



Growth responses of horse gram *Macrotyloma uniflorum* (Lam.) Verdc. to different organic farming system

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Abstract

The present investigation was done to find out the cultivation and growth response of *Macrotyloma uniflorum* (Lam.) Verdc. to different soil composition and organic farming systems. The results showed significant increase in mean length of cotyledon, 1st pair leaf, 2nd pair leaf, shoot and root in soil with 6.6, 11.83, 16.96, 18.66 and 6.26 cm in comparison to soil with recommended dose of Nitrogen and Phosphorus, soil with cow dung (1:1) and soil with vermi compost in 1:1, 2:1 and 4:1 ratio respectively. Maximum mean leaf area of 8cm² was found in soil treated with cow dung compost in comparison to growth in other treated soil. Leaf area was found to be minimum of 6.08cm² in soil where as the leaf length was maximum in crops grown in soil. The results revealed that the prevalent soil composition of the tested area has significant amount of optimum nutritional contents needed for the growth of *M. uniflorum* (Lam.) Verdc.

Keywords: crop growth, dietary fiber, organic farming system, vermi-compost

Introduction

Pulses are known as good source of protein for human consumption. Various types of pulses are used to in the diet. Among them, Horse gram [*Macrotyloma uniflorum* (Lam.) Verdc.] belonging to family Fabaceae is known as a nutrient rich food crop of poor people (Tontisirin, 2014) [10]. This pulse crop is used maximum for human consumption in Africa and India. Its centre of origin is South West India (Arora and Chandel, 1972) [2]. *Macrotyloma* is a dry season livestock feed of Australia and dry regions of Africa, indicating its capability in withstanding drought and being a suitable crop for studying moisture stress tolerance and potential source of genes for the same. Horse gram is an important crop mainly cultivated in all most all over the world in temperate and subtropical regions and cultivated in post rainy season in dry land areas (Durga, 2012; Krishna, 2010) [4, 10]. This pulse crop contributes about 0.33% of the total food grain production in India. It is as an excellent source of protein (up to 25 %), carbohydrates (60%), essential amino acids, energy, dietary fibers (5.3%), low content of lipid (0.58%), iron, molybdenum, riboflavin (0.2mg), niacin (1.5 mg) for 100g of dry matter (Bolbhat and Dhumal, 2012) [3]. This crop is used as food, fodder and traditional medicines especially to treat kidney stones, asthma, bronchitis, leucoderma, urinary releases, heart diseases, ulcer and also useful on balancing blood sugar level in diabetic patients due to the presence of useful bioactive mixtures (Nithya, 2010; Aditya *et al.*, 2019) [8, 11]. This underutilized leguminous plant has a significant contribution to the diet of rural people during the dry and drought season (Magbagbeola *et al.*, 2010) [7]. Horse gram crop is also considered as the chief nutritional source for the poor people especially in traditional subsistence farming system (Haq, 2011) [5]. Being a legume, it contributes in fixing atmospheric nitrogen through root nodules and act as organic manure as well. It is suitable as a cover crop in soil and water conservation and an excellent drought tolerant contingent crop in case of delayed monsoon. The whole

seed of horse gram is generally utilized as a cattle feed besides being a pulse. The fodder being rich in protein is widely used as a feed to mulch animals and horses. It is grown generally by the Indian farmers with zero-fertilizer conditions especially as a contingency crop and hence considered a purely organically grown crop in the real sense by the Indian farmers even today. Pesticides are also not used and the crop is raised strictly under rain fed conditions, with the marginal and small farmers assuring themselves of household nutritional security even under drought conditions. Horse gram is cultivated in intercropping systems with different cereals like finger millet, pearl millet, little millet, maize and bajra (Krishna, 2010) [6].

Materials and Methods

Experimental Site and Cultivation of *M. uniflorum* (Lam.) Verdc.

The experiment was conducted in the experimental garden of Centurion University of Management and Technology, Bhubaneswar. Pre-soaked seeds of *M. uniflorum* (Lam.) Verdc. were sown in rows with proper spacing in the poly bags containing soil with compost, NPK, and vermi-compost in different proportion. The experiments were conducted in three replications for each proportion of treated soil. The poly bags were filled with soil (kept as control), soil with recommended dose of Nitrogen (20 kg/ha) and Phosphorus (30 kg P₂O₅ kg/ha), soil with cow dung (1:1) and soil with vermi compost, in 1:1, 2:1 and 4:1 ratio respectively. The poly bags were watered Everyday and weeding was also done as and whenever required.

