APPLICATION OF RICE STRAW BASED ORGANIC FERTILIZER FOR CHILLI AND ONION CULTIVATION AND SOIL FERTILITY

Aung Aung[1], Tin Moe Khaing[2], Aye Aye Lwin[3], Thi Thi Aye[4]

Abstract

Today fertilizer has become essential to modern agriculture to feed the growing population.This research work concerns with studies on the preparation of organic fertilizers from rice straw, chicken manure and neem leaves, on the growth and yield of the selected crops: chilli and onion. The crops (chilli and onion) were cultivated in the farm (Kun Chan Village, Taungdwingyi Township, Magway Region). The organic fertilizers were prepared by five different weight ratios (1:1:1) (rice straw , chicken manure, neem leaves) for OF-1 (organic fertilizer 1), (8 : 3 :1) for OF-2 , (8 : 1 : 3) for OF-3, (12.5 : 1.5 : 1) for OF-4, (12.5:1 : 1.5) for OF-5. The NPK content OF-1 contains (2.17%, 1.52%, 1.66%), OF-2 (1.70%, 0.83%, 1.48%), OF-3 (1.73%, 0.69%, 1.37%), OF-4 (1.56%, 0.91%, 1.35%), OF-5 (1.24%, 0.85%, 1.06%). The NPK content of OF-1 is highest among five organic fertilizers. The K content of OF-2 is higher than OF- 3, OF- 4 and OF-5. OF-1 was chosen for chilli plant because these plants require abundant N, P, K ratio. OF-2 was chosen for onion plant because these plants require abundant P, K and fair N. The experiment was laid out in Randomized Complete Block (RCB) design. There are two treatments and three replications, T-1 (control without fertilizer), T-2, T-3, T-4 (OF-1 for chilli plant and OF-2 for onion plant). In this experiment, soil sample analysis before cultivation and after harvesting, determination of plant height during cultivation and after harvesting, the yield components such as number of fruits per plant and weight of fruits were measured and yields were estimated. The total N and organic carbon contents of soil sample 1, 2 and 3 are (0.09%, 0.24%, 0.21%) and (0.68%, 1.69%, 1.39%) before cultivation. After chilli plant was harvested, the total N and organic carbon content of T-1,2,3,4 (OF-1, 6 t/ha) are (0.05%, 0.21%, 0.24%, 0.20%) and (0.60%, 1.56%, 1.55%, 1.57%). After onion plant was harvested, the total N and organic carbon content of T-1,2,3,4 (OF-2, 6 $kgha^{-1}$) are (0.06%, 0.22%, 0.22%, 0.23%) and (0.63%, 1.48%, 1.40%, 1.49%). Field studies showed that the fresh weight yield of chilli; T-1 (3988.12 kg/ha), T-2 (55331.59 kg/ ha), T-3 (61064.64 kg/ha) and T-4 (61396.98 kg/ha). The dry weight yield of chilli; T-1 (516.45 kg/ha), T-2 (8320.54 kg/ha), T-3 (9163.12 kg/ha) and

1. PhD candidate, Assistant Lecturer, Department of Chemistry, Pyay University
2. Dr, Lecturer, Department of Chemistry, University of Yangon
3. Dr, Associate professor, Department of Chemistry, Yenangyaung Degree College
4. Dr, Professor and Head, Department of Chemistry, Myeik University

T-4 (10185.49 kg/ha). The yield of the onion; T-1 (16710.57 kg/ha), T-2 (53116.07 kg/ha), T-3 (54010.45 kg/ha) and T-4 (51280.26 kg/ha). From the field work investigations, it was observed that rice straw based organic fertilizer promoted plant growth, and also enhanced the growth yield of the crops. The results indicated that the rice straw based organic fertilizer should increase soil fertility and was suitable for better production of chilli and onion.

Keywords: organic fertilizers, rice straw, chicken manure, neem leaves, chilli and onion

Introduction

Fertilizer application is required to replace crop land nutrients that have been consumed by previous plant growth with the ultimate goal of maximizing productivity and economic returns. Nowadays, there is increased emphasis on the impact on soil environment due to continuous use of chemical fertilizers. The impact of chemical fertilizer application on agricultural land is seen not only in terms of the soil quality but also on the survival of soil organisms dwelling there in (Nidhi et al., 2014).

