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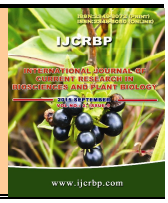

Original Research Article

Performance of Aerobic Rice (var. NSTC RC 23) Applied with Organic Inputs under Rainfed Conditions in Tarlac, Philippines

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Abstract

The performance of Aerobic rice (var. NSTC RC 23) applied with different organic inputs was evaluated at San Jose, Mayantoc, Tarlac under upland rainfed conditions. The study aimed to develop and improve organic farming technologies via production of organic inputs (vermin composts and beneficial micro-organism derived compost) and assess the performance of aerobic rice using these technologies. Results showed that50%vermicompost+ 50% BM compost plots exhibited the best substrate composition which gave a high total nitrogen content, phosphorus content, and potassium content of 2.41%, 7.20%, and 14.00% respectively. The 100% BM compost recorded the highest phosphorus content of 12.00%. Aerobic rice plants grown under plots applied with 100% vermicompost (VC), 100% beneficial micro-organism derived compost (BMC) and 50% VC + 50% BMC produced taller plants compared to the control plants with plant heights of 101.78 cm, 103.88 cm, 103.80 cm and 96.65 cm respectively. In terms of panicle length, plants applied with BM derived compost and 50% VC + 50% BMC comparatively produced the longest panicle. Aerobic rice plants applied with 100% vermicompost, 100% beneficial micro-organisms derived compost and 50% VC + 50% BMC similarly produced higher grain yield compared to the control plants. The same trend of response was observed in computed weight of grains per hectare which ranges from 3,841.66 kg/ha to 4,591.66 kg/ha.

Keywords

Aerobic rice

Beneficial microbes

Organic inputs

Vermicompost

Introduction

Organic farming is a holistic production management system which emphasizes the use of management practices using naturally available resources. This is accomplished by using agronomic, biological, and mechanical methods, as opposed to using synthetic materials.There is a growing demand from the consumers for the organically grown food materials due to increasing awareness about the harmful effects of food materials produced using agro-chemicals. Use of biofertilizers is one of the important components of integrated nutrient management, as they are cost effective and renewable source of plant nutrients to supplement the chemical fertilizers for sustainable agriculture.Nowadays, organic- based agricultural

production is a rapidly emerging technology in the Philippines, which partly solves waste disposal problem through conversion of biodegradable wastes into organic compost; this ensures the availability of organic fertilizer for crop production (PCAARRD, 2009).

The Tarlac College of Agriculture has been promoting the use of microbial inoculants and vermin in the production of organic fertilizers for crop production in the province of Tarlac. The inoculant consists of natural and organic cultures of beneficial microorganisms fortified with medicinal plants and aromatic herbs. This is a useful technology in organic farming especially in controlling pest and diseases. Bio pesticides also known as Biological Pesticides are pesticides derived from natural materials as animals, plants, bacteria, and certain minerals.

Vermitea and BM inoculant are not pesticides and are not containing chemicals. It is a microbial inoculant that functions indirectly as a biological control measure in controlling pests through the introduction of beneficial microorganisms to the plant environment. Pests and pathogens are reduced or eliminated through natural processes by increasing the competitive and antagonistic activities of the soil microorganisms through the use of inoculants (Arancon et al., 2005).

The inoculant consists of natural and organic cultures of beneficial microorganisms fortified with medicinal plants and aromatic herbs. This is a useful technology in organic farming especially in controlling pest and diseases. Driven by the desire to preserve the living soil and the environment as a whole, TCA has developed the technology on rapid composting through beneficial microorganisms and vermin. The BM derived compost is essentially naturally fortified with macro and micro nutrients, or bionutrients and biodiversed beneficial indigenous microorganisms. It is made from fermenting organic materials such as animal manure, charcoaled rice hull, fish refuses and other biodegradable wastes. Vermicompost application to field soils combined with 50% of the recommended inorganic fertilizers increased yields of tomatoes (Ponciano, 2015).

The shift from the use of synthetic fertilizers to organic is an important step in balanced and self- regulating agricultural system. The Organic- based crop production provides opportunities for producing high quality crops which support the Natural Tarlac program of the province. Likewise, help farmers to increase their income and improve farm productivity.

Materials and methods

The following were the treatments for the cultivation of aerobic rice.

Treatments

Treatment 1 - Control (no fertilizer application)

Treatment 2- 100 % Vermicompost (0.424 kg/m^2)

Treatment 3- 100% BM derived compost (0.24 kg/m^2)

Treatment 4 - 50% Vermicompost + 50% BM derived compost

Land preparation

An area of 551.25 m2 was plowed and harrowed thoroughly until the soil will be totally puddled and ready for transplanting.

Weed control

Weeding was donewhenever it is necessary.

Vermicomposting technology

The different substrates used were rice straw, sugarcane trashes, dried leaves, cow, carabao and goat manure with a C:N ratio of 1:1 or 1:2 depending on the availability of the materials. The substrates were mixed and then composted either aerobically or anaerobically using vermin worms as compost activator.

Production of enhanced compost

The enhanced compost was fortified with macro and micro nutrients and bio diversed beneficial microorganisms. Preparation was made from fermenting organic materials: animal manure, charcoaled rice hull and other bio wastes.

Fertilizer application

Fertilizer application was based from the study treatments.

Organic fertilizer application

The organic fertilizers such as vermicompost, BM compost were used in the study. Organic fertilizer was applied based on the different fertilizer treatments and result of soil analysis from the Bureau of Soils in San Fernando, Pampanga. Organic fertilizers was incorporated in the soil two weeks before transplanting.

Irrigation

Adequate application of water was one to meet the needed amount of moisture necessary for growth and development of upland rice.

