from wind and pests.

Vergara (1979) as cited by Balaoas (2006) stated that warm temperature is needed to increase the activities inside the seed and grow faster at warm temperature than a cooler temperature thus increase growth. Without covering the seeds can cause later emergence.

Effect of Straw Feed Sack

Significant differences in color of leaves were absent among the soil cover and straw feed sack as covering materials resulted to dark green leaves while without covers according to Ballang (2006).

MATERIALS AND METHODS

The materials used in this study were seeds of native rice locally known as "Sinagayo", covering materials (1 cm garden soil, white and block polyethylene, straw feed sack),organic fertilizers (sunflower and alnus), notebook for data recording, ruler and vernier caliper for measuring and other materials used for land preparation.

An area of 36 m^2 was thoroughly prepared and was divided into 3 blocks; each block was subdivided into 12 plots measuring 1 m x 1 m each.

Before seedbed preparation, soil samples were taken for soil analysis to determine the initial soil pH, organic matter and NPK content. The different organic fertilizers were applied ten days before sowing. In each treatment 4kg of organic fertilizers were incorporated into the soil. At sowing 100 seeds were set aside and planted at the center of the bed used as sample for determining the percentage emergence and survival. The experiment was laid out using two factor factorial arranged in randomized complete block design (RCBD).

The seedbeds were thoroughly prepared and construct canals in between the beds. The seedbed was irrigated and flooded before the rice seeds will be sown. The different covering materials were put on top of the newly sown seeds. For the control, seeds were not covered. The block polyethylene and straw feed sacks were removed when seed were emerging. Different treatments were labeled using bamboo sticks after sowing.

The treatments were:

Factor A (Organic Fertilizers)

O_0 -control

O_1 -sunflower

O_2 -Alnus Compost

Factor B (Covering Materials)

C_0 -no cover

C_1 -1cm garden soil

C_2 -black polyethylene

C_3 -straw feed sack

Data Gathered

1. Number of days from sowing to emergence. This was recorded when about 50% of the total number of seeds had emerged from the soil surface.

2. Height of the seedling (cm). The height of the seedling was measured from the base to the longest leaf of the seedling at 5 days interval for 4 weeks using 10 sample plants.

3. Percentage of emergence at 12 days after sowing (DAS). This was taken 12 days after sowing using the formula

$$\text{Emergence \%} = \frac{\text{No. of Seeds Emerged}}{\text{Total No. of Seeds Sown}} \times 100$$

4. Length of the leaves (cm). This was taken when the seedling is ready for transplanting by measuring from the base of the leaf blade to the tip of the leaf using the 10 sample plants.

5. Length of the roots (cm). This was taken twice at 14 days after sowing and at 35 days after sowing using the 10 samples by measuring the longest roots.

6. Final height (cm). This was taken when the seedling is ready for transplanting (35 days after sowing) by measuring from the base to the longest leaf of the seedling using the 10 samples.

7. Total number of leaves. This was taken when the seedling is ready for transplanting using the 10 samples.

8. Final weight of seedling (g). This was taken when the seedling is ready for transplanting by weighing 10 samples both fresh and over dry weight.

9. Seedling culm diameter (mm). The ten samples was measured by using a vernier caliper when the seedling is ready for transplanting.

10. Percent survival (%). This was taken when the seedling is ready for transplanting using the formula:

$$\text{Survival \%} = \frac{\text{No. of Seedlings Ready for Transplanting}}{\text{Total No. of Seeds Sown}} \times 100$$

11. Color of the leaves. This was taken using the following scale when the seedling is ready for transplanting (PhilRice, 1996):

Scale	Remarks
1	Dark green
3	Light Green
5	Yellow
7	Brown
9	Dead

12. Leaf area (cm^{2-}). This was taken by using a graphing paper.

13. Seedling vigor. This was taken at 35 days after sowing using the following scale (PhilRice, 1996):

Scale	Description	Remarks
1	Majority of the seedling have 5 or more leaves with 2 – 3 tillers	Very Vigorous
3	Majority of seedling have 1 – 5 leaves with 1 – 2 tillers	Vigorous
5	Most of the seedling have 4 leaves with tiller	Normal
7	Most of the seedling have 3 -4 leaves with tillers	Weak
9	Most of the seedling turned to yellow and thin	Very weak

14. Rice blast incidence. This was identified and assessed by rating the degree of the blast infection using the following rating scale (PhilRice, 1996).

Scale	Description	Remarks
1	0 – 5% are affected by blast	Resistant
2	6 – 25% are affected by blast	Intermediate
3	26% and above are affected by blast	Susceptible

15. Insect pest incidence. Evaluation rating scale by (PhilRice, 1996) was used.

Scale	Description	Remarks
1	0-5% are affected by insect	Resistant
3	1-7% are affected by insect	Moderate resistant
5	8-25% are affected by insect	Intermediate
9	26 and above are affected by insect	Susceptible

16. pH, NPK, organic matter of the soil (Before and after planting). Soil Samples (1000g) were collected before and after planting and was brought to the Bureau of Soil Laboratory for Analysis.

Data Analysis

All quantitative data were analyzed using Analysis of Variance (ANOVA) for Randomized Complete Block Design (RCBD) with 3 replication. The significance of differences among the treatment means were tested using Duncan's Multiple Range Test (DMRT) at 5% level of significance.

RESULTS AND DISCUSSION

Number of Days from Sowing to Emergence

Effect of organic fertilizers. Table 1 shows the number of days from sowing to emergence. Seedlings supplied with alnus were the latest to emerge. Sunflower enhanced earlier seedling emergence by almost a day. This could be due to the sunflower which is decomposed and is mixed thoroughly to the soil where in the nutrients were easily absorbed by the rice seedlings.

Table 1. Number of days from sowing to emergence of rice as affected by organic fertilizers and covering materials

TREATMENT	DAYS*
Organic fertilizers (O)	
Control	7.75[ab]
Sunflower	6.50[b]
Alnus	8.00[a]
Covering Materials (C)	
No cover	10.44 [a]
1cm garden soil	7.00[b]
Black Polyethylene	6.00[b]
Straw feed sack	6.22 [b]
O x C	*
CV (%)	21.55

*Means with the same letter (s) are not significantly different at 5 % level of DMRT

Effect of covering materials. Significant differences were obtained on the number of days from sowing to emergence as affected by covering materials. All covered seeds emerged at least 3-4 days earlier than those without cover indicating the benefit of seed cover during germination. Balaoas (2006) stated that this could be due to the increase in temperature inside the plastic cover so the seeds germinated earlier (Table 1).

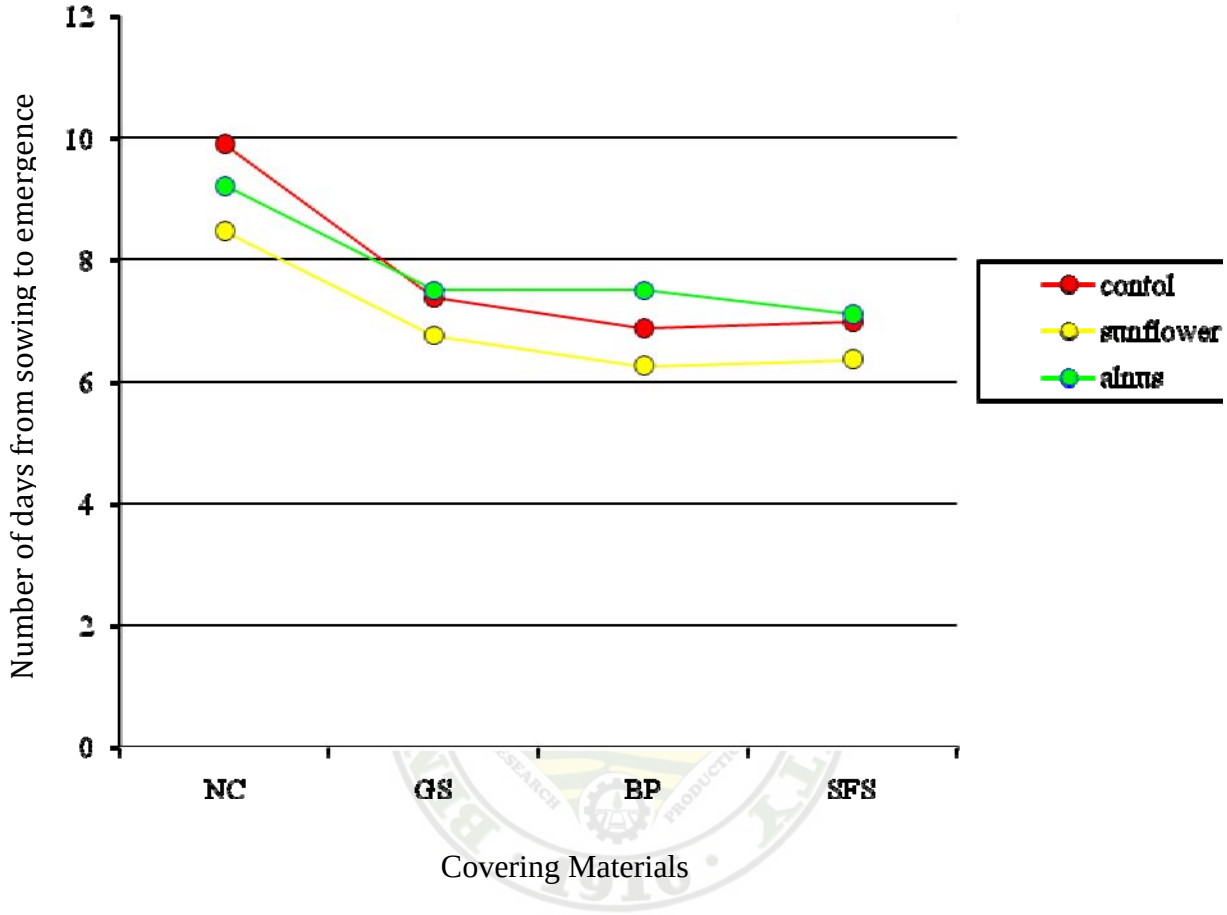
Interaction effect. Results show that there is a significant interaction between the organic fertilizers and the covering materials. The first to emerge was obtained from the seeds sown applied with sunflower covered with black polyethylene. On the other hand, the latest to emerge were the seeds applied with and not covered. This is presumably due to the high temperature produced inside the cover as observed by Vergara (1979).

Percentage of Seedling Emergence

Effect organic fertilizers. There were no significant differences observed among organic fertilizers used in the study. The percentage of seedling emergence in organic fertilizers ranges from 73.25% to 78.58% (Table 2).