Organic fertilizers are naturally occurring fertilizers (e.g, compost, manure).Organic fertilizers essential for maintaining the soil health (Thazin Nyo, 2009). Organic fertilizers release nutrients over an extended period of time. They act much like the slow-release fertilizers. Many plants need 18 elements for normal growth and completion of their life cycle. These elements are called the essential plant nutrients. Soil amendments containing the essential plant nutrients or having the effect of favorably changing the soil chemistry have been developed and used to enhance plant nutrition.

The application of chemical fertilizers is costly and gradually lead to the environmental problems. Organic residue recycling is becoming an increasingly important aspect of environmentally sound sustainable agriculture. An advantage of farm application of organic wastes is that they usually provide a number of nutritive elements to crops with little added cost (Myint, 2010). The application of organic materials is fundamentally important in that they supply various kinds of plant nutrients including micronutrients, improve soil physical and chemical properties and hence nutrient holding and buffering capacity, and consequently enhance microbial activities.

Rice straw is the only organic material available in significant quantities to most rice farmers. About 40 percent of the nitrogen (N), 30 to 35 percent of the phosphorus (P), 80 to 85 percent of the potassium(K), and 40 to 50 percent of the sulfur (S) taken up by rice remains in vegetative plant parts at crop maturity (Dobermann and Fairhurst, 2002). Neem leaves are cheap and useful fertilizer. Neem leaves improve efficiency of fertilizer utilization in crop production by gradual release of nitrogen to crops (Sumaila, 2012). Neem leaves have an adequate quantity of NPK in organic form for plant growth. Neem leaves are 100 % natural fertilizer (Emmanuel, 2013). Chicken manure is preferred amongst other animal wastes because of its high concentration of macro-nutrients. Chicken manure, used wisely, brings excellent results as a top dressing for pasture and turf. It may be used in potting mixtures for container-grown plants, and it may be used to increase the growth of flowers, fruits, and vegetables in home gardens.

Chilli (*Capsicum annuum* L.) is an important vegetable cum spice crop grown in almost all parts of tropical and subtropical regions of the world. It belongs to the family Solanaceae and originated from South and Central America where it was domesticated around 7000 BC. Many chilli constituents are important for nutritional value, flavor, aroma, texture and colour. Chillies are low in sodium and cholesterol free, rich in vitamin A, vitamin C, vitamin E and a good source of potassium and folic acid.

Onion *(Allium cepa* L.) is one of the most important bulb crops cultivated all over the world on commercial scale both for local consumption and export. Onion can be cultivated in wide range of soils. Onions are sensitive to high acidity, and the optimum pH is 5.8-6.5. Onion grow in sandy loam and clay-loam soil (Jayathilake et al., 2003).

Materials and Methods

Collection of Rice Straw, Chicken Manure, Neem Leaves

The rice straw sample and neem leaves sample were collected from Kun Chan Village in Taungdwingyi Township. The chicken manure sample was collected from Pyay Township. These samples were dried in air, ground and sieved into 80 mesh size and stored separately in air-tight plastic bags.

Preparation of Organic Fertilizers

Five piles were prepared by plastic sheets and the size of each pile was 1.5 m wide, 1.5 m long and 1.5 m high. The prepared organic fertilizers were made by five different ratios. The different types of organic fertilizers (rice straw, chicken manure, neem leaves) were OF-1 (1: 1: 1), OF-2 (8: 3: 1), OF-3 (8: 1: 3), OF-4 (12.5: 1.5: 1), OF-5 (12.5: 1: 1.5). Organic fertilizers were prepared by compost heap layer method. Firstly, dry plant materials (strong rice straw) were loosely spread on the bottom of the piles which were used for the foundation layers. The compost heap was made by the three basic layers (first layer, second layer, third layer). First layer was made by rice straw materials. This layer was 25 cm thick of the sides. Then, water was sprinkled over this layer. This layer should be moist but not soaked. The second layer was made by neem leaves (green) plant materials. This layer was added on the first layer. The second layer was 25 cm thick. The third layer was made by chicken manure with 10 cm thick. These three layers were added to the pile in the sequence, first layer, second layer, third layer, until the piles were full of compost making materials. The top of piles were covered with plastic sheets.

After one month, white fungi were appeared on the surface. And then, the piles were turned over. After 3 months, compost making material became black colour and odourless smell. And then, organic fertilizers were obtained.

