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# Off-Season Onion Seedling Production with Plant Growth Enhancer

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***Abstract***

**Aim:** This study determined the performance of onion seedlings applied with plant growth enhancer as a foliar spray and vermicompost in the soil media, as source of planting material for off-season planting.

**Methodology:** This study was conducted at the nursery area of the Provincial Agriculture Office from January to February 2023. The seedlings were applied with plant growth enhancer as a foliar spray and vermicompost in the soil media. The study was laid out in a Completely Randomized Design with three replications. Five treatments and a control were employed in the study using vermicompost at recommended rates and different levels of AMO foliar fertilizer.

**Results:** Results indicated that there was no notable effect in plant height at 15 days after planting however, at 35 days after planting, variations in seedling heights were observed among treatments. Specifically, plants applied with foliar fertilizer alone (3 liters AMO) and the plants applied with combination of 10 bags of vermicompost per hectare and 3 liters per hectare of AMO foliar fertilizer resulted in tallest plants. Leaf count at 35 days after sowing likewise was not influenced by fertilization. However, the combined application of vermicompost and foliar fertilizer effectively increased seedling weight, indicating potential advantages for onion growth and development.

**Conclusion:** Onion seedlings during off-season planting is feasible following the recommended rate of 10 bags vermicompost and AMO foliar fertilizer at 3 liters per hectare. Despite no significant effect being demonstrated in growth parameters except at 35 days after sowing, the effectiveness in increasing seedling weight is realized, suggesting its potential to enhance the growth and development of onions, which is crucial for successful transplanting and ultimately higher yields in onion cultivation.

***Keywords:*** *Onion seedlings, off-season planting, plant growth enhancer, onion bulb*

## INTRODUCTION

Onion (*Allium cepa*), commonly known in the country as "sibuyas" is one of the most important vegetable crops in the Philippines widely used as spices and are common ingredients of most Filipino dishes. *Alliums* in dehydrated and powdered forms are also used in significant quantities by industries engaged in the manufacture of instant foods, soy sauce, pickled vegetables, catsup, and canned food products. Furthermore, it is well recognized for their medicinal value which is now well recognized by some pharmaceuticals.

The production of off-season onions not only ensures a steady supply throughout the year, preventing shortages and price spikes during off-peak periods, but also provides farmers with an additional source of income outside the traditional growing season, helping to stabilize their earnings. This practice allows for more efficient use of resources, supports employment, fosters innovation, and promotes environmental sustainability, all of which are key aspects of modern agricultural practices. Since farmers build healthy soils, organic agriculture can very much be seen as part of the solution to in support to the government sustainable development goals (SDG Number 2) of ending hunger, achieving food security and improved nutrition and promoting sustainable agriculture.

Onion growers primarily face issues such as nutrient deficiencies that impact product quality and yield. Since onions heavily depend on optimal growing conditions, effective management practices are crucial for achieving high yields. Establishing robust seedlings, especially during off-season planting, is vital for successful crop growth. Onion seedlings need a balanced nutrient supply for healthy development. Ensuring strong growth and root development is

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essential, as conventional fertilization methods may not sustain long-term yields, leading to soil fertility depletion and multiple nutrient deficiencies. Using organic fertilizers can help address these challenges. By adopting effective management practices with organic fertilizers, onion growers can achieve a successful crop with high-quality bulbs at harvest. This aligns with RA 10068, the Organic Agriculture Act of 2021, amended by RA 11511 in July 2020, which supports farmers through training, organic certification, and marketing. To address these issues, it helps meet market demands, supports farmers' livelihoods, and leverages technological advancements, ultimately contributing to a more resilient and sustainable agricultural system in onion production.

**Objectives**

Generally, this study aimed to determine the performance of seedling production of onion for off-season planting applied with plant growth enhancer.

Specifically, it aimed to:

1. determine the effect of plant growth enhancer on onion seedling production for off-season planting;
2. determine the influence of plant growth enhancer on the growth of onion seedling; and
3. determine which levels of plant growth enhancer increases the growth of onion seedlings.

**Hypothesis**

Given the stated research problem, the following hypotheses were tested on 0-1% level of significance:

Hypothesis 1: There is no significant difference in the plant height at 15 days after sowing among the different levels of plant growth enhancer treatments.