Effect of covering materials. Statistical analysis revealed significant differences in terms of percentage of seedling emergence. A covering of 1 cm garden soil produced the highest mean of 80.44 % while covering with black polyethylene produced the least emergence of 69.00%. This could be due to the effect of all the micro-elements, dead organic matter and nitrogen present on the garden soil which enhances the more seeds to emerge Hiscox (2004).

Interaction effect. Significant interaction effect between the organic fertilizers and the covering materials was observed on the percentage of emergence of rice seedlings. Combination of sunflower application with 1 cm garden soil covering resulted



Legend:

NC- No Cover
GS- 1 cm Garden Soil
BP- Black Polyethylene
SFS- Straw Feed Sack

Figure 1. Number of days from sowing to emergence of rice applied with organic fertilizers and covering materials

in higher percentage of seedling emergence which the combination of straw feed sacks covering with control gave the lowest percent of emergence.

Percentage of Seedling Survival

Effect of organic fertilizer. Statistically, no significant differences were observed on the percentage of survival of seedlings. But numerically, seedlings applied with sunflower had the highest percentage of plant survival having a mean of 76.33%. This means that application of sunflower encourages higher percentage of survival as found by Algen (2006).And alnus gave the lowest plant survival with a mean of 67.00%.

Table 2. Percentage of emergence and survival at 12 DAS after sowing of rice as affected by organic fertilizers and covering materials

TREATMENT	EMERGENCE (%) (12 DAS)	SURVIVAL (%) (35 DAS)
Organic fertilizers (O)		
Control	73.25	69.58
Sunflower	78.58	76.33
Alnus	74.33	67.00
Covering Materials (C)		
No cover	76.33[ab]	73.33
1cm garden soil	80.44[a]	76.44
Black polyethylene	69.00[b]	65.67
Straw feed sack	75.78[b]	68.44
O x C	*	Ns
CV (%)	13.44	15.24

* Means with the same letter are not significantly different at 5% level of DMRT

Effect of covering materials. No significant differences were noted on the percentage of plant survival. However, seeds covered with 1cm garden soil obtained the highest percentage survival with a mean of 76.44% and black polyethylene covering obtained the least mean of 65.67%.

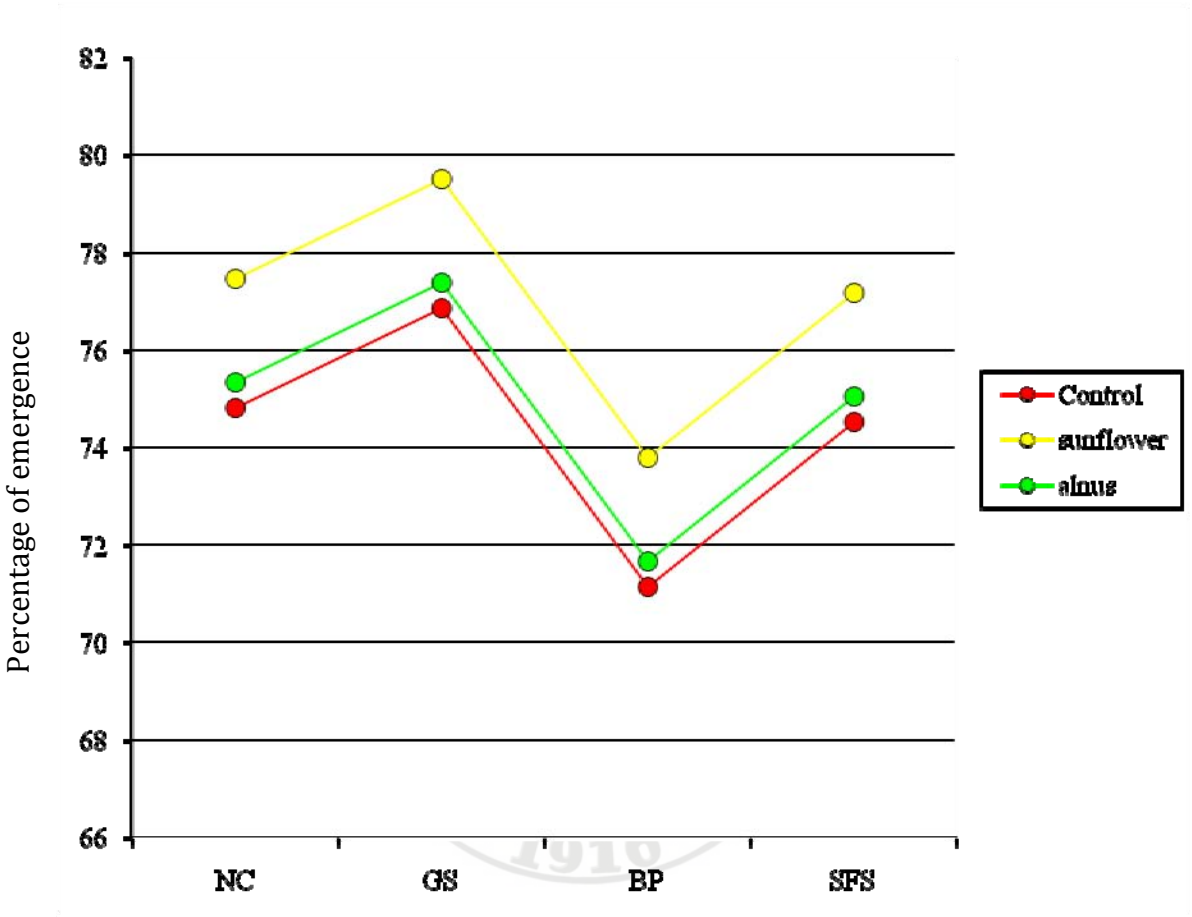
Interaction effect. No significant interaction effect was observed between organic fertilizers and covering materials on the percentage seedling survived.

Height of Seedlings at 6 DAS

Effect of organic fertilizers. Significant differences were obtained on the height of seedlings at 6 days after emergence as affected by the different organic fertilizers. The control had significantly taller plants with a height of 7.31 cm which could be due to the longer effect of organic fertilizer (Table3).

Effect of covering of materials. Table 2 shows significant differences on the height of seedlings after emergence as affected by the different covering materials. At 6 days, seedlings covered with straw feed sack had the tallest with a mean of 8.29 cm. This, maybe because in straw feed sack there is a controlled entrance of air, thus, controlling temperature and hastening the growth of seedlings (Table 3).

Interaction effect. It was observed that the interaction between the organic fertilizer and the covering materials on the height of seedlings 6 days after emergence was significant. The combination of unfertilized seedlings and straw feed sack as covering material produced the tallest seedlings.



Legend:

NC- No Cover	BP- Black Polyethylene
GS- 1 cm Garden Soil	SFS- Straw Feed Sack

Figure 2. Percentage of emergence of rice applied with organic fertilizers and covering materials at 12 DAS

Height of Seedlings at 12 DAS

Effect of organic fertilizers. Statistical analysis showed that at 12 days, there were no significant difference among the treatments used in the study.

Effect of covering materials. At 12 days after emergence, significant differences were obtained on the height of seedlings as affected by the different covering materials. Seedlings covered with straw feed sack had the highest height with a mean of 10.52 cm followed by 1 cm garden soil with a mean of 10.43 cm. Shortest height was observed on seedlings covered with black polyethylene and no cover with a mean of 9.2 cm and 8.89 cm, respectively. This could be due to the effect of controlled air temperature inside the straw feed sack and heat coming from the outside environment to the inside of the cover where it is favorable to the growth of seedlings.

Interaction effect. There is a significant interaction between the organic fertilizer and covering materials on the height of seedlings at 12 days. The combination of straw feed sack with sunflower appeared to have the highest height. In contrast to this, no cover combined with either control or alnus gave the shortest plants. This means that application of organic fertilizers significantly increases the height of seedlings (Fig. 4).

Height of Seedlings at 18 DAS

Effect of organic fertilizers. The use of organic fertilizers at day 18 shows no significant difference after emergence. However, seedlings applied with sunflower appeared to have the tallest seedlings with a height of 13.12 cm followed by the control (12.92 cm) (Table 3).

Effect of covering materials. Highly significant differences were obtained on the height of the seedlings 18 days after emergence as affected by the covering materials.

Seeds covered with straw feed sack had the tallest seedlings with a mean of 13.53 cm, followed by 1 cm garden soil, no cover, and black polyethylene with mean of 13.32 cm, 12.41 cm, and 12.24 cm, respectively. This means that application of covering materials affect the height of seedlings. This is could be due to the effect of controlled passage of air, heat and light of straw feed sack being absorbed by the seedlings (Table 3).

Interaction effect. Significant interaction effects were observed on the effect of organic fertilizers and covering materials on the height of seedlings at 18 DAS. Combination of the application of sunflower and covering of straw feed sack highly increases the height of the seedlings while covering with black polyethylene in combination with application of alnus decreases the height of seedlings. This means that application of organic fertilizers and covering materials affect entirely the height of the seedlings (Fig. 5).

Height of Seedlings at 24 and 30 DAS

Effect of organic fertilizers. Results show that there are no significant differences on the effect of organic fertilizers on the height of seedlings at 24 DAS. However, application of sunflower appeared to have the highest height with a mean of 17.53 cm while the control appeared to be the shortest in height with a mean of 16.73 cm. This could be due to the nutrient content of sunflower which enhances the growth of the seeds (Table3).

Effect of covering materials. Statistical analysis shows that there are no significant differences on the effect of covering materials on the height of seedlings at the 24 DAS after emergence. One cm garden soil (17.62 cm) resulted in the tallest seedlings while black polyethylene as cover resulted in the shortest height with 16.60 cm (Table3).

Interaction effect. Statistical analysis shows that there is no interaction between the organic fertilizers and the covering materials after emergence on the height of seedlings at 24 DAS.

Height of Seedlings at the 30 DAS

Effect of organic fertilizers. Results revealed that there are no significant differences on the effect of organic fertilizers to the height of seedlings at the 30th day after emergence. This means that application of sunflower, alnus and control did not solely affect the height of seedlings. Nevertheless, application of obtained the highest height with a mean of 26.91 cm while no application gave the shortest height with a mean of 25.20 cm. This could be due to the effect of nitrogen content of sunflower and organic matter that was deposited on the soil that serve as food for the plant.

Effect of covering materials. It was observed that on the statistical analysis, there are no significant differences on the effect of covering materials on the height of seedlings after emergence.

Interaction effect. There was no significant interaction observed between the organic fertilizes and the covering materials on the height of seedlings at 30 DAS.

Height of Seedlings at the 35 DAS

Effect of organic fertilizers. Results revealed that there are no significant differences on the effect of organic fertilizers on the height of seedlings. It appears that seedling height is not affected by organic fertilizer application after six days of sowing until a month later (Table 3).

