# Different Types and Rates of Fish Amino Acid (FAA) on the Growth and Yield of Pumpkin

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## Abstract

This study was conducted at the organic fields of Vegetable and Fruit Research Development Centre (VFRDC) Hlegu Township Yangon from October to March (2017-2018).There are two different types and three rates of fish amino acid (FAA) foliar application such as $T_0$- water only (control), $T_1$- small fish (4ml/L), $T_2$ small fish (8ml/L), $T_3$- small fish (12ml/L), $T_4$- waste parts (4ml/L), $T_5$- waste parts (8ml/L) and $T_6$- waste parts (12ml/L)were applied on 30 DAT of pumpkin plantsunder field condition. Result showed that $T_3$- small fish (12ml/L) of fish amino acid (FAA) foliar applications on pumpkin plants produced the tallest in plant length, the best quality of fruits, the highest number of young shoots, flowers, and marketable fruits yield (6.44ton/ acre). But the lowest number of marketable fruits and highest seeds yield were recorded in $T_0$ water only (control) at 120 DAT.

Keywords: fish amino acid, foliar applications, yield.

## Introduction

Pumpkin is an economically important plant and is cultivated throughout the world for oil and medicinal products and its importance as an economical and medicinal plant is becoming increasingly apparent (Fu C, Shi H, Li Q 2006).Immature fruits are eaten as vegetables while mature fruits are used for baking and jams. The ripe pumpkins are used for culinary (cooking) purpose.Seeds are eaten as snacks, source of protein various vitamins and Leaves and flowers are cooked for salad and are great source of calcium and phosphorous.Commercially liquid organic fertilizers are a cost-effective means of supplementing soil with nitrogen (N) for plant growth and high crop yields; however, improper or excessive use of N fertilizer can lead to nitrate pollution of ground or surface water (Foley *et al*. 2012). Fish amino acid (FAA) to increase N availability in soils and improve crop yields while sustaining water quality. This fact sheet addresses the production and use of FAA in Natural Farming (Park and Du Ponte 2008). Pumpkins are the very warm vegetable, which can also resist cold temperatures. Because of plentiful uses and benefits of pumpkins are cultivated all over the world. Producers can minimize this predicament by implementing Best Management Practices (BMPs) for fertilizer use that reduces nutrient losses and averts runoff and leaching from agricultural lands. Fish amino acid (FAA) to increase N availability in soils and improve crop yields while sustaining water quality. This fact sheet addresses the production and use of FAA in Natural Farming (Park and Du Ponte 2008).

## Materials and Methods

### Preparation of Fish Amino Acid

Collect small fish, fish waste (head, bones, skin, fins, viscera), weighed and mixed with an equal amount of brown sugar (1:1 ratio by weight). Select a fermentation container like clay jar, plastic cooler, etc. and place a layer of the fish

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by-product and brown sugar mixture on the container and cover with more brown sugar. Continue the process with alternating layers of the fish by-product mixture and brown sugar or molasses until the container is nearly full, ending with a layer of brown sugar/molasses. Be sure that the fish are not exposed. Cover the container with a breathable cloth to keep out insects but allow aeration, and store out of direct sunlight in a cool, well-ventilated location secured from animals. After approximately 3 to 5 days, the fish waste will begin to break down and liquefy through fermentation and the osmotic pressure generated by the addition of brown sugar. It takes 2 months (60 days) to complete the process. Fish Amino Acid, when completely fermented had a sweet, slightly fishy odor. Decant or pour off only the liquid portion from the fermentation container for use as foliar spray.

**Soil Preparation**

The experimental area had 852 square meters were plowed and harrowed by a tractor and left for two weeks to allow weeds to partially decomposed. After transplanting, place a thin layer of straw and add a thick layer of compost and manure.

**Seedling Production**

Soil used in seedling production was mixture of equal parts of organic fertilizer (cowdung), decomposed rice hull and garden soil. Seedling trays filled with prepared soil mixture were watered before seed sowing. Pumpkin seeds were sown at a rate of two seeds per hole. Seedling trays were placed in a partially shaded area for three weeks and watered using sprinkler. 240 g of pumpkins seeds were used for this experiment.