Hypothesis 2: There is a significant difference in the weight of seedlings at 35 days after sowing among the different levels of plant growth enhancer treatments.

Hypothesis 3: There is a significant difference in the plant height at 35 days after sowing among the different levels of plant growth enhancer treatments.

Hypothesis 4: There is no significant difference in the number of leaves at 15 days after sowing among the different levels of plant growth enhancer treatments.

Hypothesis 5: There is no significant difference in the number of leaves at 35 days after sowing among the different levels of plant growth enhancer treatments.

**METHODS**

**Securing of the Seeds**

The seeds of onion were procured from a reliable agricultural supply within the vicinity.

**Location of the Experimental Area**

Seedlings were raised in the Provincial plant nursery annex located at Barangay Alibagu, City of Ilagan, Isabela near Provincial Jail. The area is equipped with greenhouse nursery and solar powered irrigation system making it suitable for seedling production. The area provided protection from inclement weather conditions and infestation to pests and diseases and created an environment conducive to raise healthy seedlings.

**Raising of Seedlings**

The soil media used is the same composition used in the production of assorted vegetable seedlings being distributed to Isabela farmers. It is composed of garden soil, organic fertilizer (animal manure obtained at Cabagan Breeding Station) and carbonized rice hull to follow the 1:1:1 ratio. The soil media was mixed thoroughly, sieved and place in the seedling tray.

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**Growing of Seedlings**

The onion seeds were sown directly in a seedling tray with 128 holes (pots). One to two (2) two seeds were placed in each hole. Thinning and replanting of missing hills was done seven days after sowing to complete the plant population.

**Laying-out of the Experimental Area and Design**

Inside the nursery area, a total of 24 seedling trays were used to raise onion seedlings and arranged following the Completely Randomized Design with four replications.

**Fertilizer Application**

The seedling tray was applied with organic fertilizers while the plants was sprayed by plant growth enhancer. The plant growth enhancer as treatments was applied by spraying once a week while strictly monitoring of water management was applied.

**Experimental Treatments**

The levels of vermicompost based on a hectare basis at 10 bags per hectare was used. This was divided by the number of cells to satisfy the plant populations of 250,000 per hectare onion seedlings. Likewise, the levels of AMO foliar fertilizer was allocated from the number of seedlings.

The different levels of plant growth enhancers as treatments are as follows:

$T_1$ – Control
$T_2$ – 10 Bags Vermicompost $ha^{-1}$ (275 kg) without AMO Foliar Fertilizer
$T_3$ – 1.5 L $ha^{-1}$ AMO + 10 Bags Vermicompost $ha^{-1}$ (275 kg)
$T_4$ – 3 L $ha^{-1}$ AMO + 10 Bags Vermicompost $ha^{-1}$ (275 kg)
$T_5$ – 4.5 L $ha^{-1}$ AMO + 10 Bags Vermicompost $ha^{-1}$ (275 kg)
$T_6$ – 3 L $ha^{-1}$ AMO

**Care of the plants**

Foliar fertilizer was applied weekly for the assigned treatments.

a. Irrigation. Irrigation was done using atomizer by spraying with water evenly as needed to support the moisture requirements of the plants.
b. Pulling of Seedlings. The seedlings of onion were pulled gently one by one to prevent stress and seedling injury. Each replication was harvested, washed and subjected to measurement.

**Data Gathered**

Ten sample plants were taken at random for the following parameters:

1. Plant Height. The height of the onion seedling was recorded at 15 and 45 days after sowing from the base of the plants to the tip of the leaf's by a ruler.
2. Weight of the seedlings at 45 days after sowing. The weight of seedlings per treatment was taken at 45 days after sowing using the digital weighing balance.
3. Number of Leaves. The number of leaves taken from the 10 seedlings was counted and divided by 10 to determine the average number of leaves per plant.

**Statistical Analysis of the Data**

All the data gathered were tabulated and analyzed following the Analysis of Variance for Completely Randomized Design. Treatment means which showed significance at the 5% and 1% levels, a comparison of means was computed using the Honestly Significant Difference (HSD) test.

**Ethical Considerations**

The researcher ensured that all research protocols involving ethics in research were complied with for the protection of all people and institutions involved in the conduct of the study.