Growth Parameters

In the 3rd week, the growth of different parts of the plants was measured. From each pot, 10 plants differing in visual growth were taken out from the soil. Each plant was then placed in a clean white chart paper and the length of cotyledon, root, shoot, 1st leaf and 2nd leaf pair was measured (Fig. 1). This process was repeated for all the poly

bags containing variable soil composition. Mean value of length of the shoot and root was calculated. Leaf area of 1st and 2nd pair of leaves was calculated using graph paper (Fig. 2).



Fig 1: Seedlings growth in different soil composition

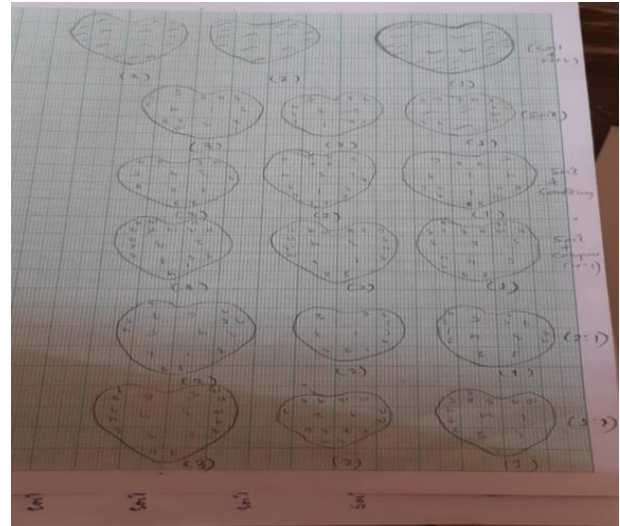


Fig 2: Leaf area measurement in different soil composition

Results and Discussion

The data in Table 1 revealed significant increase in mean length of cotyledon, 1st pair leaf, 2nd pair leaf, shoot and root in soil with 6.6, 11.83, 16.96, 18.66 and 6.26 cm in comparison to soil with recommended dose of Nitrogen and Phosphorus, soil with cow dung (1:1) and soil with vermi compost in 1:1, 2:1 and 4:1 ratio respectively (Fig. 1).

Table 1: Stages of crop growth in different soil composition

Soil composition	Ratio	Cotyledon (*ML)	First pair leaf (*ML)	Second pair leaf (*ML)	Shoot (*ML)	Root (*ML)
Soil	-	6.6	11.83	16.96	18.66	6.26
Soil + Nitrogen+ Phosphorus	-	5.26	10.4	13.2	15.23	1.83
Soil+cow dung compost	1:1	5.63	9.63	14.83	17.4	4.9
Soil+ vermi compost	1:1	4.63	9.83	16.36	18.63	3.93
Soil+ vermi compost	2:1	5.76	10.83	16.4	18.03	5.33
Soil+ vermi compost	4:1	5.96	10.86	16.16	16.96	3.7

