# EVALUATION OF VELVET-FALLOW AND COMPOST AMENDMENTS ON CORCHORUS (*Corchorus olitorus*) YIELD AND SOIL PROPERTIES IN AN ORGANIC FARMING SYSTEM

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**ABSTRACT**

Legumes can play an important role in management of nitrogen (N) for vegetable production, especially in tropics where low native fertility is a major constraint to crop production. Thus, this report therefore presents evaluation of the influence of velvet bean-fallow (residual fertility) and compost on the yields of corchorus (*Corchorus olitorus*), as well as the post-harvest soil fertility quality. Corchorus was used as the test crop. Six treatments IBBW1 (Ibadan brewery waste based grade A), IBBW2 (Ibadan brewery waste based grade B), IBBW1 compost + Velvet residual fertility, IBBW2 compost + Velvet residual fertility, Velvet residual fertility (Sole) and no fertilizer treatment as a control were investigated. The compost was applied at 100 kgN/ha. The experimental design was complete randomized block design replicated four times and means were separated using Duncan multiple range test. The result showed that the fertilizer sources had significant effects on the dry yield of corchorus. The sole velvet fallow resulted into the best dry yield of 7.22 t/ha and treatment IBBW1 + velvet fallow left the soil with better pH, total nitrogen and available phosphorus status. In general, sole velvet plus compost proved better fertilizers in the production of *corchorus olitorus*. Thus, these treatments could be useful in organic production system for corchorus.

**Key words**: Corchorus, nitrogen, Ibadan brewery waste based compost, residual soil fertility, velvet bean.

**INTRODUCTION**

Interest to preserve soil fertility for crop production through the use of legumes as cover crops or green manures has been known since the origin of agriculture. In recent years, the use of organic fertilizers such as Green Manure (GrM) crops has increased considerably due to environmental awareness and the need to reduce input costs (Pappa *et al.,* 2006). This management approach is often used by organic farmers because it is perceived to be more environmentally sound and less expensive than using inorganic mineral fertilizers (Edmeades, 2003).

Cropping without fallow and proper restoration of soil fertility could greatly lead to decrease in soil fertility, reduced levels of soil organic matter, and soil acidification. Thus, achieving food security for a rapidly growing population will require intensification of food production through improving soil fertility and improved agronomic practices. There is a wide range of technological options for improving soil conservation and land management that are economically viable, ecologically sound, and socially acceptable. These options include inorganic fertilizers, crop residue management, green manure, composting, farmyard manure, agroforestry technologies, alley farming, planted fallow, cover crops, and cereal legumes intercropping or rotation (Herencia *et al.,* 2007). Compost is widely used as a soil amendment to improve soil structure, provide plant nutrients and facilitate the re-vegetation of disturbed soils (Brady N. C. and Weil, R. R., 2005).[Hide](file:///C:\Users\Olaoluwa\Documents\Compost%20-%20Wikipedia,%20the%20free%20encyclopedia.mht)Velvet (*Mucuna pruriens*) is a legume cover crop that is an efficient, low-cost source of nitrogen with considerable potential to improve soil fertility in intensified cropping systems (Carsky *et al.,* 1998). Gaskell, 2004 reported that pepper without prior cover crops require 90 kg of nitrogen per acre to reach yield similar to pepper with a prior cover crop. However, information on the influence of velvet bean fallow on some indigenous crops like corchorus is almost none existing.

*Corchorus olitorus* is a vegetable food to many families in Africa, Asia and in the Middle East. It has a potential to become one of the major vegetables and can be grown either on its own or intercropped with other common food crops such as maize and sorghum (Masarirambi *et al.,* 2011). Despite the aforementioned benefits of manures such as enhanced N2-fixation (GrM), high subsequent crop yields, and other positive effects on soil physical and chemical properties. There is still dearth information on Velvet fallow (residual fertility) augmented with compost amendments in the production of corchorus. The objectives of this report therefore are to evaluate the single and combined effects of Velvet-fallow and compost on the yields of corchorus and also on the post-harvest soil fertility quality.

