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Effect of different levels of organic manure on the growth and yield of mustard (*Brassica juncea* L.) under *Jatropha* (*Jatropha curcas* L) based agroforestry system

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Abstract

A field experiment was conducted during Rabi season of 2017-18 at Research farm, College of Forestry, SHUATS, Allahabad. The soil of experimental plot was sandy loam in texture, nearly neutral in soil reaction (pH6.7), low in organic carbon (0.35%), N (230kg/ha), P(20kg/ha) and K(98kg/ha), The treatment comprised of 3 levels of FYM,VC and PM viz.T₁ (control),T₂ (100% FYM), T₃(100%PM), T₄(100%VC), T₅(50%FYM+50%VC), T₆(50%FYM+50%PM), T₇(50%FYM+25%VC+25%PM), T₈(25%FYM+25%VC+50%PM), T₉(25%FYM+25%PM+50%VC). There were 9 treatments; each replication thrice, the experiment was laid out in RBD. The result was shows that maximum plant height was recorded (169.27 cm)at 80DAS, number of branches (5.26)at 80 DAS, dry Weight (76.03 g) at 80DAS and yield attributes viz., number of Siliqua plant⁻¹(5.85) at harvesting time, number of seeds Siliqua⁻¹ (13.46) at harvesting time, Test weight (4.93g) after harvest, Seed yield (1.49 t/ha⁻¹) after harvest, after harvest, Stalk yield (1.93 t/ha⁻¹), B:C.Ratio 1:4.3, were recorded in treatment (T₅ 50% FYM+50%VC). These parameters were significantly influenced by different sources and doses of organic manure.

Keywords: mustard, jatropha, FYM, vermicompost, poultry manure, agroforestry, growth & yield

Introduction

The man has been practicing Agroforestry since he learnt the art of cultivating agricultural crops and domesticating of livestock's and has never stopped using trees. Agroforestry system is not new. In fact they are very old and traditional. The only new at present is the use of the term "Agroforestry". It can promotes economic and environmental growth, mitigates deforestation and prevent soil degradation and restores degraded lands in both village as well as urban area of India (Pathak *et al.*, 2016) [16]. It provides a different land use option, compared with traditional arable and forestry system, and it also allows for the diversification of farm activities and makes better use of environmental resource. Tree and animal, which are grown in agricultural field or on field bunds, are also often and usually grown on farm boundaries. They also help in the demarcation of the farm and field boundaries, and serves as wind breaks and shelter belts. This system is very extensively practiced in all agro-ecological regions of India. Under dry farming situation where the natural resources are scarce the soil nutrient balance needs to be maintained by rotation of cereal and pulse crops in alternate years. The tree component in agroforestry system helps to reduce the pH, EC and increased organic matter content, available nitrogen, phosphorus and potash content of soil over the years (Kumar *et al.*, 2015) [15]. The choice of intercrop is important as the economic returns depend on particular tree component, though the choice is also determined by the technical factors like agro-climatic and edaphic conditions. Agroforestry system with judicious mixing of crop and trees meet all basic requirements of mankind and ecosystem (Ranjan *et al.*, 2016) [17]. Plant *Jatropha curcas* was named first by greatest botanist Carlyon Linnaeus. *Jatropha* belongs to the family Euphorbiaceae, is a medium, soft wooded, deciduous multipurpose tree of 4-7 meter in height and grows in tropical and sub-tropical climates across the developing world. Plant displays vigorous growth in early periods. *Jatropha* is a morphologically diverse genus that comprises of 470 species (Paramathma *et al.*, 2004). It is used in contour planting to prevent soil erosion or to rehabilitate eroded watersheds. Globally *Jatropha* is a large possible source of biofuel. Mustard (*Brassica juncea* L.) is the major Rabi oilseed crop of India, occupying a prominent place being next in importance to groundnut, both in area and production. The oil content of mustard seed ranges from 30 - 47 % and 20 - 40 % protein. The seed and oil are used as condiment in the preparation of pickles and for flavoring curries and

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vegetables. The oil is utilized for human consumption throughout northern India in cooking and frying purposes. The oil cake is used as feed and manure. Organic manures generally improves the soil physical and biological properties along with conserving the moisture holding capacity of soil and thus resulting in enhanced crop productivity Organic manures like farmyard manure, Vermicompost and poultry manure are good source of nutrients required by plants for quality produce. It contains stable organic matter of up to 60%. Vermicompost helps to improve plants health, acts preventively against fungal diseases; scientific research conducted on the effects of Vermicompost has found 30-50% increase in nitrogen uptake, increase in root length, root numbers and shoot length. Organic farming is an eco-friendly system of farming which can maintain the soil fertility and productivity Repeated studies and observation have found that organic farming can withstand severe weather conditions better than conventional farming. However organic farms yields on average 10-15% less than conventional farming system, but the lower yields are balanced by the lower input cost such as fertilizer and pesticides etc. and higher profit margin.