Experimental Design and Treatments

A field experiment was carried out on sandy loam soil during (cool season) from 9th September, 2016 to 9th January, 2017 at farm, Kun Chan Village, Taungdwingyi Township, Magway Region in Myanmar. The experiment was conducted in a complete block design with two replications and 4 treatments using chilli and onion Tables 1 and 2. Gross plot size was 12 ft x 3 ft (36 ft^2). In each of 4 treatments, two types of organic fertilizers (OF-1 and OF-2) were used. The field was irrigated and growth characters such as plant height, leaf length and number of fruits per chilli plant, and plant height of onion plant were recorded at 15 days intervals. The wet and dry weight, and yield of chilli were measured after harvesting. Weight and yield of onion bulbs were also measured after harvesting.

Table 1: Description of the Treatments for Chilli Plant (OF-1)

Treatment No	Treatment
T-1	Control
T-2	rice straw , chicken manure , neem leaves (1 :1 :1) (OF-1) (6 t/ha)
T-3	rice straw , chicken manure , neem leaves (1 :1 :1) (OF-1) (6 t/ha)
T-4	rice straw , chicken manure , neem leaves (1 :1 :1) (OF-1) (6 t/ha)

Table 2: Description of the Treatments for Onion Plant (OF-2)

Treatment No	Treatment
T-1	Control
T-2	rice straw , chicken manure , neem leaves (8 :3 :1) (OF-2) (6 t/ha)
T-3	rice straw , chicken manure , neem leaves (8 :3 :1) (OF-2) (6 t/ha)
T-4	rice straw , chicken manure , neem leaves (8 :3 :1) (OF-2) (6 t/ha)

Study on Physicochemical Properties of Organic Fertilizers and Soil Samples

Total N, P_2O_5, K_2O of organic fertilizers and total N, P_2O_5, K_2O, pH, moisture, organic matter, organic carbon, humus, texture, electrical conductivity, available P_2O_5, available K_2O, exchangeable Ca^{2+}, exchangeable Mg^{2+} and exchangeable K^{1+} of soil samples were analyzed. The pH was determined by pH meter. Moisture was determined by oven dry method and organic matter was determined by Walkey and Black' titration method. Total N, P_2O_5 and K_2O were determined by Kjeldahl digestion method, visible spectrophotometric method and atomic absorption spectrometric method respectively. Total S was determined by turbidity method. Electrical conductivity was measured by conductivity meter. Organic matter was determined by Walkey and Black' Titration method. Organic carbon was measured by the loss on ignition method using a temperature controlled oven and a muffle furnace. Available P_2O_5 (ppm) was analyzed by

9C-Olsen's P-malachite green method using a UV-Vis spectrophotometer. The available K_2O (mg/100g) was measured using the 1 N ammonium acetate extraction method and analyzed using an atomic absorption flame emission spectrophotometer. Cation exchange capacity (CEC) was determined using the Kappen method.

Results and Discussion

NPK Contents in the Prepared Fertilizers

Table 3 shows the macronutrients and micronutrients in prepared organic fertilizers. The total N, P_2O_5 and K_2O contents of OF-1 were highest in these organic fertilizers. The K_2O content of OF-2 was higher than OF-3, OF-4 and OF-5. The total N and K_2O contents of OF-5 was the lowest in these organic fertilizers.

Table 3: NPK Content in Prepared Fertilizers

No	Fertilizers	N(%)	P_2O_5(%)	K_2O(%)
1	OF-1	2.170	1.523	1.663
2	OF-2	1.700	0.825	1.478
3	OF-3	1.729	0.689	1.372
4	OF-4	1.563	0.913	1.346
5	OF-5	1.241	0.849	1.056

(OF= organic fertilizer)

Soil Analysis

Table 4 shows the physical parameters and chemical compositions of soil samples (1,2,3) before cultivation. These soils were subjected to different treatments by using OF-1, OF-2 and control. These farm soils were sandy loam soil and the pH of these were nearly neutral. The electrical conductivity of control was lower than OF-1 and OF-2. The total N, humus, organic carbon, Available P_2O_5, available K_2O, Cation exchange capacity (CEC) of OF-1 and OF-2 were found to be higher than control. Analytical data of the farm soil before cultivation expected that the pronounced effects of fertilizers on the growth and yield of crops will be observed.