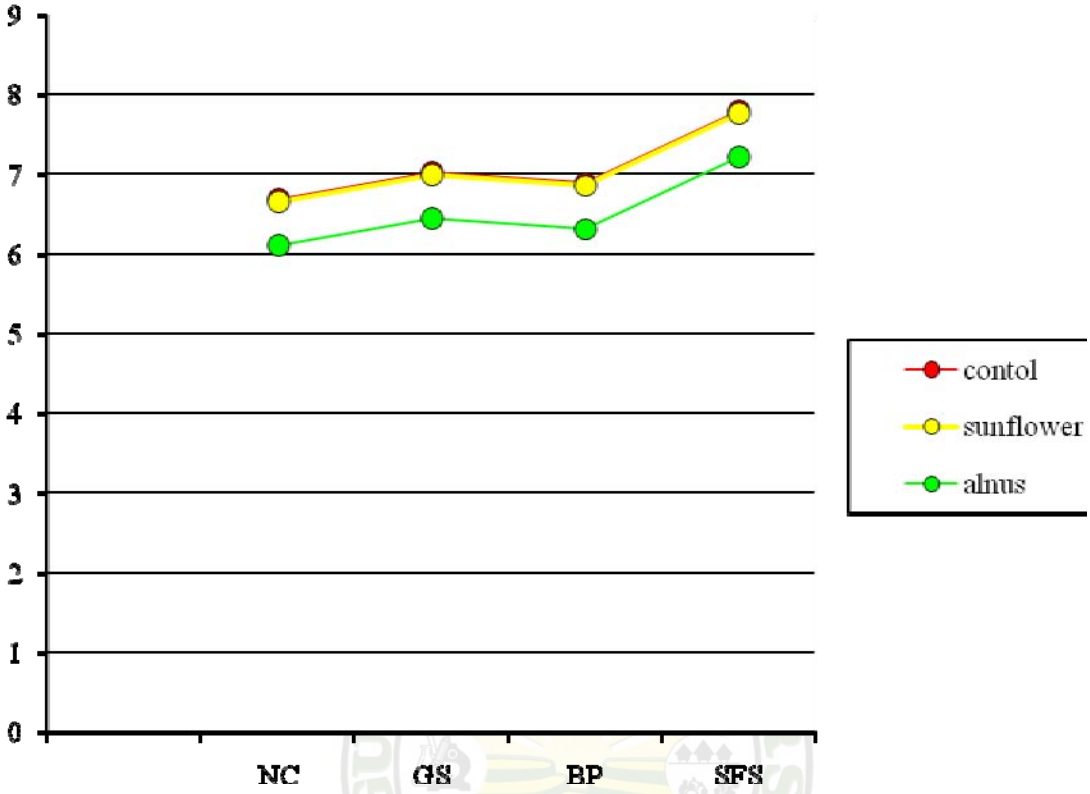
Effect of covering materials. At 35 DAS no significant differences were noted on the height of the seedlings as affected by covering materials. Covering the plants 1 cm garden soil appeared to have the tallest seedlings with a mean of 34 cm while black polyethylene resulted in the shortest plants which were more than 3 cm shorter (Table 3). Apparently, this is influenced by organic matter deposited in the soil by plants and animals that were decomposed by soil organisms. The resulting released nutrients were absorbed and stored by the plants (Hiscox, 2004).

Interaction effect. It was observed that there is an interaction effect between the organic fertilizers and covering materials on the height of seedlings at 35 DAS. Combining 1 cm garden soil as covering method with either application of sunflower or alnus significantly increased the height of seedlings. In contrast to this, combination of black polyethylene as covering with no application control depressed the height of seedlings (Fig. 6).

Table 3. Height of seedlings after emergence at 6, 12, 18, 24, 30 and 35 DAS (final height) as affected by organic fertilizers and covering materials

TREATMENT	DAYS AFTER SOWING					
	6 (cm)	12 (cm)	18 (cm)	24 (cm)	30 (cm)	35 (cm)
Organic Fertilizers (O)						
Control	7.31[a]	9.68	12.92	16.73	25.20	31.02
Sunflower	7.23[a]	9.80	13.12	17.53	26.91	32.29
Alnus	6.14[b]	9.68	12.58	17.01	26.34	32.24
Covering Materials(C)						
No cover	6.06[b]	8.89[b]	12.41[bc]	16.67	26.61	31.39[ab]
1cm garden soil	6.74[b]	10.43[a]	13.32[ab]	17.62	26.66	34.01[a]
Black Polyethylene	6.47[b]	9.02[b]	12.24[c]	16.60	24.81	30.14[b]
Straw Feed Sack	8.29[a]	10.52[a]	13.53[a]	17.46	26.52	31.85[ab]
O x C	*	*	*	ns	ns	*
CV (%)	15.02	9.89	7.86	7.14	8.43	8.55

*means with the same letter (s) are not significantly different at 5 % level of DMRT



Legend:

NC- No Cover BP- Black Polyethylene

GS- 1 cm Garden Soil SFS- Straw Feed Sack

Figure 3. Seedling height of rice applied with organic fertilizers and covering materials at 6 DAS

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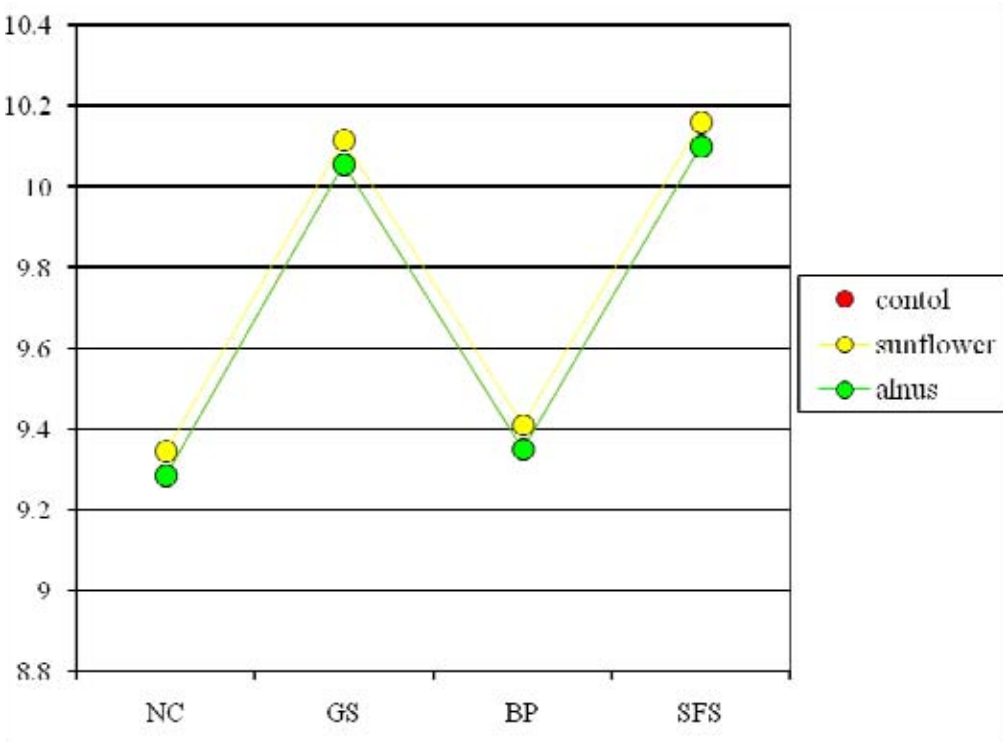
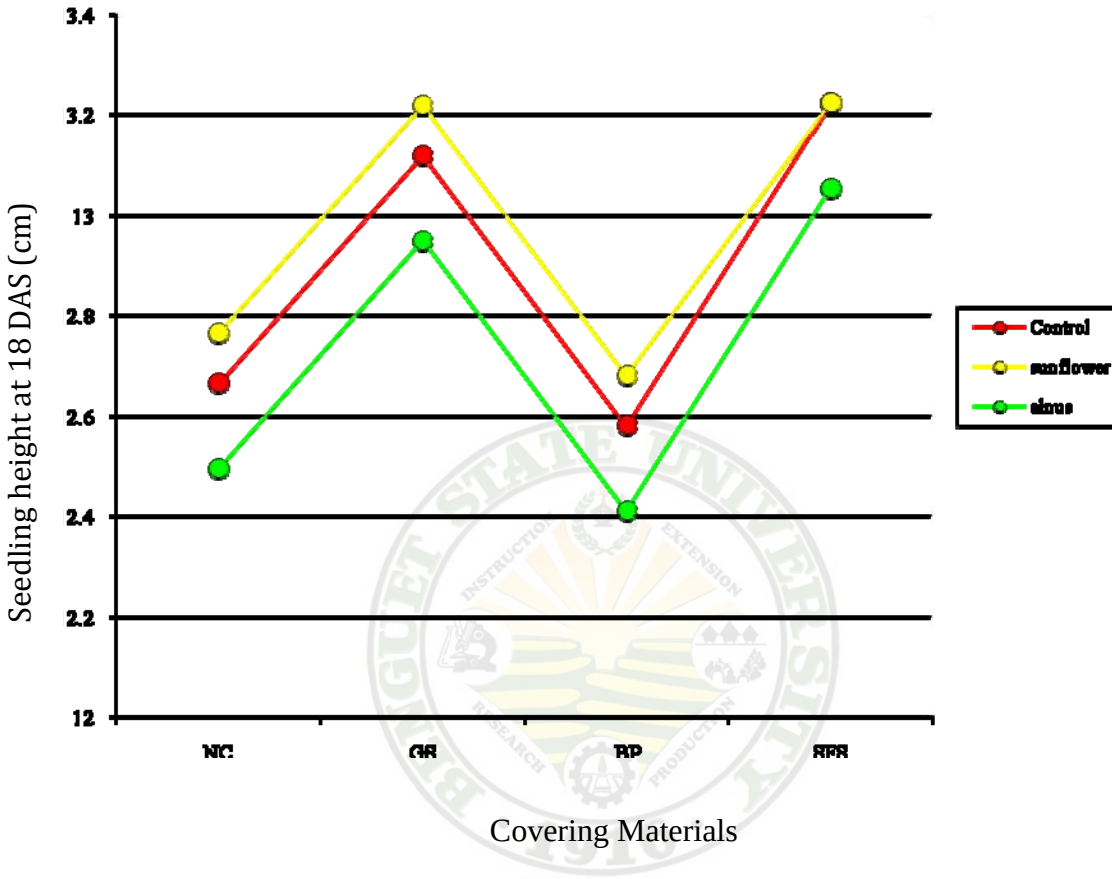


Legend:

NC- No Cover
GS- 1 cm Garden Soil
BP- Black Polyethylene
SFS- Straw Feed Sack

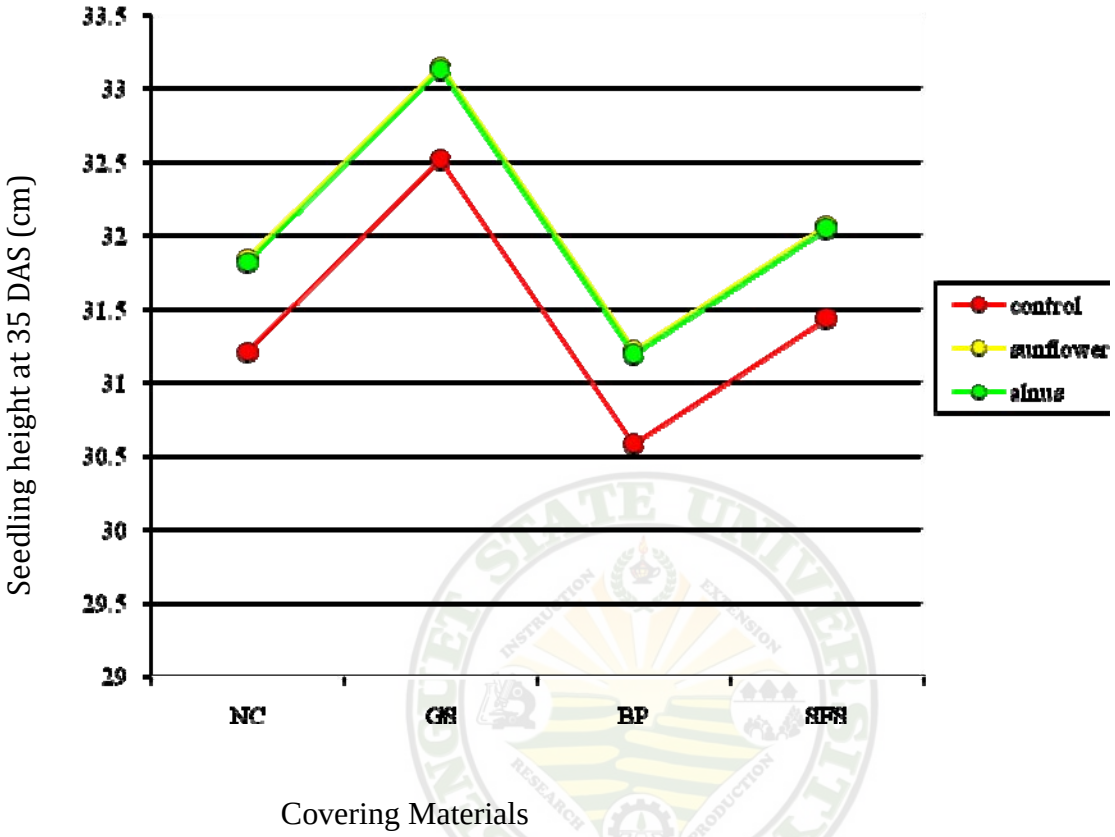
Figure 4. Seedling height of rice applied with organic fertilizers and covering materials at 12 DAS



Legend:

NC- No Cover	BP- Black Polyethylene
GS- 1 cm Garden Soil	SFS- Straw Feed Sack

Figure 5. Seedling height of rice applied with organic fertilizers and covering materials at 18 DAS



Legend:

NC- No Cover
GS- 1 cm Garden Soil
BP- Black Polyethylene
SFS- Straw Feed Sack

Figure 6. Seedling height of rice applied with organic fertilizers and covering materials at 35 DAS

Length of Roots at 14 Days

Effect of organic fertilizer. Statistically, there were no significant differences on the effect of organic fertilizers to the length of roots although the application of sunflower produced roots that were about one cm longer (Table 4). This is because sunflower is the best source of nitrogen which the roots penetrate.

Effect of covers. No significant differences were observed on the length of root as affected by the different covering materials. Nevertheless, the length of roots increased from 6.03 cm to 7.30 cm. No cover appeared to have the lowest length while black polyethylene cover obtained the longest length. This could be due to effect of high temperature inside the cover which increases the activities inside the seed and grow faster at warm temperature than a cooler temperature (Vergara, 1979).

Interaction effect. There is no interaction effect between the organic fertilizer and the covering materials on length of roots.

Length of Root at 35 DAS

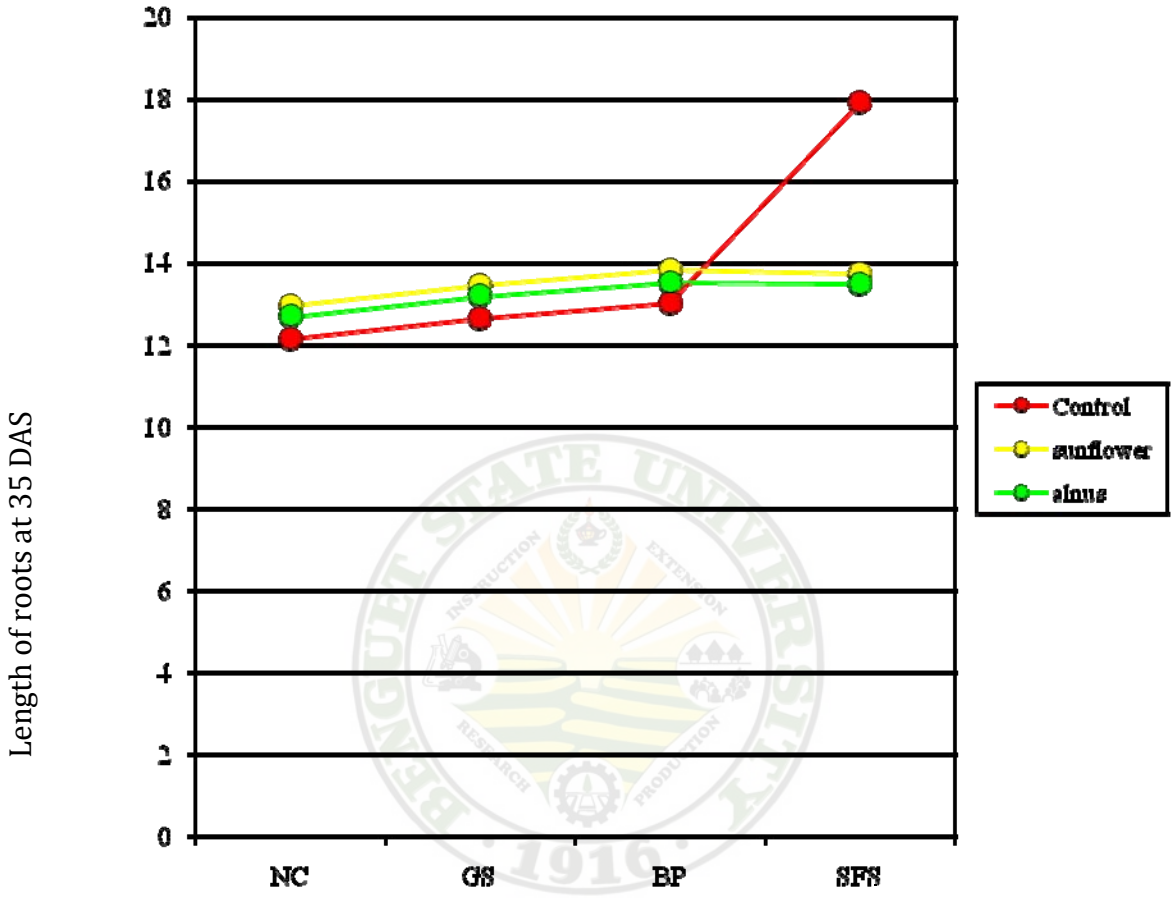
Effect of organic fertilizer. The length of the roots at the 35 DAS is shown in Table 4. Results revealed that there were significant differences among the treatments used in the study. Application of sunflower obtained the longest roots with a mean of 13.85 cm while the shortest roots were observed on the control with a mean of 12.26 cm. This is probably due to the faster decomposition of sunflower that allows earlier release of nutrients. This is in addition to its effect on loosening the soil resulting in better aeration, root growth, drainage, improved soil property and increased compaction resistance (PCCARD, 2006).

Table 4. Length of the roots at 14 and 35 DAS as affected by organic fertilizers and covering materials

TREATMENT	LENGTH OF ROOTS AT: 14 DAS (cm)	35 DAS (cm)
Organic Fertilizers (O)		
Control	6.11	12.26[b]
Sunflower	7.09	13.85[a]
Alnus	6.78	13.33[ab]
Covering Materials (C)		
No cover	6.03	12.07
1 cm garden soil	6.64	13.07
Black Polyethylene	7.30	13.82
Straw feed sack	6.67	13.63
O x C	ns	*
CV (%)	18.6	13.06

* Means with the same letter are not significantly different at 5% level of DMRT

Effect of covers. Statistical analysis show that at 35 DAS no significant differences among the covering materials on the length of roots. But numerically, black polyethylene covering gave the longest length with a mean of 13.82 cm while no cover appeared to have the lowest length of root with a mean of 12.07 cm. This means that non-covering of the seeds may produce shorter roots, which is in accordance to the findings of (Balaoas, 2006).



Legend:

NC- No Cover	BP- Black Polyethylene
GS- 1 cm Garden Soil	SFS- Straw Feed Sack

Figure 7. Length of roots of rice applied with organic fertilizers and covering materials at 35 DAS

Interaction effect. There is an interaction effect between the organic fertilizers and the covering materials on the length of root. Combining of sunflower and black polyethylene significantly increased the length of roots, unlike the combination of control and no cover which depressed the length of root. This means that application of organic fertilizers and covering materials affect the length of roots of rice seedlings (Fig.7).

Seedling Culm Diameter (mm)

Effect of organic fertilizers. No significant differences were observed among the organic fertilizers on the diameter of the seedlings. Nevertheless, application of sunflower gave the thickest diameter with a mean of 7.77 mm while control gave the thinnest with a mean of 6.82 mm. Maybe the sunflower gave the highest height and longest roots which makes large culm.

Effect of covering materials. No significant differences were observed on the diameter of the seeds as affected by the different covers. However, straw feed sack as a cover appeared to have the thickest diameter of 8.04 mm while no cover was found to have the thinnest diameter of 6.73 mm. Maybe this could be due to the effect of soil moisture and protection from wind and pest (Hanaida , 2000).

Interaction effect. There was no interaction observed on the effect of organic fertilizers and the covering materials on the diameter of the seeds.