*ML: Mean length

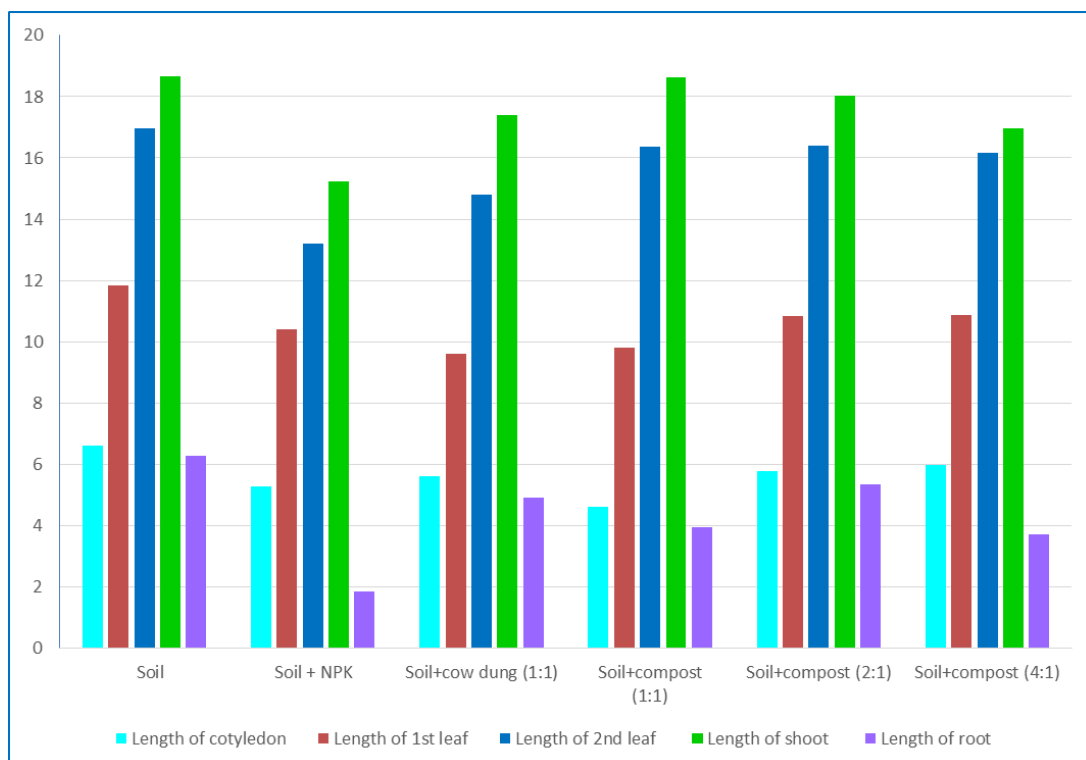


Fig 3: Graph showing stages of crop growth in different soil composition)

Leaf Area

The results revealed maximum leaf area in soil treated with cow dung compost with mean area of 8cm² in comparison to growth in other treated soil (Table 2, Fig. 4). A controversial finding was noticed in leaf area and leaf length. Leaf area was found to be minimum of 6.08cm² in soil where as the leaf length was maximum in crops grown in soil. This might be due to the fact that the length of the leaf is longer in soil grown plants than the area suggesting the leaf became narrower in comparison to the crops grown in soil with cow dung compost.

Table 2: Leaf area of *M. uniflorum* Lam. in different soil composition.

Soil composition	Ratio	Leaf area (cm sq.)
Soil	-	6.08
Soil + Nitrogen+ Phosphorus	-	7.6
Soil+cow dung compost	1:1	8
Soil+ vermi compost	1:1	7.18
Soil+ vermi compost	2:1	6.83
Soil+ vermi compost	4:1	7.42

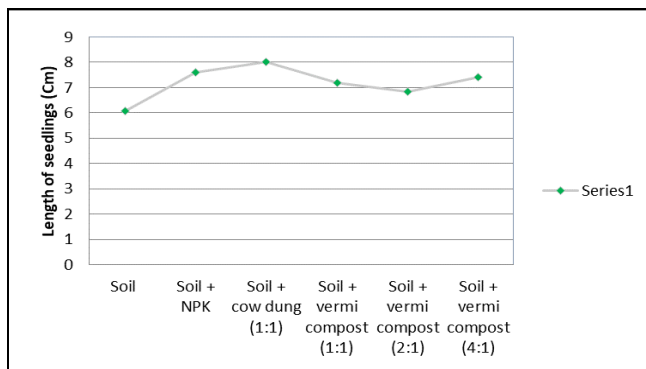


Fig 4: Leaf area *M. uniflorum* (Lam.) Verdc. in different soil composition

Conclusion

The present experiment showed the effective growth of horse gram in soil in comparison to other treated soil with different ratios of cow dung compost and vermin compost. Better growth of different plant parts was noticed in soil only. The maximum leaf area was noticed in soil and cow dung in 1:1 ratio as compared to the pure soil and other variable soil composition with vermin compost. This ensures that the soil of experimental area was found to be optimum for the crop growth with the prevailing climatic factors like temperature, humidity, pH and other cultivation approaches.

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