**Experimental Design, Layout and Treatments**

The experimental area was laid-out in 10 equal blocks; each plot had 6 x 6 meters (36 square meters) with 2 meter between plots. Spacing 1.5 meter, between the plants along with spacing rows about 2 meters is considered. There were16 plants per plot and the data were collected in four plants. There were 112 plants in this experiment.The experimental treatments were allocated following the randomization procedure for Randomized Complete Block Design. The use of organic fertilizer with different rates of fish amino acid served as experimental treatments of the study as follows:

$T_0$ –Water only(control)

$T_1$- small fish (4ml/L)

$T_2$- small fish (8ml/L)

$T_3$- small fish (12ml/L)

$T_4$- waste parts (4ml/L)

$T_5$- waste parts (8ml/L)

$T_6$- waste parts (12ml/L)

**Statistical Analysis**

Statistical analysis as one-way ANOVA. Therefore, the variance analysis was performed and, when significant, the Crop test was applied at the 5% level of significance. For the field experiment, the multivariate analysis was performed through Principal Component Analysis. All of the analysis were performed using the statistical software SAS 9.3.

**Application of Manures and Fertilizers**

In pumpkin farming, 25kgof cowdung manure, 12.5 kg of rice hull and 12.5 kg of ashes of plant product (dry) (2;1;1)is to be applied while land preparation,

generally in the last plow to the topmost soil. It should be applied in two equal doses; 1/2 at land preparation, and another one at one month of the plantation. 0.23 acre (852 square meter) was used for this cultivation.

**Transplanting, Treatment Application and Management**

Transplanting was done 26 days after seed sowing. One seedling per hole was planted and covered with soil. The base of the plant was pressed lightly for easy anchorage of root into the soil. Watering of the newly transplanted seedlings was done immediately after transplanting.

Application of different rates of Fish Amino Acid (FAA) that dose was 5 litre/ 1 plot started two weeks after transplanting. Succeeding applications were done at 7 days interval up to 40 days after transplanting or when the pumpkin started to flower. Spraying FAA at reproductive stage caused overgrowth that affects flowering.

Cultivation and weeding were done to prevent nutrient competition and provide good aeration to the plants. Watering of the plants was done daily .To prevent pest and disease occurrence, fish amino acid was used in cocktail with other natural farming inputs like organic pesticides.

**Thinning**

After 3 or 4 fruits appear, then replace the row cover but not before thinning the vine with pruning shears. Wanted to grow the largest pumpkins in the neighborhood, thin the growth to one or two plants per hill and only allow one fruit to mature on a vine. Remove all but the best fruit when they grow to about the size softball. Just remember to water well and often and watch as the fruit grows bigger and bigger.

**Harvesting**

A pumpkin is ripening when its skin turns a deep, solid color (orange or yellowish for most varieties). When you thumb the pumpkin, the rind will feel hard and it will sound hollow. Press your nail into the pumpkin's skin; if it resists puncture, it is ripe. To harvest the pumpkin, cut the fruit off the vine carefully with a sharp knife or pruners; do not tear. Be sure not to cut too close to the pumpkin; a liberal amount of stem (3 to 4 inches) will increase the pumpkin's keeping time.

## Results

**Total Yield (Before harvesting)**

Total yield of number young shoots, flowers and fruits as per plant and per acre of as affected by the foliar spraying of fish amino acid (waste fish parts) are presented in Table (1). It isclear that, the largest number of young fruits and flowers are associated with the plants which sprayed by fish amino acid (waste parts12ml/ L), followed in descending order by that plants sprayed with lower concentration and then followed the different levels of small fish amino acid . Moreover, it could be noticed that, all treated plants resulted in the total and early yield over the control plants (water only). The statistical analysis of the obtained data indicated that the differences within different treatments were great enough to reach the 5 % level, with except a number of shoots and flowers per acre during thinning or before harvesting.