Table 5. Seedling culm diameter after emergence at as affected by organic fertilizers and covering materials

TREATMENT	DIAMETER OF CULM (mm)
Organic Fertilizers (O)	
Control	6.82
Sunflower	7.77
Alnus	7.43
Covering Materials (C)	
No cover	6.73
1 cm Garden Soil	7.33
Block Polyethylene	7.24
Straw feed sack	8.04
O x C	ns
(CV %)	30.78

*Means with the same letter (s) are not significantly different at 5 % level of DMRT

Total Number of Leaves

Effect of organic fertilizers. No significant differences were observed on the effect of organic fertilizers on the total number of leaves. Numerically, application of sunflower appeared to have the highest number of leaves while the control produced the least number of leaves. This could be due to the effect of longer roots, wider culms and leaves which increases the number of leaves of seedlings. Hence, the longer the roots and leaves the more the number of leaves.

Table 6. Total number of leaves after emergence as affected by organic fertilizers and covering materials

TREATMENT	NUMBER OF LEAVES	LENGTH OF LEAVES
Organic Fertilizers (O)		
Control	7.02	22.54
Sunflower	7.84	24.16
Alnus	7.86	23.92
Covering Materials(C)		
No Cover	6.72	22.99
1cm Garden Soil	7.31	24.87
Black Polyethylene	8.51	22.41
Straw Feed Sack	7.74	23.89
O x C	ns	ns
(CV %)	23.17	11.55

*Means with the same letter (s) are not significantly different at 5 % level of DMRT

Effect of covering materials. No significant differences were observed on the number of leaves as affected by the different covers. However, covering of black polyethylene produced the highest number of leaves with a mean of 8.51 while no cover gave the least number. This means that without covering materials, the number of leaves is lesser.

Interaction effect. It was observed that the interaction of organic fertilizers and covering materials did not significantly affect the number of leaves of seedlings.

Length of Leaves

Effect of organic fertilizers. Statistical analysis showed that no significant differences among the organic fertilizers on the length of leaves. But numerically, the longest leaves obtained was found on the application of sunflower with 24.16 cm while the shortest leaves were observed on control with 22.54 cm. This could be the effect of height of the seedling which affects the length of the leaves.

Effect of covering materials. No significant differences on the effect of covers to the length of leaves of seedlings. However, 1 cm garden soil covered seedlings appeared to have the longest leaves with a mean of 24.87 cm while black polyethylene covered seedlings registered the shortest leaves of 22.41 cm. This may due to the effect of decayed plants and animals, nutrients and beneficial microorganisms that makes up the garden soil (Hiscox, 2005) which helps in the elongation of length of leaves of rice seedlings.

Interaction effect. Results revealed that there is no interaction among the organic fertilizers and the covering materials on the length of leaves of the seedlings.

Color of the Leaves

Effect of organic fertilizers. No significant differences were observed on the effect of organic fertilizers to the color of leaves. Both the sunflower and alnus applied seedlings appeared to have the dark green color unlike the control which showed the light green leaves. This means that the seedlings may have absorbed all the nutrients which made the color of the leaves darker.

Table 7. Color of the leaves after emergence as affected by fertilizers and covering materials

TREATMENT	SCALE	REMARKS
Organic Fertilizes (O)		
Control	3	Light green
Sunflower	1	Dark green
Alnus	1	Dark green
Covering Materials (C)		
No Cover	3	Light green
1 cm Garden Soil	1	Dark green
Black Polyethylene	1	Dark green
Straw Feed Sack	1	Dark green

Color of the leaves: 1-dark green, 3-yellow, 5-yellow, 7-brown, 9-dead

Effect of covering materials. It was observed that application of covering materials did not affect the color of the leaves of seedlings. No cover appeared to have light green leaves while the others had dark green leaves.

Leaf Area

Effect of organic fertilizers. No significant differences were observed among the organic fertilizers on the leaf area of the seedlings. However, sunflower applid seedlings obtained the widest leaves of 41.70 cm^2, alnus applied obtained 37.72 cm^2 and the least area of 32.93 cm^2 was obtained from the control (Table 8).

Effect of covering materials. Statistical analysis shows that there are no significant differences on the effect of covers on the area of leaves (Table 8).

Table 8. Leaf area after emergence as affected by organic fertilizers and covering materials

TREATMENT	LEAF AREA (cm^2)
Organic Fertilizer (O)	
Control	32.93
Sunflower	41.70
Alnus	37.72
Covering Materials (C)	
No Cover	36.70
1 cm Garden Soil	40.70
Black Polyethylene	31.40
Straw Feed Sack	40.99
O x C	ns
CV (%)	38.67

*Means with the same letter(s) are not significantly different at 5% level of DMRT

Interaction effect. It was observed that there is a significant interaction between the organic fertilizers and covering materials. Combination of black polyethylene covering and sunflower application produced very vigorous seedlings than the other combinations. This means that application of sunflower and block polyethylene may help in maintaining the vigor of seedlings.

Interaction effect. It was observed that there is no interaction effect of the organic fertilizers and covering materials on the leaf area of seedlings.

Seedling Vigor

Effect of organic fertilizers. Table 9 shows the effect of organic fertilizers on the seedling vigor of seedlings. Sunflower applied seedlings appeared to be more vigorous than those of control and alnus applied. Sunflower application resulted in the highest number of leaves and widest culm diameter which made the seeds vigorous.

Effect of covering materials. Table 10 shows the different effect of covers on the seedling vigor of the seeds. The use of black polyethylene as cover appeared to have resulted in more vigorous seeds than the other treatments.

Table 9. Seedling vigor after emergence as affected by organic fertilizers and covering materials

TREATMENT	SCALE	REMARKS
Organic Fertilizers (O)		
Control	3	Vigorous
Sunflower	1	Very Vigorous
Alnus	3	Vigorous
Covering Materials		
No Cover	3	Vigorous
1 cm Garden Sol	3	Vigorous
Black Polyethylene	1	Very Vigorous
Straw Feed Sack	3	Vigorous

Seedling vigor: 1=very vigorous, 3=vigorous, 5-normal, 7-week, 9-very weak

Rice Blast Incidence

Effect of organic fertilizers. Table 10 shows the rice blast incidence as affected by the different organic fertilizer treatments. Application of organic fertilizers made the seedlings resistant to blast but alnus made seedlings more resistant to blast.

Effect of covering materials. In Table 11, results revealed that there were differences among the covers on the blast resistance of seedlings. It shows that the covering of black polyethylene and straw feed sack may help the seedlings become more resistant to blast than those of with no cover and 1 cm garden soil.

Table 10. Rice blast after emergence as affected by organic fertilizers and covering materials

TREATMENT	RATING	REMARKS
Organic Fertilizers (O)		
Control	2	Intermediate
Sunflower	2	Intermediate
Alnus	1	Resistant
Covering Materials		
No cover	2	Intermediate
1 cm Garden Soil	2	Intermediate
Black Polyethylene	1	Resistant
Straw Feed Sack	1	Resistant

1-resistant, 2-intermediate, 3-susceptible

Insect Pest Evaluation

Effect of organic fertilizers. Table 11 shows the insect pest evaluation as affected by the different organic fertilizers. Result revealed that alnus covered seedlings are more resistant to insect than those applied with sunflower and control. This means that application of organic fertilizer affects the resistance of seedlings to insects.

Effect of covers. Seedlings with covering of 1 cm garden soil and black polyethylene appeared to be more resistant to insect than those with no cover and straw feed sack. This means that without covering makes the seeds more susceptible to insect attack (Table 11).

Table 11. Insect pest after emergence as affected by organic fertilizers and covering materials

TREATMENT	RATING	REMARKS
Organic Fertilizers O)		
Control	3	Moderately Resistant
Sunflower	3	Moderately Resistant
Alnus	1	Resistant
Covering Materials		
No cover	3	Moderately Resistant
1 cm Garden Soil	1	Resistant
Black Polyethylene	1	Resistant
Straw Feed Sack	3	Moderately Resistant

1-resistant, 3-moderate resistant, 5-intermidiate, 9-susceptible

Fresh Weight of Seedlings

Effect of organic fertilizers. Table 12 shows the fresh weight of seedlings as affected by the different organic fertilizers. Statistical analysis shows no significant differences among the treatments. However, application of sunflower appeared to have the heaviest seedlings with a mean of 5.28 g while the lightest was observed in the control with a mean of 4.23 g. This could be due to the effect of number of leaves, longer length of roots, and length of leaves and thick culm diameter makes the seeds heavier.

Effect of covering materials. No significant differences were observed on the fresh weight of seedlings as affected by the covering materials. However, using of black polyethylene covering gave the heaviest seedlings with a mean of 5.2 g while straw feed sack gave the lightest with a mean of 4.64 g.

Interaction effect. Result show that there is no significant interaction between the treatments. Nevertheless, the combination of black polyethylene covering and sunflower application significantly increased the fresh weight of seedlings. In contrast to this, straw feed sack covering combined with control decreased the fresh weight of the seedlings.

Dry Weight of Seedlings

Effect of organic fertilizes. Significant differences were observed on the effect of organic fertilizers to the dry weight of seedlings. Sunflower applied seedlings obtained the heaviest with a mean o f 1.11 g while control gave the lightest with a mean of 0.82g. This means that application of organic fertilizers affects the entire weight of seedlings. This could be due to the effect of more leaves, longer roots, longer leaves and thicker culms which makes the weight of seedlings heavier.

Table 12. Final fresh weight and dry weight of seedlings as affected by organic fertilizers and covering materials

TREATMENT	FRESH WEIGHT (g)	DRY WEIGHT (g)
Organic Fertilizers (O)		
Control	4.23	0.22[b]
Sunflower	5.28	1.11[a]
Alnus	5.11	0.96[ab]
Covering Materials (C)		
No cover	4.97	0.98
1cm garden soil	4.86	0.94
Black polyethylene	5.02	1.00
Straw feed sack	4.64	0.91
O x C	Ns	*
(CV %)	21.87	27.81

*means with the same letter are not significantly different at 5% of DMRT

Effect of covering materials. It was observed that there are no significant differences on the dry weight of seedlings as affected by the different covering materials. However, black polyethylene covered seedlings appeared to have the heaviest (1.00 g) while the lightest appeared on straw feed sack covered seedlings with a mean of 0.91 g.