Table 4: Analytical Data of the Farm Soil before Cultivation

No	Parameters	Soil sample 1 before Cultivation	Soil sample 2 before Cultivation	Soil sample 3 before Cultivation
1	Texture- Sand (%)	42.55	44.62	39.96
	Silt (%)	43.85	43.46	43.63
	Clay (%)	11.70	10.87	14.14
	Total (%)	98.10	98.95	97.75
2	Moisture (%)	1.34	1.54	1.52
3	pH	6.97	6.72	6.47
4	Electrical Conductivity (mS/cm)	0.07	0.26	0.18
5	Organic Carbon (%)	0.68	1.69	1.39
6	Humus (%)	1.17	2.32	2.40
7	Total N (%)	0.09	0.24	0.21
8	Available P_2O_5 (%) (ppm)	9.13	98.67	95.66
9	Available K_2O (%) (mg/100g)	13.98	53.55	50.62
10	Exchangeable Ca^{2+} (mmol/100g)	12.82	15.16	17.10
11	Exchangeable Mg^{2+} (mmol/100g)	1.35	2.90	1.93
12	Exchangeable K^{1+} (mmol/100g)	0.30	1.88	1.61
13	C/N ratio	7.56	7.04	6.62

Soil sample 1 = control
Soil sample 2 = OF-1 treated Soil **(**rice straw , chicken manure , neem leaves) (1 :1 :1)
Soil sample 3 = OF-2 treated Soil **(**rice straw , chicken manure , neem leaves) (8 : 3 : 1)

Analysis of the Farm Soil Media Used for Chilli Plant after Harvesting

Table 5 shows the physical parameters and chemical compositions of soil samples (T-1,control) and (T-2,3,4, OF-1 treated soil sample) after harvesting. Those soils were subjected to different values by using OF-1 and control. These farm soils were sandy loam soil and the pH of these are near neutral. The electrical conductivity of control was lower than OF-1. The total N, humus, organic carbon, Available P_2O_5, available K_2O, Cation exchange capacity (CEC) of OF-1 were found to higher than control. Analytical data of

the farm soil after harvesting was found that the effects of OF-1 on the growth and yield of chilli increased.

Table 5: Analytical Data of the Farm Soil of chilli after Harvesting

No	Items	T-1	T-2	T-3	T-4
1	Texture- Sand(%)	43.25	40.50	42.93	40.74
	Silt(%)	45.80	49.45	43.66	44.18
	Clay(%)	7.97	8.85	11.37	13.18
	Total (%)	97.02	98.80	97.96	98.66
2	Moisture (%)	1.29	1.44	1.35	1.41
3	pH	6.50	6.60	6.80	6.77
4	Electrical Conductivity (mS/cm)	0.06	0.16	0.19	0.18
5	Organic Carbon(%)	0.60	1.56	1.55	1.57
6	Humus(%)	1.72	2.66	2.74	2.74
7	Total N(%)	0.05	0.21	0.24	0.20
8	Available P_2O_5 (%) (ppm)	8.92	93.42	88.90	90.11
9	Available K_2O (%) (mg/100g)	12.99	45.63	48.33	44.23
10	Exchangeable Ca^{2+} (mmol/100g)	9.80	13.25	11.56	13.65
11	Exchangeable Mg^{2+} (mmol/100g)	1.26	2.88	2.97	2.05
12	Exchangeable K^{1+} (mmol/100g)	0.22	1.76	1.54	1.77
13	C/N ratio	12.00	7.42	6.46	7.85

T-1= control

T-2,3,4= OF-1 treated Soil **(**rice straw , chicken manure , neem leaves) (1 :1 :1)

Analysis of the Farm Soil Media Used for Onion Plant after Harvesting

Table 6 shows the physical parameters and chemical compositions of soil samples (T-1, control) and (T-2, 3, 4, OF-2 treated soil sample) after harvesting. Those soils were subjected to different treatments by using OF-2 and control. Those farm soils were sandy loam soil and the pH are nearly neutral. The electrical conductivity of control was lower than OF-2. The total N, humus, organic carbon, Available P_2O_5, available K_2O, Cation exchange

capacity (CEC) of OF-2 were to found to be higher than control. Analytical data of the farm soil harvesting was found that the effects of OF-2 on the growth and yield of onion increased.