Table 1. Effect of fish amino acids on total yield of pumpkin plant during thinning before harvesting.

| TREATMENTS | No. of young shoots | | No. of flowers | | No. of fruits | |
|---|---|---|---|---|---|---|
| | Per plant | Per acre | Per plant | Per acre | Per plant | Per acre |
| $T_0$- (water only) | 39.50 | 13985.35 | 21.15 | 7699.95 | 10.50 | 3822.67 |
| $T_1$- small fish (4ml/L) | 40.05 | 14115.95 | 21.45 | 7879.95 | 12.50 | 4562.05 |
| $T_2$- small fish (8ml/L) | 40.20 | 14252.44 | 21.65 | 7889.25 | 12.60 | 4584.99 |
| $T_3$- small fish (12ml/L) | 40.40 | 14492.50 | 21.85 | 7908.00 | 12.61 | 4588.84 |
| $T_4$- waste parts (4ml/L) | 41.15 | 14715.15 | 21.45 | 7882.65 | 12.50 | 4563.62 |
| $T_5$- waste parts (8ml/L) | 41.25 | 14930.25 | 21.85 | 7902.05 | 12.55 | 4580.71 |
| $T_6$- waste parts 12ml/L) | 42.25 | 15124.40 | 22.35 | 7962.19 | 12.65 | 4596.56 |
| L.S.D. at 5% | $3.25^{*}$ | $316.45^{ns}$ | $1.20^{*}$ | $123.88^{ns}$ | $2.55^{*}$ | $138.68^{*}$ |

**Plant Growth Characters**

The presented data in Table (2) show clearly that, the plant growth measurements of pumpkin as expressed by length, leaves and shoots number, fresh and dry weight of whole plant and its leaves and shoots are influenced by small fish amino acids treatments. Moreover, within the above mentioned treatments, the obtained data indicate that, using higher level of two types of fish amino acid resulted in better growth than using the lower level. Generally, it could be concluded that led to using amino acid (small fish) the best plant growth followed in descending order by that plants sprayed by amino acid (waste parts), but the lowest values were correlated with the control plants (water only). The statistical analysis of the obtained data reveals that the differences within different foliar spraying treatments were enough to reach the 5% level of significance except for number of leaves, fresh and dry weight of leaves and fresh weight of shoot as well as dry weight of whole pumpkin plant and its shoots.

Table 2. Effect of fish amino acids on the vegetative growth of pumpkin plant during harvesting.

| Treatment | Plant Length (cm) | No/ Plant | | Fresh weight (Kg/plant) | | Dry weight (Kg/plant) | |
|---|---|---|---|---|---|---|---|
| | | Leaves | Shoot | Leaves | Shoot | Leaves | Shoot |
| $T_0$- (water only) | 255.17 | 95.30 | 2.35 | Leaves | Shoot | 0.86 | 0.39 |
| $T_1$- small fish (4ml/L) | 265.30 | 103.15 | 3.15 | 4.23 | 2.60 | 1.10 | 0.58 |
| $T_2$- small fish (8ml/L) | 275.12 | 105.22 | 3.25 | 5.30 | 2.40 | 1.15 | 0.63 |
| $T_3$- small fish (12ml/L) | 280.42 | 110.55 | 3.65 | 5.30 | 2.30 | 1.25 | 0.65 |
| $T_4$- waste parts (4ml/L) | 276.42 | 100.55 | 3.05 | 5.45 | 2.40 | 1.08 | 0.45 |
| $T_5$- waste parts (8ml/L) | 275.78 | 101.45 | 3.20 | 5.20 | 2.15 | 1.19 | 0.52 |
| $T_6$- waste parts 12ml/L) | 276.20 | 102.55 | 3.10 | 5.05 | 2.35 | 1.18 | 0.55 |
| L.S.D. at 5% | $35.07^{*}$ | $14.55^{ns}$ | $1.02^{*}$ | 5.25 | 2.35 | $0,49^{ns}$ | $0.92^{*}$ |

**Total Fruit Yield (Harvesting)**

Total fruits yield as kg/ acre and ton/acre, as well as the some physical quality of pumpkin fruits as affected by the foliar spraying by fish amino acid (small fish), are presented in Table (3). It was clear that the heaviest total fruits are associated with that plants which sprayed by small fish amino acid (12ml/ L), followed in descending

order by that plants sprayed with lower concentration and then followed the different levels of waste parts of fish amino acid . Moreover, it could be noticed that all treated plants resulted the total and early yield over than the control plants (water only). The statistical analysis of the obtained data indicated that the differences within different treatments were great enough to reach the 5 % level, with except physical quality of fruits that height and diameter of fruits during harvesting.