# MATERIALS AND METHODS

This study was carried out on the field of the Organic Vegetable Garden at the Teaching and Research Farm of the Department of Agronomy, Faculty of Agriculture and Forestry, University of Ibadan, Nigeria at latitude 70 24' N and longitude 300 54' E between January and March 2014. It is located in the derived savannah of South West Nigeria.

The treatments consisted IBBW1 Ibadan brewery waste based grade A, IBBW2 Ibadan brewery waste based grade B, IBBW1 compost + Velvet residual fertility, IBBW2 compost +Velvet residual fertility, Velvet residual fertility (residue of velvet planted on the soil before planting of the vegetables), and a control treatment (no fertilizer). The compost were obtained from organic section of Teaching and Research Farm University Ibadan and the Cochorus seeds was obtained from a seed shop at Orogun, Ojo road, Ibadan. Each treatment was replicated four times in a randomized complete block design. The experimental plot consisted of thirty-two 2 m x 1.5 m in all with the total land area of 456.8 m2 (24 m x 19.8 m). The crop was planted at a spacing of 3cm inter-row and 0.5 m inter-bed spacing and the corchorus plants were thinned to a planting density of 1.8 million plants per hectare two weeks after planting.

Surface soil samples (0-15 cm depth) were collected from experimental field before and after the investigation. The samples were air dried and sieved (<2 mm). Composites of the soil samples were processed for laboratory analysis. At harvesting, fresh and dry root weight were determined using destructive samplings. Samples were oven dried at 70oC. Data generated were analysed statistically by analysis of variance (ANOVA) using GENSTAT. Duncan Mutiple Range Test (DMRT) was used to seperate treatment means at 0.05 significant level.

**RESULTS**

The chemical and physical soil properties are shown on Table 1. The pH of the soil is 6.8 and is moderately acidic. Soil total nitrogen is lower than the lower limit of the critical range. It low in organic carbon (2.81 g/kg). The available phosphorus (P) of the soil is (14 mg/kg). Exchangeable potassium (K) is in cmol/kg and also at the lower limit of the critical range (0.2 – 0.4 cmol/kg). The soil at the experimental site is low loamy sand texture. The soil is suitable for the fertilizer experiment. Details of nutrient compositions of the brewery based waste compost A and B revealed that total nitrogen ranged from 0.93 % - 0.98%, while the phosphorus ranged from 0.92 % - 0.94 % as well as potassium 0.74% - 1.12%. Table 2 shows the comparative effects of different organic amendments on dry yield of corchorus. The treatments had a significant effect at (P< 0.05) on all the yield parameters collected. The treatment Velvet + IBBW1 gave the highest dried shoot weight (6.50 t/ha), Velvet fallow resulted into the highest total dry weight (7.22 t/ha), followed by IBBW2 treatment (7.16 t/ha).

**Comparative effect of Organic amendments on the soil properties**

Table 3 revealed that the treatment applied significantly affect the post fertility status of the soil. Treatment IBBW1 + Velvet (residual fertility) increased the soil organic carbon, nitrogen, available phosphorus, calcium and potassium when compared with the other treatments as well as the initial fertility status.

Table 1: Soil chemical properties and particle size distribution before planting

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameters | pH | O C | N | Av. P | Ca | K | Na | Mn | Fe | Cu | Sand | silt | Clay |
|  |  | g/kg | | mg/kg | cmol/kg | | | mg/kg | | | g/kg | | |
| Values | 6.8 | 2.8 | 0.1 | 14 | 3.1 | 0.2 | 0.5 | 65 | 67 | 11 | 650 | 236 | 114 |

**Discussion**

The effects of organic fertilizers were significantly different on the yield of Jute as evident in parameters evaluated. The least performance of the plants in the control was a reflection of soil nutrients deficit. This is in consonance with Okpara *et al.,* 2007.