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## RESULTS and DISCUSSION

### Observations

1. Percentage Germination. It was observed that the seeds of onion showed 98 percent germination 10 days after sowing. Missing holes were immediately replaced to maintain the number of plants.
2. Seedling Vigor. The growth of onion seedlings was robust as indicated by the upright and erect leaves and their fully develop foliage. It was observed that bulb of onion started at 25 days after sowing.
3. Occurrence of Insect Pests. Thorough observation was done throughout the period of the study. As far as it was conducted inside the nursery area, no occurrence of insect pest was recorded.

### Plant Height at 15 Days after Sowing (cm).

The data presented in Table 1 indicates that the addition of vermicompost to the soil did not have a significant effect on plant height at 15 days after sowing. This suggests that even without vermicompost added to the soil media in the case of the control treatment, the average plant height remained relatively consistent at 12.84 cm, which was comparable to the height of seedlings grown with vermicompost. This could be attributed to the slow nutrient release of the organic fertilizers. Furthermore, the plants used in the study were homogeneous and healthy, and would, thus, did not reveal differences due to vermicompost application in the soil media. This emphasized that the uniformity on the height of the plants might be attributed to the even distribution of nutrients absorbed via the application of vermicompost.

Table 1. Plant Height at 15 Days after Sowing (cm) as affected by Levels of Plant Growth Enhancer

| **TREATMENTS** | Height (cm) |
|---|---|
| $T_1$ – Control | 13.59 |
| $T_2$ – 10 Bags Vermicompost ha$^{-1}$ (275 kg) without AMO Foliar Fert. | 14.76 |
| $T_3$ – 1.5 L ha$^{-1}$ AMO + 10 Bags Vermicompost ha$^{-1}$ (275 kg) | 13.23 |
| $T_4$ – 3 L ha$^{-1}$ AMO + 10 Bags Vermicompost ha$^{-1}$ (275 kg) | 15.74 |
| $T_5$ – 4.5 L ha$^{-1}$ AMO + 10 Bags Vermicompost ha$^{-1}$ (275 kg) | 13.30 |
| $T_6$ – 3 L ha$^{-1}$ AMO | 12.84 |
| F- RESULTS | ns |
| C. V. (%) | 9.03 |

*ns-not significant*

### Plant Height at 35 Days after Sowing (cm).

The average heights of the onion seedlings as shown in Table 2 increases as affected by the growth enhancers. Surprisingly, the seedlings treated solely with the recommended rate of foliar fertilizer (3 liters AMO) exhibited the tallest with mean of 21.68 centimeters. This was attributed to profuse vegetative growth of onion tissues applied with foliar fertilizer as these penetrates in plants through stomata, increases the internal balanced nutrient content of plant which results in more storage assimilations, more photosynthetic activity of the onion plants (Joshi, 2005). Moreover, foliar fertilizer contains micronutrients that are also essential for organization and rapid alternation of nutrition compound within plant owing to their great importance in contribution to direct the enzymes way in metabolism as cited by Massoud *et al.*, (2005).

On the other hand, the fertilized plants treated with the combination of 10 Bags Vermicompost ha$^{-1}$ along with either 3L ha$^{-1}$ or 4.5 Lha$^{-1}$ of AMO ($T_4$ and $T_5$) were as tall with the above-mentioned treatments which produced comparable with averages of 20.10 and 20.08 centimeters, respectively. The control plots, which did not receive any fertilization, produced an average of 17.33 centimeters. However, the plants in Treatment 2 were as tall in seedlings treated with 10 Bags Vermicompost ha$^{-1}$ and those in $T_3$ (10 Bags Vermicompost ha$^{-1}$ + 1.5 Lha$^{-1}$ AMO) with mean of 18.00 cm and 17.33 centimeters, respectively.

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The result agreed to the study of Liu *et al.*, (2017) and Ma *et al.*, (2019) which mentioned that foliar fertilizer promotes onion growth by supplementing essential nutrients during short or critical growth stages. Nitrogen absorbed through the roots during dormancy is stored in the plants and subsequently remobilized to support the next growth phase like in the case of $T_6$ (3L ha-1 AMO). However, increasing the levels of foliar fertilizer application, did not increase onion growth. This finding aligns with Alam *et al.,* (2010) who asserted that foliar application should be viewed primarily as a supplementary method to soil application.