Table 6: Analytical Data of the Farm Soil of Onion after Harvesting

No	Parameters	T-1	T-2	T-3	T-4
1	Texture- Sand (%)	43.22	41.83	39.66	43.28
	Silt (%)	45.32	48.44	46.85	43.67
	Clay (%)	8.01	8.36	10.87	11.62
	Total (%)	96.55	98.63	97.38	98.57
2	Moisture (%)	1.13	1.46	1.37	1.48
3	pH	6.72	6.29	6.02	6.33
4	Electrical Conductivity(mS/cm)	0.06	0.16	1.14	1.11
5	Organic Carbon (%)	0.63	1.48	1.40	1.49
6	Humus (%)	1.69	2.71	2.96	3.01
7	Total N (%)	0.06	0.22	0.22	0.23
8	Available P_2O_5 (%) (ppm)	8.67	93.96	92.66	94.00
9	Available K_2O (%) (mg/100g)	12.03	47.20	45.13	46.29
10	Exchangeable Ca^{2+} (mmol/100g)	10.48	15.06	15.00	14.96
11	Exchangeable Mg^{2+} (mmol/100g)	1.31	1.67	1.65	1.69
12	Exchangeable K^{1+} (mmol/100g)	0.22	1.48	1.22	1.37
13	C/N ratio	10.50	6.73	6.36	6.48

T-1= control

T-2,3,4 = OF-2 treated Soil **(**rice straw , chicken manure , neem leaves) (8 :3:1)

Plant height of Chilli

Data presented in the Table 6 indicates a progressive increase in plant height with the age of the crop. The highest values at 120 days after cultivation were recorded in treatments T-2, T-3, and T-4 (OF-1) and T-1 (control). Data presented in the Table 7 indicates a progressive increase in plant height with the age of the crop. The highest values at 120 days after cultivation were recorded treatments T-2, T-3 and T-4 (OF-1) and T-1 (control). The plant heights in treatments T-2, T-3, andT-4 were 33.40 in, 32.00 in and 33.50 in, respectively. However, the shortest plant height of 25.00 in was observed in the treatment T-1.

Leaf length and number of fruits of Chilli

The maximum average number of leaf length in T-2 and T-3 were 2.50 in at 120 days after cultivation (Table 8). The leaf length of plants in T-4 was 2.40 in. The shortest leaf length was recorded in T-4. Application of OF-1 was 0.5 in higher than control. Table 9 shows the number of fruits of chilli in T-1, T-2, T-3 and T-4 i.e., 20.00, 145.00, 143.00 and 142.66, respectively. In this table results, T-2 is the highest in these treatments. Therefore OF- 1 was used to increase the number of fruits of chilli than control.

Yield of chilli

The yield of chilli (fresh and dry weight) responded significantly by the application of OF-1 in Tables 10 and 11. The highest fruit yield (61396.98 kg/ ha and 10185.49 kg/ ha for fresh and dry weight) was obtained by the application of T-4 (OF-1). The fresh and dry weights of chilli fruit in T-2 and T-3 were recorded and showed, lower fruit' yield (55331.59 kg/ ha and 8320.54 kg/ ha, and 61064.64 kg/ ha and 9163.12 kg/ ha respectively) than the treatment T-4 but were significantly different (Tables 10 and 11). On the other hand, treatment with (control) recorded a fruit yield (fresh and dry weight) of 3988.12 kg/ ha and 516.45 kg/ ha, which was significantly lower than 59264.40 kg/ ha and 9223.05 kg/ ha in the OF-1 (T-2, T-3 and T-4).

Plant height of onion

Table 12 indicates a progressive increase in plant height with the age of the crop. The highest values at 105 days after cultivation were recorded in treatments T-2, T-3, and T-4 (OF-2) and T-1 (control). Data presented in the Table 12 indicates a progressive increase in plant height with the age of the crop. At 120 days the treatments T-1, T-2, T-3 and T-4 were 9.90 in, 20.00 in, 21.26 in and 21.10 in, respectively. The T-1 was the shortest height and T-3 was the longest height among these treatments.

Bulb yield

The highest bulb yield (54010.57 kg/ ha) was obtained by the application of T-3 (OF- 2). In T-2 and T-4 was recorded, lower bulb' yield (53116.07 kg/ ha and 51280.26 kg/ ha respectively) than the above T-3 but were significantly different (Table 13). On the other hand, T-1 (control) recorded a bulb yield of 16710.57 kg/ ha, which was significantly lower than 52802.26 kg/ ha in the OF-2 (T-2, T-3 and T-5).