Interaction effect. There was an interaction effect between the organic fertilizers and covering materials on the dry weight of seedlings. Combination of lack polyethylene covering and sunflower application increased the dry weight of seedlings. This means that application of both organic fertilizers and covering materials affect the weight of rice

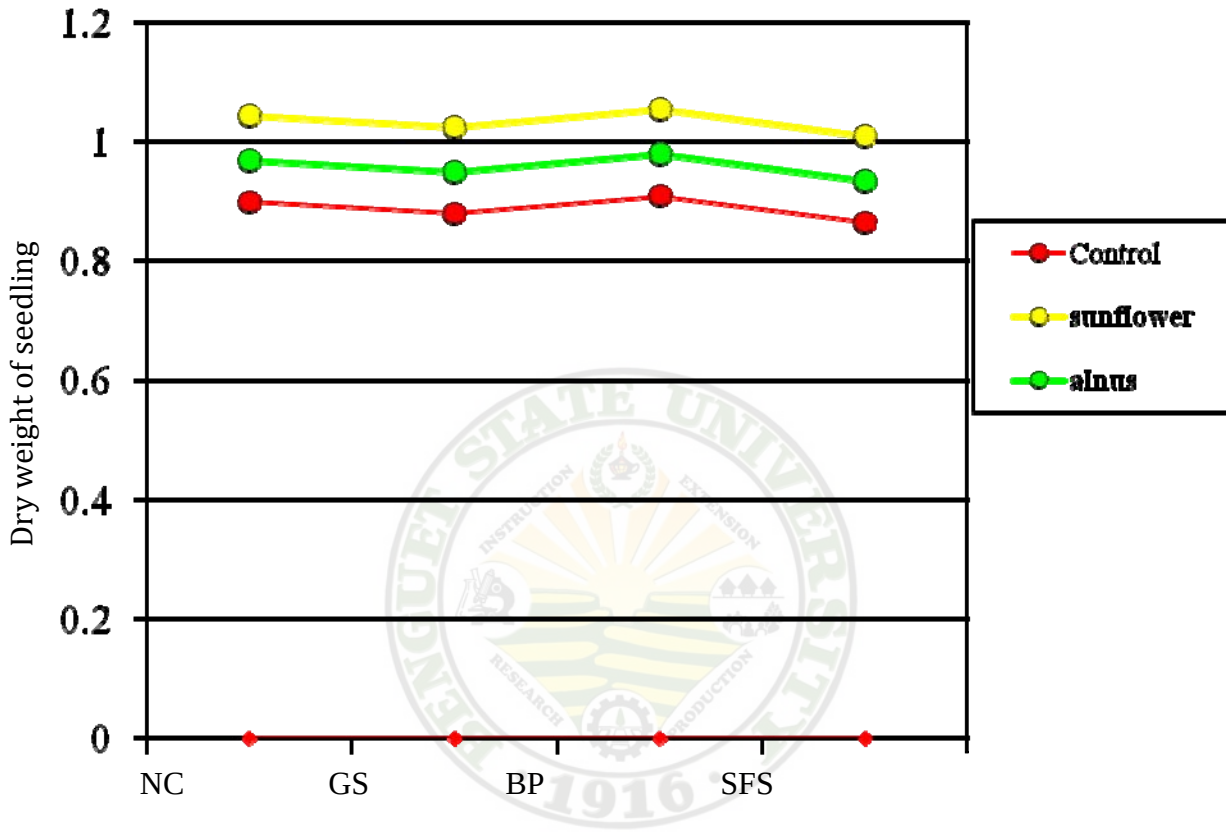
seedlings. This could be due to the effect of the warm temperature and high nutrients which helps in the elongation of leaves, roots and multiplication of tillers which made the seedling heavy (Fig. 8).

Final pH of the soil

The pH content of the soil as affected by the different organic fertilizers revealed that there is a difference among the treatments used in the study. Alnus applied seedlings gave the highest level of soil pH compared with sunflower applied and control. Results indicate that initial soil pH increased from 5.67 to 6.10. This means that soil is slightly acidic which indicates that application of organic fertilizer decreased the acidity of the soil (Brady, 1985).

Final Organic Matter of the Soil

The organic matter of the soil as affected by the different organic fertilizers is shown in Table 13. Results revealed that there is no difference among the treatments used in the study.



Legend:

NC- No Cover	BP- Black Polyethylene
GS- 1 cm Garden Soil	SFS- Straw Feed Sack

Figure 8. Dry weight of seedlings of rice applied with organic fertilizers and covering materials

Table 12. pH, OM, NPK content of the soil as affected by organic fertilizers and covering materials

TREATMENT	pH	OM	N (%)	P (ppm)	K (ppm)
Organic Fertilizers (O)					
Initial Soil	5.67	4.0	20	100	160
Control	5.61	4.0	20	100+	172
Sunflower	5.93	4.0	20	100+	224
Alnus	6.10	4.0	20	100+	500

Final Nitrogen of the Soil

Result shows that the application of organic fertilizers did not affect the nitrogen content of the soil. This means that the nitrogen content of organic fertilizers had absorbed by rice seedlings. This indicates that the organic fertilizers that was applied provides the amount of nitrogen needed by rice seedlings.

Final Phosphorous of the Soil

Table 12 shows that there is no difference on the phosphorous content of the soil being affected by the different organic fertilizers. The sunflower and alnus increases the phosphorous content of the soil.

Final Potassium of the Soil

The final potassium content of the soil as affected by the different organic fertilizers is shown on Table 14. Results showed that there is a difference among the treatments used. From initial soil with a potassium content of 160 ppm increases to 500

ppm in alnus to 224 ppm in sunflower while it decreases to 172 ppm in control. This means that application of organic fertilizers helps in the increase of potassium content of the soil. Ebbes (2000) stated that alnus promotes an increase on the potassium content of the soil.

SUMMARY, CONCLUSION AND RECOMMENDATION

Summary

The study was conducted to determine the effect of organic fertilizers on the seedling emergence and growth of rice, determine the effect of covering materials on the seedling emergence and growth of rice and determine the combination of organic fertilizers and covering materials on the seedling emergence and growth of rice seedlings.

Result revealed that seedlings applied with sunflower were the earliest to emerge, had the longest roots, had dark green leaves, very vigorous and had the highest weight. The alnus application increased the number of days of rice seedling. However, alnus application appeared to have dark green in color, vigorous and resistant to blast and insect pests.

Results indicate that application of covering materials made the seedling earlier to emerge, but without covering materials the seeds results in longer emergence. Using block polyethylene, the seeds took shorter days to emerge, dark green in color, very vigorous and resistant to blast and insect pest. Garden soil used as cover produced the highest percent emergence, dark green leaves, vigorous and resistant to insect. Straw feed sack as a cover produced the tallest seedlings at 6, 12, and 18 DAS, dark green leaves, vigorous and resistant to blast. Significant differences were obtained between organic fertilizers and covering materials. The combination of sunflower and black polyethylene made the seeds earlier to emerge and made the seedling very vigorous. The sunflower or any covering materials made dark green leaves. It shows also that the combination of alnus and block polyethylene or straw feed sack made the seedlings resistant to blast. The application of sunflower and alnus decreased the acidity of the soil.

Conclusions

In conclusion, application of organic fertilizers and covering materials affects the seedling emergence and growth of rice under wet-bed method. In terms of choosing the best combination, it was found out that sunflower application coupled with black polyethylene covering produced the best rice seedlings.

Recommendation

1. Sunflower as an organic fertilizer is the best for rice seedling production.

2. Black polyethylene as a covering material is the best for rice seedling production.

3. The combination of black polyethylene and sunflower is the best for rice seedling production.

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APPENDICES

Appendix Table 1. Number of days from sowing to emergence as affected by organic fertilizer and covering materials

TREATMENT	REPLICATION I	II	III	TOTAL	MEAN
O_0C_0	12	11	9	32	10.66
C_1	9	9	6	24	8.00
C_2	6	6	5	17	5.66
C_3	8	6	6	20	6.00
O_1C_1	9	11	9	29	9.66
C_1	6	6	6	18	6.00
C_2	5	6	5	16	5.33
C_3	6	4	5	15	5.00
O_2C_0	12	12	9	33	11.00
C_1	9	6	6	21	7.00
C_2	11	5	5	21	7.00
C_3	9	6	6	21	7.00
TOTAL	102	88	77	267	88.97

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARE	COMPUTED F	TABULAR F 0.05	0.01
Replication	2	26.17	13.08	4.69*	0.05	5.72
Treatment	11	135.42	12.31	4.41*	2.26	3.18
O - Organic fertilizers	2	15.50	7.75	2.78	3.44	5.72
C - Covering materials	3	114.97	38.32	13.74*	3.05	4.82
O x C	(6)	4.94	0.82	0.29*	2.55	3.76
Error	22	61.33	2.79			
TOTAL	35	358.33				

* = Significant Cv (%) = 21.55

Appendix Table 2. Seedling height at 6 DAS as affected by organic fertilizer and covering materials

TREATMENT	REPLICATION I	II	III	TOTAL	MEAN
O_0C_0	6.30	5.40	4.40	16.10	5.36
C_1	5.90	8.10	7.30	21.30	7.10
C_2	8.45	5.55	9.50	23.50	7.83
C_3	8.40	8.90	9.50	26.80	8.93
O_1C_1	6.80	7.10	8.80	22.70	7.56
C_1	5.35	5.70	7.00	18.05	6.02
C_2	6.00	6.10	7.50	19.60	6.53
C_3	8.65	8.60	9.10	26.35	8.78
O_2C_0	5.00	4.65	6.10	15.75	5.25
C_1	6.00	6.30	9.05	21.35	7.12
C_2	5.40	4.80	4.90	15.10	5.03
C_3	7.25	7.20	7.00	21.45	7.15
TOTAL	79.50	78.40	90.15	248.05	613.30

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARE	COMPUTED F	TABULAR F 0.05	0.01
Replication	2	7.02	3.51	3.00*	0.05	5.72
Treatment	11	55.85	5.08	4.35*	2.26	3.18
O - Organic fertilizers	2	10.24	5.12	4.38*	3.44	5.72
C - Covering materials	3	25.60	8.53	7.30*	3.05	4.82
O x C	(6)	20.01	3.34	2.86*	2.55	3.76
Error	22	25.70	1.17			
TOTAL	35	144.42				

* = Significant Cv (%) = 15.02

Appendix Table 3. Percentage of emergence at 12 DAS as affected by organic fertilizers and covering materials

TREATMENT	REPLICATION I	II	III	TOTAL	MEAN
O_0C_0	59	85	83	227	75.66
C_1	70	88	85	243	81.00
C_2	65	70	50	185	61.66
C_3	69	70	85	224	74.66
O_1C_1	80	85	90	255	85.00
C_1	80	80	70	230	76.67
C_2	70	75	78	223	74.33
C_3	80	70	85	235	78.33
O_2C_0	70	65	70	205	68.33
C_1	90	86	75	251	83.67
C_2	70	90	53	213	71.00
C_3	60	88	75	223	74.33
TOTAL	863	952	899	2,714	904.64