Materials and Methods

The field experiment was conducted during Rabi season of 2017-18 at Nursery area, College of Forestry SHUATS, Allahabad is at an elevation of 98m above sea level at 28.87° N latitude and 81.15° E longitude. All the required materials and facilities necessary for the cultivation are readily available in the Dept. Allahabad has sub-tropical climate with extremes of During the winter months especially December and march, temp 3-5°C, The annual rainfall is 1100mm, mostly during the winter months. The physio-chemical status of the surface soil (0-18cm) of the experimental site of the Agroforestry system under sand 70.4%, silt 12.0%, clay 17.6%, soil: Sandy Loam. Organic carbon:17%, Nitrogen (N):43kg/ha, Phosphorus (P): 14.6 kg/ha, Potash (K): 24.5 kg/ha, Soil pH:7.6, EC (dSm-1):0.17, Methods employed Walkely and Black (1934). Recommended dose of fertilizer (80 kg N + 40 kg P₂O₅ + 40 kg K₂O/ha) Organic manures: Farm yard manure 8 t ha⁻¹, Vermicompost 4 t ha⁻¹, Poultry manure 3 t ha⁻¹. The field experiment was laid out in RBD (randomized block design) with three replications. The experiment comprised 9 treatment combinations consisting of three levels of Organic manure (FYM 8 t/ha, PM 3t/h, VC 4 t/h). Mustard was grown within the alleys of 6 year old Jatropha plantation. The Jatropha trees were boundary

planting. Mustard was sowing at 45X15 cm between the spacing the plants between the Jatropha trees. There were a total of 9 rows of mustard within the alley of two rows of Jatropha, the gross area 193.6 and net plot area 108 sizes was 2 x 2 m respectively. The distance between the mustard and Jatropha row was 1 m on both sides. Organic manure was applied as per treatments 5 days before sowing respectively. FYM 8t/h, Vermicompost 4 t/ha, and poultry manure 3t/h elemental respectively. The recommended dose for mustard is 80N, 40P, 40K. The organic manure was applying the furrows at 5 cm below the seedling depth before sowing at the recommended seed rate Mustard was 4 to 6 kg/ha and at 2.5 cm soil depth. The seeds were covered with the soil from the other side of furrow. Periodic hand weeding was done as and when needed. Grain and stalk yields were recorded after proper sun-drying and tagged in bundles. Each bundle was weighed, threshed and cleaned separately and seed yield per plot was calculated from net plot. Grain and straw yields were recorded separately. Moisture in the seed was 10 per cent at the time of harvesting. Randomly selected 5 plants were taken from each plot for agronomic observations of yield and yield parameters. Test weight of 1000 seeds from each plot was recorded with the seed yield.

Results and Discussion

Growth attributes

The growth parameters *viz.*, plant height, dry weight accumulation and number of branches was affected significantly by different levels of Organic manures. The highest plant height (180.0 cm) at 80DAS were observed in T₅ (50% FYM + 50% VC,) followed by T₄ (100%VC). The plant height was increased by applying FYM and Vermicompost compared to other treatment because of VC helps to up take of nutrients is more than compare to other manures. Total plant dry weight was recorded significantly highest dry weight (139.83g) at 80DAS in integrated application of T₅ (50% FYM + 50% VC,). The lowest values of dry weight (110.33) were recorded at T₁ control. The maximum number of branches recorded was (7.0) at 80DAS, were observed with T₅ (50% FYM + 50% VC).The balanced nutrient application made higher nutrients available to plants resulted into more height. Plant height and branches growth and it was also supported by (Tomar *et al.* 2007 and yadav *et al.* 2013) respectively. Higher availability of essential nutrients particularly nitrogen increased the plant height, vigor, dry weight (Amit kumar *et al.*, 2007) ^[1]. Growth attributes was observed in (Table 1).

Table 1: Effect of organic manure on growth attributes of mustard (at 80 das) under Jatropha based agroforestry system.