Table 3. Effect of fish amino acids on the fruit yield of pumpkin during harvesting.

| Treatment | Fruit Height (cm) | Fruit Diameter (cm) | Number of fruit/ Plant | Fruit Yield (Kg/acre) | Fruit Yield (ton/acre) |
|---|---|---|---|---|---|
| $T_0$- (water only) | 24.14 | 22.42 | 1.90 | 12899.21 | 5.75 |
| $T_1$- small fish (4ml/L) | 24.88 | 22.49 | 2.42 | 14360.25 | 6.41 |
| $T_2$ small fish (8ml/L) | 24.15 | 22.57 | 2.50 | 14376.79 | 6.43 |
| $T_3$- small fish (12ml/L) | 12.11 | 22.46 | 2.58 | 14404.97 | 6.44 |
| $T_4$- waste parts (4ml/L) | 11.74 | 22.25 | 2.20 | 14276.12 | 6.37 |
| $T_5$- waste parts (8ml/L) | 11.72 | 22.52 | 2.22 | 14290.58 | 6.34 |
| $T_6$- waste parts (12ml/L) | 11.49 | 22.50 | 2.25 | 14372.69 | 6.41 |
| L.S.D. at 5% | $13.35^{ns}$ | $1.45^{ns}$ | $2.35^{*}$ | $126.75^{*}$ | $1.65^{*}$ |

**Fruit Quality**

Table 4 showed that the quality of fruits (fruits pulp, TSS, pulp thickness score and hardness) of pumpkin fruits as influenced by foliar spraying of small fish amino acids whereas the data indicate that the pumpkin plants which received small fish amino acid. Gained the best quality of pumpkin fruit, i.e highest values of pulp thickness, sweetness and hardness .Within different types and rates of fish amino acids application, using the higher concentration resulted in the better fruit quality if compared with the lower one. But the poorest values resulted from control plants (water only). Statistically, analysis of the obtained data reveals that the differences within various treatments were great enough to reach the 5 % level of significance with except values of fruit pulp thickness.

Table 4. Effect of fish amino acids on the fruit quality of pumpkin during harvesting.

| **TREATMENTS** | Fruit Pulp thickness (cm) | Pulp Stickness Score (1,3,5,7,9) | Sweetness (˚Brix) | Hardness ($Kg/cm^2$) |
|---|---|---|---|---|
| $T_0$- (water only) | 3.31 | 8.22 | 5.30 | 4.74 |
| $T_1$- small fish (4ml/L) | 3.34 | 8.36 | 5.30 | 4.68 |
| $T_2$- small fish (8ml/L) | 3.35 | 8.36 | 5.32 | 4.70 |
| $T_3$- small fish (12ml/L) | 3.38 | 8.49 | 5.32 | 4.73 |
| $T_4$- waste parts (4ml/L) | 3.26 | 8.36 | 5.30 | 4.78 |
| $T_5$- waste parts (8ml/L) | 3.26 | 8.38 | 5.30 | 4.68 |
| $T_6$- waste parts (12ml/L) | 3.34 | 8.48 | 5.30 | 4.85 |
| L.S.D. at 5% | $0.18^{ns}$ | $1.32^{*}$ | $0.36^{*}$ | $1.23^{*}$ |

## Seed Yield

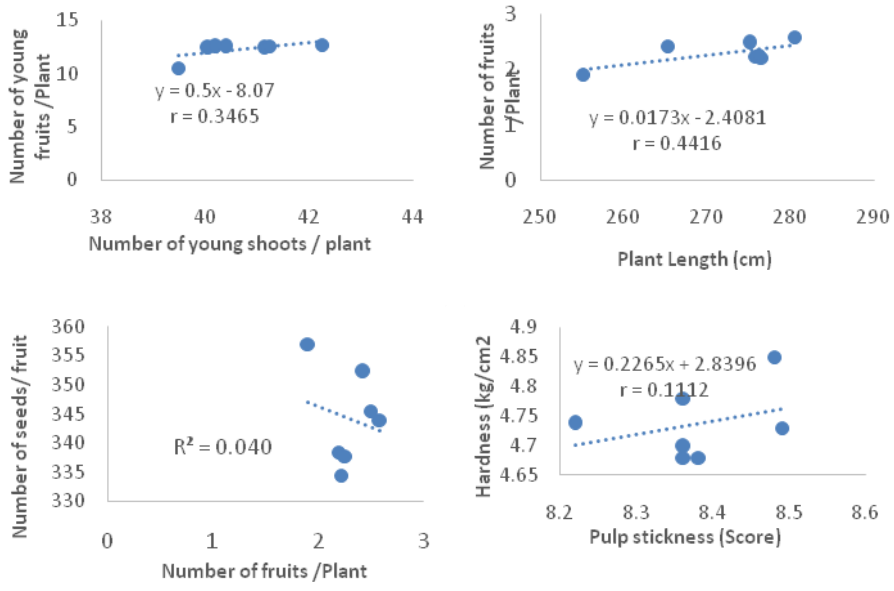
Table 5 shows that number of seeds, dry weight of seed yield (g/ fruit) and (kg/acre) of pumpkin fruits as influenced by the foliar application of different rates and types of fish amino acids. The waste parts of fish amino acid application resulted in higher seeds number and seed yield than the small fish amino acids application of pumpkin plants. The highest seeds yield resulted in control of plants (water only). Moreover, the statistical analysis of the obtained data reveals the differences in all treatments were great enough to reach 5 % level of significance.