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARE	COMPUTED F	TABULAR F 0.05	0.01
Replication	2	334.05	167.03	1.49*	0.05	5.72
Treatment	11	1388.56	126.23	1.23	2.26	3.18
O - Organic fertilizers	2	190.72	95.36	0.85	3.44	5.72
C - Covering materials	3	606.78	202.26	1.81	3.05	4.82
O x C	(6)	591.05	98.51	0.88	2.55	3.76
Error	22	2,464.00	112.00			
TOTAL	35	5,575.16				

* = Significant Cv (%) = 13.44

Appendix Table 4. Seedling height at 12 DAS as affected by organic fertilizers and covering materials

TREATMENT	REPLICATION I	II	III	TOTAL	MEAN
O_0C_0	9.0	8.0	8.4	25.40	8.46
C_1	9.2	11.0	1.0	30.20	10.06
C_2	8.8	9.0	10.5	28.30	9.43
C_3	10.5	9.4	12.3	32.20	10.73
O_1C_1	10.0	10.0	9.0	29.00	9.66
C_1	10.1	8.9	11.0	30.00	10.00
C_2	8.5	8.4	10.0	26.90	8.96
C_3	10.3	10.4	11.0	31.70	10.56
O_2C_0	8.0	8.3	9.3	25.60	8.53
C_1	9.2	11.5	13.0	33.70	11.23
C_2	8.6	9.0	8.4	26.00	8.66
C_3	9.8	10.0	11.0	30.80	10.26
TOTAL	112	113.9	123.9	349.8	116.54

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARE	COMPUTED F	TABULAR F 0.05	0.01
Replication	2	6.81	3.41	3.38*	0.05	5.72
Treatment	11	27.82	2.53	2.51*	2.26	3.18
O - Organic fertilizers	2	0.13	0.06	0.06	3.44	5.72
C - Covering materials	3	20.97	6.99	6.93**	3.05	4.82
O x C	(6)	6.72	1.12	1.11	2.55	3.76
Error	22	22.19				
TOTAL	35	84.64	1.01			

* = Significant Cv (%) = 9.89

Appendix Table 5. Seedling height at 18 DAS as affected by organic fertilizers and covering materials

TREATMENT	REPLICATION I	II	III	TOTAL	MEAN
O_0C_0	13.4	10.7	11.8	35.9	11.96
C_1	11.2	14.1	14.00	39.3	13.1
C_2	11.2	12.9	13.05	37.15	12.38
C_3	14.6	13.7	14.4	42.7	14.38
O_1C_1	12.7	13.1	14.6	40.4	14.23
C_1	12.2	12.4	14.45	38.95	13.46
C_2	11.5	13.0	13.15	37.65	12.98
C_3	13.6	13.35	13.5	40.45	12.55
O_2C_0	11.7	11.1	12.6	35.4	13.48
C_1	13.0	13.3	15.3	41.6	11.8
C_2	12.12	12.3	10.9	35.32	13.86
C_3	12.3	13.2	13.15	38.65	11.77
					12.88
TOTAL	149.42	153.15	160.9	463.47	154.45

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARE	COMPUTED F	TABULAR F 0.05	0.01
Replication	2	5.71	2.86	2.56*	0.05	5.72
Treatment	11	21.46	1.95	1.75	2.26	3.18
O - Organic fertilizers	2	1.79	0.89	0.80	3.44	5.72
C - Covering materials	3	11.27	3.75	3.36	3.05	4.82
O x C	(6)	8.39	1.40	1.25	2.55	3.76
Error	22	24.58	1.12			
TOTAL	35	73.20				

* = Significant

Cv (%) = 7.86

Appendix Table 6. Seedling height at 24 DAS as affected by organic fertilizers and covering materials

TREATMENT	REPLICATION I	II	III	TOTAL	MEAN
O_0C_0	16.30	16.80	14.50	47.60	15.76
C_1	14.72	17.99	18.08	50.79	16.93
C_2	15.80	16.20	18.10	50.10	16.70
C_3	17.05	17.39	18.10	52.54	17.51
O_1C_1	17.92	17.10	18.49	53.51	17.83
C_1	15.97	17.08	19.35	52.40	17.46
C_2	15.77	15.70	17.65	49.12	16.37
C_3	18.08	16.22	19.97	54.27	18.09
O_2C_0	16.00	17.10	16.10	49.20	16.40
C_1	18.32	17.85	19.20	55.37	18.45
C_2	15.78	17.85	15.55	49.18	16.39
C_3	15.71	17.36	17.30	50.37	16.79
TOTAL	197.42	204.64	212.39	614.45	204.68

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARE	COMPUTED F	TABULAR F 0.05	0.01
Replication	2	9.34	4.67	2.79*	0.05	5.72
Treatment	11	20.94	1.90	1.14	2.26	3.18
O - Organic fertilizers	2	2.91	1.46	0.87	3.44	5.72
C - Covering materials	3	8.36	2.79	1.67	3.05	4.82
O x C	(6)	9.66	1.61	0.96	2.55	3.76
Error	22	36.88	1.67			
TOTAL	35	88.09				

ns = Not significant Cv (%) = 7.14

Appendix Table 7. Seedling height at 30 DAS as affected by organic fertilizers and organic materials

TREATMENT	REPLICATION I	II	III	TOTAL	MEAN
O_0C_0	22.05	26.01	23.95	72.01	24.00
C_1	23.5	25.25	28.60	77.35	25.78
C_2	25.2	26.8	23.95	75.95	25.31
C_3	25.8	25.15	26.08	77.03	25.67
O_1C_1	27.6	29.0	27.01	83.61	27.87
C_1	26.35	27.4	26.85	80.6	26.86
C_2	24.05	25.01	26.35	75.41	25.13
C_3	28.85	28.12	26.35	83.32	27.77
O_2C_0	34.1	27.0	22.75	83.85	27.95
C_1	26.9	25.65	29.4	81.95	27.31
C_2	22.9	25.65	23.35	71.9	23.96
C_3	25.4	27.90	25.05	78.35	26.12
TOTAL	312.7	318.94	309.69		313.73

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARE	COMPUTED F	TABULAR F 0.05	0.01
Replication	2	3.71	1.86	0.35*	0.05	5.72
Treatment	11	66.49	6.04	1.14	2.26	3.18
O - Organic fertilizers	2	18.33	9.16	1.73	3.44	5.72
C - Covering materials	3	21.67	7.22	1.36	3.05	4.82
O x C	(6)	26.49	4.42	0.83	2.55	3.76
Error	22	11.67	5.30			
TOTAL	35	148.36	148.36			

ns = Not significant Cv (%) = 8.43

Appendix Table 8. Seedling height at 35 DAS as affected by organic fertilizers and covering materials

TREATMENT	REPLICATION I	II	III	TOTAL	MEAN
O_0C_0	30.44	29.05	29.10	88.59	29.53
C_1	27.58	35.56	38.59	101.73	33.91
C_2	30.20	27.87	29.10	87.17	29.05
C_3	33.30	28.78	32.70	94.78	31.59
O_1C_1	34.80	33.56	34.57	102.93	34.31
C_1	32.22	30.12	34.75	97.09	32.36
C_2	30.20	29.43	31.30	90.93	30.31
C_3	33.36	34.80	28.47	96.63	32.18
O_2C_0	29.75	33.63	27.63	91.01	30.33
C_1	37.68	33.07	36.55	107.30	35.76
C_2	28.94	35.07	29.15	93.16	31.05
C_3	29.72	33.63	32.00	95.35	31.78
TOTAL	378.19	384.57	383.91	1,146.67	382.16

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARE	COMPUTED F	TABULAR F 0.05	0.01
Replication	2	2.05	1.03	0.13*	0.05	5.72
Treatment	11	133.74	12.06	1.50	2.26	3.18
O - Organic fertilizers	2	12.40	6.20	0.77	3.44	5.72
C - Covering materials	3	70.32	23.44	2.90	3.05	4.82
O x C	(6)	51.01	8.50	1.05	2.55	3.76
Error	22	178.11	8.09			
TOTAL	35	447.63				

* = Significant Cv (%) = 8.55

Appendix Table 9. Length of roots at 14 DAS as affected by organic fertilizers and covering materials

TREATMENT	REPLICATION I	II	III	TOTAL	MEAN
O_0C_0	6.20	5.30	4.60	16.10	5.37
C_1	15.30	6.20	6.00	17.50	5.83
C_2	7.40	6.32	9.31	23.03	7.68
C_3	5.90	5.65	5.16	16.71	5.57
O_1C_1	7.30	6.58	5.40	19.28	6.43
C_1	4.80	9.16	7.13	21.09	7.03
C_2	6.25	7.20	8.53	21.98	7.33
C_3	6.4	9.52	6.76	22.68	7.56
O_2C_0	6.6	5.90	6.4	18.90	6.30
C_1	6.3	9.40	5.47	21.17	7.06
C_2	6.4	7.9	6.35	20.65	6.88
C_3	6.7	7.2	6.75	20.65	6.88
TOTAL	75.55	86.33	77.86	239.74	79.92

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARE	COMPUTED F	TABULAR F 0.05	0.01
Replication	2	5.37	2.68	1.60*	0.05	5.72
Treatment	11	19.23	1.75	1.04	2.26	3.18
O - Organic fertilizers	2	5.96	2.98	1.77	3.44	5.72
C - Covering materials	3	7.19	2.40	1.43	3.05	4.82
O x C	(6)	36.96	1.68		2.55	3.76
Error	22					
TOTAL	35	80.78				

ns = Not significant Cv (%) = 18.60

Appendix Table 10. Length of roots at 35 DAS as affected by organic fertilizers and covering materials

TREATMENT	REPLICATION I	II	III	TOTAL	MEAN
O_0C_0	11.25	12.40	9.69	31.34	10.45
C_1	11.25	12.05	12.1	35.35	11.78
C_2	13.25	12.65	17.7	43.6	14.53
C_3	12.25	11.65	12.94	36.84	12.28
O_1C_1	13.15	14.8	12.65	40.6	13.53
C_1	10.85	17.35	13.01	41.21	13.74
C_2	12.27	13.7	15.20	41.17	13.72
C_3	12.3	16.9	14.00	43.20	14.4
O_2C_0	12.9	11.5	12.30	36.70	12.23
C_1	13.21	15.57	12.25	41.03	13.68
C_2	13.15	14.16	12.30	39.61	13.20
C_3	14.70	12.45	15.44	42.59	14.20
TOTAL	150.48	163.18	159.58	473.24	157.74