**Table 3: Comparative effects of organic amendments on the yields of corchorus (t/ha) after 5 weeks of sowing**

|  |  |  |
| --- | --- | --- |
| Treatment | Dry shoot weight | Total dry weight |
| Control | 3.48b | 4.17b |
| IBBW1 + Velvet residual fertility | 5.46ab | 6.08ab |
| IBBW2 + Velvet residual fertility | 5.62ab | 6.29ab |
| IBBW 1 | 6.50ab | 7.16a |
| IBBW 2 | 5.46ab | 6.15ab |
| Velvet | 6.50a | 7.22a |

Means separated by the same letters in a column are not significantly different by Duncan Multiple Range Test at 5% level.

Ibeawuchi *et al.* (2006) reported that organic fertilizers increased the nutrient status of the soil through gradual release of nutrients to the soil. Similarly, Olanikan (2006) reported that organic fertilizer increased organic matter status of the soil and enhanced crop production and this could have resulted into the significant difference observed in the dry yield of corchorus. The compost application rate of 100 kg N/ha agrees with NIHORT (1986) where they reported positive responses of *Corchorus olitorus* to N with optimum rate at 75 kg N/ha, which was contrary to the rates obtained in the study by Olaniyi and Ajibola (2008) where 45 kg N/ha was used and observed maximum fresh shoot and dry matter yields of corchorus. However, the appreciable and significant difference (P ≤ 0.05) in dry weight of corchorus (7.22 t/ha) by velvet bean fallow may be due to the fact that velvet bean has the potential to improve the soil quality by N-fixation. Ayeni *et al., (*2008) attributed improvement in soil health to the nutrient content and the amount of material applied. Thus, the improvement in soil fertility by the velvet fallow and IBBW composts could have led to increase in photosynthate accumulation (Siemonsma, 1991). The result of this trial showed clearly the potentials of organic materials in improving soil properties.

**CONCLUSION**

Organic farming is one of the ways to maintain soil health while retaining the productivity levels. The result revealed velvet (residual fertility) had significant influence on the yield of corchorus and it performed better compared to the control treatment (no fertilizer). Post-harvest soil with velvet bean fallow plus IBBW compost treatments had better nutrient status compared to the untreated plots in terms of nitrogen, phosphorus and organic matter contents.

**Table 4: Post harvest soil analysis for corchorus**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Treatments | pH | O C | N | Av. P | Ca | K | Na | Mn | Fe | Cu |
|  |  | g/kg | | mg/kg | cmol/kg | | | mg/kg | | |
| Control | 6.3 | 1.7 | 0.2 | 13 | 2.4 | 0.1 | 0.5 | 471 | 144 | 9 |
| IBBW1 + Velvet residual fertility | 6.5 | 3.5 | 0.4 | 72 | 4.9 | 0.6 | 0.7 | 532 | 210 | 12 |
| IBBW2 + Velvet residual fertility | 6.1 | 2.8 | 0.4 | 53 | 4.1 | 0.4 | 0.7 | 664 | 431 | 14 |
| IBBW1 Compost | 6.5 | 2.3 | 0.3 | 52 | 3.5 | 0.2 | 0.6 | 504 | 234 | 13 |
| IBBW2 Compost | 6.5 | 2.4 | 0.3 | 15 | 3 | 0.2 | 0.6 | 557 | 145 | 13 |
| Velvet residual fertility | 5.9 | 2.7 | 0.3 | 23 | 2.9 | 0.1 | 0.7 | 548 | 250 | 10 |
| Mean | 6.3 | 2.6 | 0.3 | 38 | 3.5 | 0.3 | 0.6 | 546 | 236 | 12 |
| SD | 0.2 | 0.5 | 0.1 | 21 | 0.8 | 0.2 | 0.1 | 56 | 89 | 2 |

Legend: SD: Standard deviation, IBBW 1 – Ibadan Brewery Waste Based Grade A Compost, IBBW 2 - Ibadan Brewery Waste Based Grade B Compost

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