Control of pests and diseases

Sanitation was employed and appropriate control measure was applied to protect plants from insect pests and diseases.

Data gathered

1. Final plant height
2. Number of tillers/hill
3. Panicle length
4. Weight of 1000 grains
5. Yield per hectare
6. Chemical and physical characteristics of the soil before and after planting.

Results and discussion

Soil analysis

Table 1 shows the results of soil analysis before and after planting. Initial result of soil analysis shows that soil texture is high, soil pH is 6.21, organic matter content is 1.19, phosphorous content is 4.0 ppm and potassium content is 40 ppm. After harvesting, soil analysis result showed decrease in soil ph in all treatments, increase in organic matter content and phosphorous in all treatments.

Phosphorous content increased in Treatments 3 (100% BM +100% vermicompost) and Treatment 2 (100% BMC) while potassium content increased in Treatments 2 and 3.The combination of BM and vermicomposts gave the highest potassium contents.

Table 1. Before planting and after planting results of soil analysis.

Treatment	Texture	pH	O.M content %	P (ppm)	K (ppm)
Initial Soil Analysis	H	6.21	1.19	4.00	40.00
1 –Control	M	5.51	1.36	4.00	90.00
2-100 % VC	M	5.51	1.41	4.25	90.00
3-100% BM C	M	5.89	2.31	12.00	90.00
4- 50% VC + 50% BMC	M	5.71	2.41	7.600	140.00

Growth performance of aerobic rice as influenced by organic inputs

Plant height, number of tillers per hill, panicle length of aerobic rice (var. NSTC Rc 23) applied with different sources of organic fertilizer is shown in Table 2. Plants grown under plots applied with 100% vermicompost,(VC)(T2), 100% beneficial micro-organism derived compost (BMC)(T3) and 50% VC + 50% BMC(T4) comparatively produced taller plants against the control (T1) with plant heights of 101.78 cm, 103.88 cm, 103.80 cm and 96.65 cm respectively. It is observed that plants grown in the different treatments produced similar number tiller ranging from 5.50 to 5.83. In terms of panicle length, Treatment 3 and Treatment 4 comparatively produced the longest panicle.

Table 2. Some growth parameters of aerobic rice (var. NSTC RC 23) as influenced by different sources of organic fertilizer

Treatment	Plant height (cm)	Number of Tillers per hill	Panicle Length(cm)
1 –Control	96.65 b	5.83 a	19.29 c
2-100 % VC	101.78 a	5.50 a	20.38 b
3-100% BM C	103.88 a	5.68 a	21.81 a
4 -50% VC + 50% BMC	103.80 a	5.58 a	22.15 a

Further, de Souza et al. (2013) observed similar results in corn plants fertilized with vermicompost enriched with rock powder which exhibited taller and heavier than plants compared to plants grown under plots with non-enriched vermicompost. The findings coincides with the report of Nattudurai et al. (2014) who observed that vermicompost led to the marked increase in plant biomass.

Yield performance of aerobic rice as influenced by organic inputs

Table 3 presents the weight of 1,000 grains, weight of grains and computed yield per hectare of aerobic rice (var. NSTCrc 23) applied with different sources of organic fertilizer. Weight of 1,000 grains was observed to have the same weight which shows insignificant differences among treatments. Grain weight harvested in a 3m x 4m crop cut area revealed significant differences among treatments.

Aerobic rice plants grown under plots applied with 100% vermicompost, 100% beneficial micro-organisms derived compost and 50% VC + 50% BMC similarly produced higher grain yield compared to the control plants. The same trend of response was observed in computed weight of grains per hectare which ranges from 3,841.66 kg/ha to 4,591.66 kg/ha.

Table 3. Some yield parameters of aerobic rice (var. NSTC RC 23) as influenced by different sources of organic fertilizer.

Treatment	Weight of 1,000 grains (g)	Weight of grains (kg) (Area-3m × 4m)	Computed Yield per Hectare (kg)
1- Control	31.92 a	4.61 b	3,841.66 b
2-100 % VC	34.72 a	5.50 a	4,583.33 a
3-100% BM C	33.19 a	5.39 a	4,146.15 a
4 -50% VC + 50% BMC	34.87. a	5.51 a	4,591.66 a

Conclusion

Based on the results of the study, the following conclusions can be drawn.

1. 100% BM + 100% Vermicompost plots produces the best substrate composition which gave the highest total nitrogen and potassium contents.
2. 100% BM compost reported the highest phosphorous contents and comparable potassium content with the other substrates.
3. 100% vermicompost (VC), 100% beneficial micro-organism derived compost (BMC) and 50% VC + 50% BMC produces taller plants compared to the control plants.
4. In terms of panicle length, plant applied with BM derived compost and 50% VC + 50% BMC comparatively produce the longer panicles.
5. Aerobic rice plants applied with 100% vermicompost, 100% beneficial micro-organisms derived compost and 50% VC + 50% BMC similarly increases grain yield.
6. The same trend of response was observed in computed weight of grains per hectare which ranges from 3,841.66 kg/ha to 4,591.66 kg/ha.

Recommendation

1. To obtain higher nutrient contents for the different composts, it is recommended to incorporate or add substrates which can enhance their nitrogen contents such as blood meal, tobacco dusts, duckweed, azolla and leguminous plants.
2. In enhancing production of taller rice plants and longer panicles in the 100% vermicompost, 100% beneficial micro-organism derived compost (BMC) and 50% VC + 50% BMC is recommended.
3. To obtain an increased aerobic rice yield, the application of 100% vermicompost, 100% beneficial micro-organisms derived compost and 50% VC + 50% BMC is recommended.

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