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARE	COMPUTED F	TABULAR F 0.05	0.01
Replication	2	7.14	3.57	1.11*	0.05	5.72
Treatment	11	49.33	4.48	1.39	2.26	3.18
O - Organic fertilizers	2	15.71	7.86	2.44	3.44	5.72
C - Covering materials	3	16.61	5.54	1.72	3.05	4.82
O x C	(6)	17.00	2.83	0.88	2.55	3.76
Error	22	70.76	3.22			
TOTAL	35	176.55				

ns = Not significant Cv (%) = 13.06

Appendix Table 11. Percent survival of the seedlings as affected by organic fertilizers and covering materials

TREATMENT	REPLICATION I	II	III	TOTAL	MEAN
O_0C_0	59	83	80	222	74
C_1	70	86	70	226	75.33
C_2	58	70	48	176	58.00
C_3	60	70	81	211	70.33
O_1C_1	78	85	90	253	84.33
C_1	75	77	70	222	74.00
C_2	66	75	74	215	71.67
C_3	80	66	80	226	75.33
O_2C_0	60	65	60	185	61.67
C_1	85	80	75	240	80.00
C_2	60	90	50	200	66.67
C_3	49	80	50	179	59.67
TOTAL	800	927	828	804	851.00

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARE	COMPUTED F	TABULAR F 0.05	0.01
Replication	2	742.06	371.03	2.91*	0.05	5.72
Treatment	11	2104.97	191.36	1.50	2.26	3.18
O - Organic fertilizers	2	557.39	278.69	2.18	3.44	5.72
C - Covering materials	3	630.53	210.18	1.65	3.05	4.82
O x C	(6)	917.06	152.84	1.20	2.55	3.76
Error	22	2808.00	127.64			
TOTAL	35	7,760.01				

ns = Not significant Cv (%) = 15.24

Appendix Table 12. Seedling culm diameter as affected by organic fertilizers and covering materials

TREATMENT	REPLICATION I	II	III	TOTAL	MEAN
O_0C_0	9.40	9.20	6.40	25.00	8.33
C_1	8.00	5.60	5.20	18.80	6.26
C_2	4.80	5.30	6.90	17.00	5.67
C_3	6.10	9.20	5.70	21.00	7.00
O_1C_1	6.50	8.10	5.50	20.10	6.70
C_1	5.90	9.90	6.60	22.40	7.47
C_2	6.00	10.00	6.20	22.20	7.40
C_3	10.90	8.00	9.63	28.53	6.51
O_2C_0	4.80	5.30	5.40	15.50	5.17
C_1	10.80	4.30	9.70	24.80	8.27
C_2	9.40	10.60	6.00	26.00	8.67
C_3	6.80	12.40	3.60	22.80	7.60
TOTAL	89.40	97.90	76.83	264.13	88.05

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARE	COMPUTED F	TABULAR F 0.05	0.01
Replication	2	18.73	9.36	1.68	0.05	5.72
Treatment	11	52.81	4.80	0.86	2.26	3.18
O - Organic fertilizers	2	5.58	2.79	0.50	3.44	5.72
C - Covering materials	3	7.76	2.59	0.47	3.05	4.82
O x C	(6)	39.46	6.58	1.18	2.55	3.76
Error	22	122.39				
TOTAL	35	246.73	5.56			

^{ns} = Not significant Cv (%) = 30.78

Appendix Table 13. Total number of leaves as affected by organic fertilizers and covering materials

TREATMENT	REPLICATION I	II	III	TOTAL	MEAN
O_0C_0	6.50	5.2	6.9	18.6	6.2
C_1	9.00	7.1	5.1	21.2	7.07
C_2	9.00	8.4	6.5	23.9	7.97
C_3	8.7	7.6	4.2	20.5	6.83
O_1C_1	9.1	6.9	6.9	22.9	7.63
C_1	6.0	7.4	6.3	19.7	6.57
C_2	8.7	10.2	10.1	29.0	9.67
C_3	7.4	7.9	7.2	22.5	7.50
O_2C_0	8.7	5.5	4.8	19.0	6.33
C_1	9.2	10.6	5.1	24.9	8.33
C_2	9.3	7.8	6.6	23.7	7.90
C_3	12.1	7.7	6.9	26.7	8.90
TOTAL	103.7	92.3	76.6	272.60	

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARE	COMPUTED F	TABULAR F 0.05	0.01
Replication	2	30.86	15.43	4.59*	0.05	5.72
Treatment	11	36.54	3.32	0.99	2.26	3.18
O - Organic fertilizers	2	5.56	2.78	0.83	3.44	5.72
C - Covering materials	3	15.32	5.11	1.52	3.05	4.82
O x C	(6)	15.67	2.61	0.78	2.55	3.76
Error	22	73.91	3.36			
TOTAL	35	177.86			272.60	90.90

ns = Not significant Cv (%) = 23.17

Appendix Table 14. Length of leaves as affected by organic fertilizers and covering materials

TREATMENT	REPLICATION I	II	III	TOTAL	MEAN
O_0C_0	19.60	19.50	21.45	60.55	20.18
C_1	19.32	25.70	28.50	73.52	24.50
C_2	22.60	23.32	21.45	67.37	22.45
C_3	23.32	21.98	23.76	69.06	23.02
O_1C_1	24.05	25.32	21.45	70.82	23.60
C_1	26.70	24.30	30.16	81.16	27.05
C_2	20.10	24.30	20.92	65.32	21.77
C_3	22.98	25.68	23.89	72.55	24.18
O_2C_0	24.35	25.32	25.90	75.57	25.19
C_1	26.31	17.92	24.92	69.15	23.05
C_2	20.82	22.02	26.16	69.00	23.00
C_3	21.70	28.98	22.7	73.38	24.26
TOTAL	271.85	284.34	291.26	847.45	282.45

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARE	COMPUTED F	TABULAR F 0.05	0.01
Replication	2	16.13	8.06	1.00	0.05	5.72
Treatment	11	100.89	9.17	1.14	2.26	3.18
O - Organic fertilizers	2	18.26	9.13	1.13	3.44	5.72
C - Covering materials	3	31.19	10.40	1.29	3.05	4.82
O x C	(6)	51.43	8.57	1.06	2.55	3.76
Error	22	177.52	8.07			
TOTAL	35	395.42				

^{ns} = Not significant Cv (%) = 11.55

Appendix Table 15. Leaf area of seedlings as affected by organic fertilizers a covering materials

TREATMENT	REPLICATION I	II	III	TOTAL	MEAN
O_0C_0	36.00	19.00	26.16	81.16	27.05
C_1	31.29	33.49	51.5	116.28	38.76
C_2	39.38	20.86	45.42	105.66	35.22
C_3	30.60	17.73	13.7	92.03	30.68
O_1C_1	57.00	55.64	64.5	177.14	59.04
C_1	47.00	41.99	52.04	141.03	47.01
C_2	30.40	30.15	39.92	100.47	33.49
C_3	21.56	30.68	29.49	81.73	27.24
O_2C_0	29.00	18.00	25.00	72.00	24.00
C_1	17.53	39.03	52.40	708.96	36.32
C_2	25.99	20.64	29.86	76.49	25.50
C_3	36.00	49.77	109.36	195.13	65.54
TOTAL	401.75	378.98	569.35	1,348.08	499.35

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARE	COMPUTED F	TABULAR F 0.05	0.01
Replication	2	1825.26	912.63	3.99*	0.05	5.72
Treatment	11	5774.33	524.94	2.30*	2.26	3.18
O - Organic fertilizers	2	462.77	231.39	1.01	3.44	5.72
C - Covering materials	3	541.75	180.58	0.79	3.05	4.82
O x C	(6)	4769.81	794.97	3.48*	2.55	3.76
Error	22	5028.21	228.55			
TOTAL	35	18402.13				

ns = Not significant Cv (%) = 38.67

Appendix Table 16. Fresh weight of the seedlings as affected by organic fertilizers and covering materials

TREATMENT	REPLICATION I	II	III	TOTAL	MEAN
O_0C_0	3.6	4.2	3.8	11.6	8.87
C_1	5.1	3.2	5.2	13.5	4.5
C_2	5.0	3.5	4.0	12.5	4.17
C_3	5.0	3.0	5.2	13.2	4.4
O_1C_1	5.5	6.7	5.0	17.2	5.73
C_1	6.5	4.6	6.0	17.1	5.7
C_2	5.0	6.9	4.0	15.9	5.3
C_3	4.3	5.8	3.0	13.1	4.37
O_2C_0	5.2	6.7	4.0	15.9	5.3
C_1	5.1	5.0	3.0	13.1	4.37
C_2	6.5	5.1	5.2	16.8	5.6
C_3	4.5	5.9	5.1	15.5	5.17
TOTAL	61.3	60.6	53.5	175.4	58.748

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARE	COMPUTED F	TABULAR F 0.05	0.01
Replication	2	3.10	1.55	1.25	0.05	5.72
Treatment	11	14.37	1.31	1.05	2.26	3.18
O - Organic fertilizers	2	7.51	3.76	3.03	3.44	5.72
C - Covering materials	3	0.75	0.25	0.20	3.05	4.82
O x C	(6)	6.10	1.02	0.82	2.55	3.76
Error	22	27.26	1.24			
TOTAL	35	59.09				

^{ns} = Not significant Cv (%) = 15.24

Appendix Table 17. Dry weight of the seedlings as affected by organic fertilizers and covering materials

TREATMENT	REPLICATION I	II	III	TOTAL	MEAN
O_0C_0	0.53	0.69	0.49	1.71	0.57
C_1	1.00	0.80	1.00	2.80	0.93
C_2	0.95	0.90	0.66	2.51	0.84
C_3	0.89	0.87	1.00	2.76	0.92
O_1C_1	1.30	1.50	0.90	3.70	1.23
C_1	1.46	0.66	1.36	3.48	1.16
C_2	0.80	1.55	1.00	3.35	1.12
C_3	0.64	1.00	1.14	2.78	0.93
O_2C_0	0.93	1.60	0.89	3.42	1.14
C_1	0.73	0.89	0.58	2.20	0.73
C_2	1.30	0.87	1.00	3.17	1.06
C_3	0.77	1.20	0.72	2.69	0.90
TOTAL	3.73	4.56	3.19	11.48	

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARE	COMPUTED F	TABULAR F 0.05	0.01
Replication	2	0.14	0.07	0.89	0.05	5.72
Treatment	11	1.22	0.11	1.43	2.26	3.18
O - Organic fertilizers	2	0.52	0.26	3.34	3.44	5.72
C - Covering materials	3	0.04	0.01	0.18	3.05	4.82
O x C	(6)	0.66	0.11	1.14	2.55	3.76
Error	22	1.71	0.07			
TOTAL	35	4.29				

^{ns} = Not significant Cv (%) = 11.55