Table 5. Effect of fish amino acids on the seed yield of pumpkin fruit during harvesting.

| TREATMENTS | Number of seed /fruit | Seed dry weight (g/ fruit) | Seed yield (Kg/ac) |
|---|---|---|---|
| $T_0$- (water only) | 357.00 | 115.88 | 26.62 |
| $T_1$- small fish (4ml/L) | 352.50 | 110.65 | 25.57 |
| $T_2$- small fish (8ml/L) | 345.50 | 112.45 | 25.49 |
| $T_3$- small fish (12ml/L) | 344.00 | 110.75 | 25.44 |
| $T_4$- waste parts (4ml/L) | 338.50 | 109.20 | 25.07 |
| $T_5$- waste parts (8ml/L) | 334.50 | 109.05 | 25.15 |
| $T_6$- waste parts (12ml/L) | 337.75 | 108.50 | 35.13 |
| L.S.D. at 5% | 23.78* | 7.33* | 9.25* |

The number young shoots per plant, plant length, pulp stickness were moderately positively correlated with the number of young fruits per plant, number of fruits (yield) per plant and hardness of fruit before and after harvesting. And then number of fruits per plant was slightly negatively correlated with the number of seeds per fruit.

Correlation Coefficient



## Discussion and Conclusion

The increments in pumpkin plant growth measurements under the foliar application of fish amino acid might be attributed to the multiple advantages of foliar spraying methods such as rapid and efficient response to the plant needs, and independence of soil condition. FAA application as a source of nitrogen fertilizer had a great role in enhancing the metabolism processing due to the importance of nitrogen in building carbohydrates, protein and fats in the plant tissues. Consequently gained a promotion in vegetative plant growth i.e., plant length, number of shoots and/or leaves per plant, fresh and dry weight of whole pumpkin plant. The obtained results are in good agreement with the results of (Shaheen. *et al* 1989). Amino acids are also supplied to plant by incorporating them into the soil. It helps in improving the microflora of the soil thereby facilitating the assimilation of nutrients. Foliar nutrition in the form of protein hydrolysate (known as amino acids liquid) and foliar spray provide readymade building blocks for protein synthesis (Rafque and Muhsi, 2004). From other point, the recorded results in Table (2) cleared that, that pumpkin plants which sprayed with highest concentration of small fish amino acids (12ml/l) resulted that plants more yield and yield components than supplied the all concentration of the waste parts of fish amino acids. The response of vegetable plants to the application of amino acids were studied and their results are in good agreement with the obtained ones. The increment in total fruits as well as its physical properties might be attributed to that area resulted a promotion effect on plant growth measurements i.e., plant length, number of leaves and/or shoots as well as whole fresh and dry weight of plant and its different organs. Consequently, these might be reflected in the total and fruits yield and/or its components (average fruit weight, length and diameter).

It could be concluded that foliar application of small fish amino acid resulted in the highest fruit yield and the best physical and chemical quality, followed by plants supplied by waste fish parts amino acid. All types of amino acid treatments had an enhancement effect for increasing the elemental nutrition in plant tissues. The higher concentration of two types of fish amino acids caused a promotion effect on increasing the values of yield and yield components except for the number of seeds yield per fruit, per plant and acre.

Figure. Preparation of types of fish amino acids

Figure. Foliar Application of fish amino acid on pumpkin plants.

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