	Treatment Combinations	Plant height (cm)	Number of branches	Dry Weight (g)
T ₁	Control	152.14	4.73	110.33
T ₂	100% FYM	179.11	6.33	132.96
T ₃	100% PM	171.49	5.73	130.90
T ₄	100% VC	178.87	6.80	137.03
T ₅	50% FYM + 50% VC	180.00	7.00	139.83
T ₆	50% FYM + 50%PM	169.27	5.53	130.00
T ₇	50% FYM +25% VC + 25% PM	169.22	5.80	126.70
T ₈	25% FYM + 50% PM+ 25% VC	169.08	5.33	128.86
T ₉	25%FYM + 25% PM + 50% VC	165.42	5.53	123.73
	F test	S	S	S
	C.D.	7.22	0.21	2.60
	SE(m)	2.39	0.06	0.86

FYM: Farm yard manure, VC: Vermicompost, PM: Poultry manure, S: Significant, NS: Non-significant

Yield attributes

All yield parameters including number of siliqua plant⁻¹, number of seeds/siliqua, test weight, seed yield (t/ha) and stalk yield, differed significantly with different nutrient management treatments. In general, the higher values of yield parameters were recorded treatment T₅ (50% FYM + 50% VC.). Number of siliqua per plant increased with fertility levels and significantly highest value was recorded (5.85) treatment T₅ was gave significantly higher number of siliqua/plant under *Jatropha* based agroforestry system, however, it remained significantly with higher value was followed by treatments T₄ (100%VC) and treatment T₁ (control) had significantly lowest number of siliqua per plant (207.80). The maximum number of seeds/siliqua (13.46) was also found in treatment T₅ was gave significantly higher value and followed treatment was 100% VC. The significantly maximum test weight (4.93g) was also found in treatment T₅

(50% FYM + 50% VC) and treatment T₁ (control) had significantly lowest test weight (3.39g) and followed higher test weight (4.91g) was found in T₄ (100% VC). The significantly maximum seed yield (1.49 t/ha) was also recorded at treatment T₅ and treatment T₁ (control) had significantly lowest seed yield (0.96 t/ha). The significantly maximum stalk yield (1.93t/ha) was recorded at treatment T₅ and treatment T₁ (control) had significantly lowest stalk yield (1.60 t/ha). The significantly maximum Harvest Index (77.20%) was recorded at treatment T₅ and significantly T₁ lowest Harvest Index (60.0%). The *Jatropha* trees gave comparatively less competition with compare to other tree species. The yield attributes was also supported by (Bhagchand kansotia *et al.*, 2013) [3]. Further, the yield parameters were significantly differed with different nutrient levels was shown in (Table 2). The yield was reduced with control organic manures *i.e.* T₁.

Table 2: The effect of organic manure on yield attributes of mustard under *Jatropha* based agroforestry system.

	Treatment Combinations	Number of Siliqua plant ⁻¹	Number of seeds Siliqua ⁻¹	Test weight (g)	Seed yield (t/ha ⁻¹)	Stalk yield (t/ha ⁻¹):	Harvest Index (HI) %
T ₁	Control	207.80	10.73	3.39	0.96	1.60	60.00
T ₂	100% FYM	261.26	11.60	4.90	1.40	1.86	75.26
T ₃	100% PM	250.93	12.13	4.66	1.12	1.78	62.92
T ₄	100% VC	267.73	12.53	4.91	1.44	1.87	77.00
T ₅	50% FYM + 50% VC	268.33	13.46	4.93	1.49	1.93	77.20
T ₆	50% FYM + 50%PM	241.53	12.13	4.42	1.31	1.81	72.37
T ₇	50% FYM +25% VC + 25% PM	237.13	12.13	4.32	1.33	1.84	72.28
T ₈	25% FYM + 50% PM+ 25% VC	257.53	11.86	4.14	1.25	1.75	71.42
T ₉	25%FYM + 25% PM + 50% VC	242.26	11.46	4.33	1.33	1.83	66.66
	F test	S	S	S	S	S	-
	C.D.	17.58	1.25	0.37	4.80	5.90	-
	SE(m)	5.81	0.41	0.12	1.59	1.95	-

Conclusion

On the basis of field experiment conducted on effect of different doses of organic manures on growth and yield of mustard under *Jatropha* based agroforestry system concluded that the treatment T₅ (50% FYM + 50% VC) was found superior among the organic manure treatment for growth and yield of mustard under *Jatropha* based agroforestry system was seen in treatment T₅ (50% FYM + 50% VC) obtaining higher seed yield 1.49 t/ha and stalk yield 1.93 t/ha, As per as economics feasibility performance is concerned treatment T₅ (50% FYM + 50% VC).

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