Additionally, the incorporation of vermicompost into the soil medium resulted in enhanced plant growth, agrees to Joshi *et al.,* (2015), who observed increased seed germination, stem height, leaf number, leaf area, leaf dry weight, root length, root number, total yield, chlorophyll and nutrient content, as well as improved fruit and seed quality with vermicompost application. Similarly, Lazcano and Domínguez (2011) claimed that the effect of vermicompost varies depending on the plant species. Vermicompost exhibits characteristics similar to peat, such as high porosity, aeration, drainage, and effective water retention.

Table 2. Plant Height at 35 Days after Sowing (cm) as affected by Levels of Plant Growth Enhancer

| **TREATMENTS** | Height (cm) |
|---|---|
| $T_1$ – Control | 17.33$^{c}$ |
| $T_2$ – 10 Bags Vermicompost ha$^{-1}$ (275 kg) without AMO Foliar Fert. | 16.08$^{c}$ |
| $T_3$ – 1.5 L ha$^{-1}$ AMO + 10 Bags Vermicompost ha$^{-1}$ (275 kg) | 18.00$^{bc}$ |
| $T_4$ – 3 L ha$^{-1}$ AMO + 10 Bags Vermicompost ha$^{-1}$ (275 kg) | 20.10$^{ab}$ |
| $T_5$ – 4.5 L ha$^{-1}$ AMO + 10 Bags Vermicompost ha$^{-1}$ (275 kg) | 20.08$^{ab}$ |
| $T_6$ – 3 L ha$^{-1}$ AMO | 21.68$^{a}$ |
| F- RESULTS | ** |
| C. V. (%) | 4.66 |

*Note: Means with common letter are not significantly different with each other using HSD.*
***-significant at 1% level*

**Weight of Seedlings**.

Weight of seedlings was taken before transplanting to trace the effect of fertilization on the onion seedling as shown in Table 3. It showed that the varying concentrations of foliar and constant rate of vermicompost influenced the weight of seedlings at 35 days after sowing. Results revealed that seedlings weight was heavier when treated with 10 Bags of Vermicompost per hectare along with 3 liters per hectare of AMO foliar fertilizer (24.34 grams). It is evident from the results of the data that foliar application of AMO increased the weight of seedlings at 35 days after sowing and agrees to the claim of Sharma et al., (2002) who found that application of organic materials caused substantial increase in weight due to better increase the uptake of ions such as nitrogen and phosphorus by plants from vermicompost which ultimately enhance yield and yield attributes (Maleki *et al.,* 2013).

However, either reducing the levels to 1.5 liters per hectare or increasing it up to 4.5 liters per hectare, yielded similar mean weigh with 22.15 grams and 21.51 grams, respectively.

The increase in biomass yield (weight of seedlings) in response to the increasing rate of foliar fertilizer may be probably associated with the nitrogen supply based on the recommended application which enhances the vegetative growth of plants like plant height which contribute for improved rate of photosynthesis and assimilate production in the vegetative part and partitioning to the bulbs. Other contributing factor on the weight increase is the application of vermicompost that improves the soil quality as a whole which may be reflected through better crop production. Besides supplying various nutrients to the crop on the field, they often leave substantial residual effect to succeeding crops and help to improve health as well as quality of soil (Karmakar, 2013).

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Table 3. Weight of Seedlings at 35 Days after Sowing (g) as affected by Levels of Plant Growth Enhancer

| **TREATMENTS** | Weight (g) |
|---|---|
| $T_1$ – Control | 16.72$^{c}$ |
| $T_2$ – 10 Bags Vermicompost ha$^{-1}$ (275 kg) without AMO Foliar Fert. | 16.43$^{c}$ |
| $T_3$ – 1.5 L ha$^{-1}$ AMO + 10 Bags Vermicompost ha$^{-1}$ (275 kg) | 22.15$^{ab}$ |
| $T_4$ – 3 L ha$^{-1}$ AMO + 10 Bags Vermicompost ha$^{-1}$ (275 kg) | 24.34$^{a}$ |
| $T_5$ – 4.5 L ha$^{-1}$ AMO + 10 Bags Vermicompost ha$^{-1}$ (275 kg) | 21.51$^{ab}$ |
| $T_6$ – 3 L ha$^{-1}$ AMO | 18.23$^{bc}$ |
| F- RESULTS | ** |
| C. V. (%) | 8.01 |

*Note: Means with common letter are not significantly different with each other using HSD.*
***-significant at 1% level*

**Number of Leaves at 15 Days after Sowing.**

The maximum number of leaves at 15 days after sowing is shown in **Table 4. Result** shows that there was no further increase on the number of leaves of onion as affected by fertilization. This suggests that the plants did not significantly affect by fertilization combination maybe due to genetic factors which much likely have a stronger influence on the production of leaves in onion plants at 15 days after sowing with mean ranged from 2.00 to 2.75 counts.