Table 7: Effect of Organic Fertilizer on Plant Height of Chilli Plant at Different Days after Cultivation

No	Treatment	Plant height (in) after cultivation							
		15 Days	30 Days	45 Days	60 Days	75 Days	90 Days	105 Days	120 Days
1	T-1= Control	4.30	7.43	15.26	15.30	15.90	16.26	24.00	25.00
2	T-2= OF-1 (6t/ha)	4.43	15.33	20.90	25.00	28.50	28.66	29.66	33.40
3	T-3= OF-1 (6t/ha)	5.00	15.33	20.80	25.00	28.00	29.10	30.33	32.00
4	T-4= OF-1 (6t/ha)	5.00	14.66	21.43	27.33	29.00	30.23	30.66	33.50

Table 8: Effect of Organic Fertilizer on Leaf Length of Chilli Plant at Different Days after Cultivation

No	Treatment	Leaf length (in) after Cultivation							
		15 Days	30 Days	45 Days	60 Days	75 Days	90 Days	105 Days	120 Days
1	T-1= Control	1.10	1.23	1.43	1.50	1.73	1.90	2.00	2.00
2	T-2= OF-1 (6t/ ha)	1.10	1.23	1.50	1.80	2.10	2.26	2.33	2.50
3	T-3= OF-1 (6t/ ha)	1.20	1.26	1.60	1.73	2.00	2.23	2.33	2.50
4	T-4= OF-1 (6t/ ha)	1.10	1.26	1.40	1.70	2.00	2.20	2.33	2.40

Table 9: Effect of Organic Fertilizer on Number of Fruits per Chilli Plant at Different Days after Cultivation

No	Treatment	Number of Fruits per plant after Cultivation						
		30 Days	45 Days	60 Days	75 Days	90 Days	105 Days	120 Days
1	T-1= Control	4.20	10.33	11.00	13.00	10.00	14.00	20.00
2	T-2= OF-1 (6t/ ha)	12.00	24.00	60.33	64.33	70.00	110.66	145.00
3	T-3= OF-1 (6t/ ha)	13.00	23.00	58.33	62.00	69.00	105.33	143.00
4	T-4= OF-1 (6t/ ha)	12.00	22.00	61.66	66.66	70.00	100.33	142.66

Table 10: Effect of OF-1 on Yield of Chilli Fruits (Fresh Weight)

No	Treatment	Fruit Weight (g)	Yield (kg/ha)	Average yield(kg/ha)
1	T-1= Control	4.17	3988.12	3988.12
2	T-2= OF-1 (6t/ ha)	7.98	55331.59	
3	T-3= OF-1 (6t/ ha)	8.93	61064.64	59264.40
4	T-4= OF-1 (6t/ ha)	9.00	61396.98	

Table 11: Effect of OF-1 on Yield of Chilli Fruits (Dry Weight)

No	Treatment	Fruit Weight (g)	Yield (kg/ha)	Average yield(kg/ha)
1	T-1= Control	0.54	516.45	516.45
2	T-2= OF-1 (6t/ ha)	1.20	8320.54	
3	T-3= OF-1 (6t/ ha)	1.34	9163.12	9223.05
4	T-4= OF-1 (6t/ ha)	1.50	10185.49	

Table 12: Effect of OF-2 on Plant Height of Onion at Different Days after Cultivation

No	Treatment	Plant height (in) after cultivation						
		15 Days	30 Days	45 Days	60 Days	75 Days	90 Days	105 Days
1	T-1= Control	4.00	5.00	6.33	7.33	8.86	9.00	9.90
2	T-2= OF-2 (6t/ ha)	4.66	6.00	13.26	18.00	19.00	19.60	20.00
3	T-3= OF-2 (6t/ ha)	4.00	6.66	13.23	18.33	19.33	21.00	21.26
4	T-4= OF-2 (6t/ ha)	5.00	7.00	13.60	19.66	20.00	20.86	21.10

Table 13: Effect of OF-2 on Yield of Onion Bulbs

No	Treatment	Bulb Weight (g)	Yield (kg/ha)	Average yield(kg/ha)
1	T-1= Control	17.75	16710.57	16710.57
2	T-2= OF-2 (6t/ ha)	56.42	53116.07	52802.26
3	T-3= OF-2 (6t/ ha)	57.37	54010.45	
4	T-4= OF-2 (6t/ ha)	54.47	51280.26	