This result is in contradictory to the findings of Rao *et al.,* (2013) who reported that highest leaf number per plant of onion was recorded with the highest combination of 75 kg N ha$^{-1}$. Likewise, Khan *et al.,* (2002) also claimed that that lower leaf number per plant of onion was recorded from the treatment without nitrogen level however, similar to the higher levels of foliar fertilizer. This indicates that the quantity of foliar fertilizer applied did not ultimately led to a similar number of leaves, which closely aligns with the inherent genetic traits of the plants.

Table 4. Number of Leaves at 15 Days after Sowing (g) as affected by Levels of Plant Growth Enhancer

| **TREATMENTS** | Number of Leaves |
|---|---|
| $T_1$ – Control | 2.00 |
| $T_2$ – 10 Bags Vermicompost ha$^{-1}$ (275 kg) without AMO Foliar Fert. | 2.50 |
| $T_3$ – 1.5 L ha$^{-1}$ AMO + 10 Bags Vermicompost ha$^{-1}$ (275 kg) | 2.75 |
| $T_4$ – 3 L ha$^{-1}$ AMO + 10 Bags Vermicompost ha$^{-1}$ (275 kg) | 2.75 |
| $T_5$ – 4.5 L ha$^{-1}$ AMO + 10 Bags Vermicompost ha$^{-1}$ (275 kg) | 2.75 |
| $T_6$ – 3 L ha$^{-1}$ AMO | 2.50 |
| F- RESULTS | ns |
| C. V. (%) | 19.12 |

*ns-not significant*

**Number of Leaves at 35 Days after Sowing.**

Table 5 presents the mean number of leaves of onion seedling at 35 days after sowing. The mean ranged from 2.75 to 3.25 across different treatment groups indicates a relatively stable leaf count despite variations in the application of foliar fertilizer. This consistency implies that the growth enhancers present in the foliar fertilizer and vermicompost did not significantly affect the leaf production and increasing the rate of foliar fertilizer did not lead to an increase in the number of leaves.

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Table 5. Number of Leaves at 35 Days after Sowing (g) as affected by Levels of Plant Growth Enhancer

| TREATMENTS | Number of Leaves |
|---|---|
| $T_1$ – Control | 3.00 |
| $T_2$ – 10 Bags Vermicompost $ha^{-1}$ (275 kg) without AMO Foliar Fert. | 3.00 |
| $T_3$ – 1.5 L $ha^{-1}$ AMO + 10 Bags Vermicompost $ha^{-1}$ (275 kg) | 3.25 |
| $T_4$ – 3 L $ha^{-1}$ AMO + 10 Bags Vermicompost $ha^{-1}$ (275 kg) | 3.25 |
| $T_5$ – 4.5 L $ha^{-1}$ AMO + 10 Bags Vermicompost $ha^{-1}$ (275 kg) | 3.75 |
| $T_6$ – 3 L $ha^{-1}$ AMO | 2.75 |
| F- RESULTS | ns |
| C. V. (%) | 16.64 |

*ns-not significant*

**Conclusions**

Onion seedlings during off-season planting is feasible following the recommended rate of 10 bags vermicompost and AMO foliar fertilizer at 3 liters per hectare. Despite no significant effect being demonstrated in growth parameters except at 35 days after sowing, the effectiveness in increasing seedling weight is realized, suggesting its potential to enhance the growth and development of onions, which is crucial for successful transplanting and ultimately higher yields in onion cultivation.

**Recommendations**

From the above findings it is recommended that for successful seedling production for off-season planting, the application of 10 bags of vermicompost and AMO foliar fertilizer at 3 liters per hectare is an effective approach to promote heavier seedlings. This, in turn, contributes to improved onion seedling production and overall crop productivity even in an off-season cultivation. Further study is recommended up to bulb yield to confirm the effectiveness of the treatments used in the study.

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