Conclusion

In the present work, the selected agricultural wastes (rice straw, chicken manure, neem leaves) were recycled to use as organic fertilizers. The field experiments were conducted at the farm suited in Kun Chan Village (Taungdwingyi Township, Magway Region in Myanmar) from 9th September,

2016 to 9th January, 2017. The experiment was laid out in complete block design with three replications. Before the chilli and onion plants were cultivated, the total N of the soil sample 1 (control), 2 (OF-1 treated soil) and 3 (OF-2 treated soil) are 0.09%, 0.24% and 0.21%. After harvesting of chilli plant, the total N of T-1(control) and T-4 (OF-2 treated with soil) are 0.06% and 0.23%. After harvesting of onion plant, the total N of T-1(control) and T-3 (OF-1 treated with soil) are 0.05% and 0.24%. Therefore the total N of OF-1 and OF-2 treated soil were found to be higher fertility than control soil. The lowest and highest plant height of chilli were 25.00 in (T-1) and 33.50 in (T-3). The lowest and highest plant height of onion were 9.90 in (T-1) and 21.26 in (T-3).The yield for fresh weight of chilli was 3988.12 kg/ha (control) and 59264.40 kg/ha (OF-1 treated soil). The yield for dry weight of chilli was 516.45 kg/ha (control) and 9223.05 kg/ha (OF-1 treated soil). The application of organic fertilizer 1 had produced higher yield percent of chilli fruits than control. The lower yield of onion was 16710.57 kg/ha (control) and the higher yield of onion was 52802.26 kg/ha (OF-1 treated soil). The application of organic fertilizer 2 had also produced higher yield percent of onion than control. The application of organic fertilizer was effective in enhancing growth and the yield of chilli and onion. These results have the great potential for reducing the use of chemical fertilizers without decreasing the yield of chilli and onion. Clearly, the combined application of organic fertilizers can enhance soil fertility and crop productions. Further studies investigating how different application methods and various types of organic fertilizers might enhance the growth of new crop varieties should be performed in the future. Therefore, the prepared organic fertilizer (rice straw, chicken manure, neem leaves) should be used in cultivation of crops and improving the soil fertility.

Acknowledgements

The authors would like to thank the Department of Higher Education (Yangon Office), Ministry of Education, Yangon, Myanmar, for the permission to do this research and Myanmar Academy of Arts and Science for allowing to present of this paper. Special thanks are extended to Professor and Head, Dr Myint Myint Than, Department of Chemistry, Pyay University.

References

Dobermann, A. and Fairhurst T.H. (2002). "Rice Straw Management". *Journal of Better Crops International,* vol., 16 (4), pp. 7-11

Emmanuel, I.M. (2013). "Comparative Evaluation of Neem Leaf (*Azardirachta Indica* L.), Wood Ash and Modified Neem Leaf Extracts on the Soil Fertility, Growth and Yield of Garden Eggplant (*Solanium melongena* L.)". *American Journal of Agricultural Science and Technology*, vol., 1 (3), pp .84-92

Harold, F. and Reetz, Jr. (2016). "Fertilizers and their Efficient Use" .French, *Journal of Agriculture*, vol., 3 (10), pp. 80-90

Jayathilake, P.K.S., Reddy, I.P., Srihari, D., Reddy, K.P. and Neeaja. G. (2003). "Integrated Nutrient Management". *Journal of Tropical Agricultural Research,* vol.,15 (3), pp 1-9

Myint, A. K., Yamakawa,T., Kajihara, Y. and Zenmyo.T. (2010) . "Application of Different Organic and Mineral Fertilizers on the Growth, Yield and Nutrient Accumulation of Rice in a Japanese Ordinary Paddy Field". *Journal of Science World,* vol., 5 (2), pp. 47-49

Nidhi, R. and Priyanka, A. (20014). "Comparative Study of the Effect of Chemical Fertilizers and Organic Fertilizers on Eisennia Foetida". *Journal of Innovative Research in Science*, vol., 3 (5), pp. 12991-12998

Sumaila, R. (2012). *The Potential of Azadirachta indica Leave Biomass as a Nutrient Source for Maize Cultivation*. M.Sc Thesis, Department of Agroforestry, Kwame Nkrumah of University, Science and Technology

Thazin Nyo. (2009). *Study on Fertilizers Prepared from Rice Husk Ash and Tea Residue* .PhD Dissertation, Chemistry Department, University of Yangon