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Effect of different types of organic manure on the growth and yield of pea (*Pisum sativum*) under *Jatropha curcas* based agroforestry system

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Abstract
A study on the effect of different types of organic manure on the growth and yield of pea under *Jatropha curcas* based agroforestry system was conducted at Forest Nursery and Research Centre, College of Forestry, SHUATS, Allahabad, U.P. to access the potential of these different organic manure in replacing the chemical fertilizer for pea production under protection structure. The study area size was carried out in $4m^2$ with 27 sub-plots for each treatment. The total number of nine treatment and three replication were applied i.e. FYM@ 7.272 t/ha, Neem Cake @8.69 q/ha, Poultry manure @2.666 t/ha, Vermicompost @ 6.666 t/ha, Poultry Manure 50%+ Neem cake 50%, FYM 50% + Poultry manure 50%, FYM 50%+ Neem cake 50%, FYM 50% + Vermicompost 50% and control respectively by applying the Randomized Block Design (RBD) in the present study of the one year crop data trail, it was found out that the organic manure FYM had marked the influence on the growth parameter like plant height, number of branch, number of pods per plant, number of peas per pod, root length, and pod yield. The plant under FYM found out to be the most effective for the marketable yield of pea than the other treatment. The FYM treatment gives the highest marketable yield of 51.50 q /ha. So the treatment FYM emerged the best for the growth and yield attribute of pea as well as for jatropha based to suite the environmental condition of Allahabad region.

Keywords: organic manure, jatropha, pea, growth and yield

1. Introduction
India has a long tradition of agroforestry and many different types of indigenous agroforestry systems can be seen in different parts of the country, which are location-specific (Nair and Dagar, 1991). It has now been well realized that agroforestry can solve some of the major land-use problems of rain fed farming systems, and a great deal can be accomplished by improving the indigenous systems. Pea probably originated in south- western Asia, possibly north-western India, Pakistan or adjacent area of former USSR and Afghanistan and thereafter spread to the temperate zone of Europe (KAY, 1979; Makasheva, 1983). Based on genetic diversity, four centres of origin, namely. Central Asia, the Near east, Abyssinia and the Mediterranean have been recognized (Gritton, 1980). In India pea covers an area of 5.83 lakh hectares with a production of about 40 lakh tonnes. UP is the most Pea growing state; UP alone produces about 46% of total pea produced in India. According to National Horticulture Board Estimates, (NHB, 2013-14) [10]. Nutrient balance is the key component to increase crop yields. Providing of these nutrients through organics and combination with organics and inorganics has a direct impact on soil health and crop productivity (Datt *et al.* 2003 [6]. Pea is being used in a growing snack market. One snack item is prepared by soaking the pea overnight and frying them in the palm oil or coating them with other food items such as rice flour before frying for the purpose of imparting deferent flavour. Another product is prepared by finely grinding the pea and extruding them under pressure to create different shapes. The different shapes are then fried, seasoned and package (Jambunqthan *et al*., 1994). Cultivar such as 'Alaska' 'Super Alaska' Super Green and Alaska Wilt Resistant has long been the standard type of canning pea.

2. Materials and Methods
The research work was carry out at Forest nursery and Research centre, College of Forestry, Sam Higginbottom University of Agriculture, Technology and Sciences. Allahabad (U.P) during the period of November 2017 to March 2018. The experimental site (research and nursery area) is at the elevation of 98m above sea level at 28.87^{o}N and 81.15^{0}E longitude Agro climatically, Allahabad district represents the subtropical belt of the South East of Uttar Pradesh, and is endowed with extremely hot summer and fairly cold winter. The maximum temperature of the location reaches up to 46^{0}C- 48^{0}C and seldom falls as low as 4^{0}C -5^{0}C. The relative humidity ranged between 20 to 94percent. The average rainfall of this area is around 1100mm annually. The experiment was carried out in a Randomized Block Design (RBD) with four different types of organic manures and the treatment was replicated three times. Treatment doses were FYM@ 7.272 t/ha, Neem Cake @ 8.69 q/ha, Poultry manure @2.666 t/ha, Vermicompost @ 6.666 t/ha, Poultry Manure 50%+ Neem cake 50%, FYM 50% + Poultry manure 50%, FYM 50%+ Neem cake 50%, FYM 50% + Vermicompost 50% and control. During the experimentation, growth and yield were recorded.

3. Results and Discussion

3.1 Plant height (cm)

At 30 DAS, The maximum plant height was found in T_1 FYM with16.12 cm. The minimum plant height was found in T_0 Control with 14.43 cm. At 60 DAS, The maximum plant height was found out in T_1 FYM with 52.50 cm. The minimum plant height was found inT_0 control with 44.34 cm. At 90 DAS, the maximum plant height was found out in T_1 FYM with 58.15 cm. The minimum plant height was found in T_0 control 52.61 cm. similar observations have been reported by IIhe *et al.* (2007) [10]

3.2 Number of branch

At 30 DAS, The maximum number of branches was found in T_1 FYM with 6.The minimum number of branches was found in T_0 Control with 4.43.At 60 DAS, The maximum number of branches was found in T_1 FYM 11.27. The minimum numbers of branches was found in T_0 Control with 8.53. At 90 DAS, The maximum number of branches was found in T_1 FYM with 15.50. The minimum numbers of branches was found in T_0 Control with 12.80.

3.3 Days taken to flowering

The minimum days taken to flowering was observed in T_1 FYM with 54.57. The maximum days take to flowering was observed in T_o Control with 56.74 respectively.

3.4 Number of pods per plant

The maximum number of pods per plant was found in T_1 FYM with 15.21. The minimum number of pods per plant was found in T_o Control with 10.63 respectively. IIhe *et al., (2007)* [10] conducted an experiment and observed that the number of pods were higher with the application of FYM compared with the vermicompost.

3.5 Number of peas in a pod

The maximum number of peas in one pod was found out in T_1 FYM with 9.43. The minimum number of peas in pods was found out in T_0 control with 7.07.

3.6 Test weight (thousand seed)

The maximum seed test weight was found in T_1 FYM with 502.33g.The minimum seed test weight was observed in T_5 Poultry manure with 482.00 g.

3.7 Pod yield

The maximum pod yield was recorded at T_1 FYM with 51.50 q/ha. The minimum yield was found out in T_0 Control with 38.63 q/ha respectively. Baswana and Rana (2007) conducted a field experiment and observed that higher pod yield (93.96 q/ha) was recorded when farm yard Manure (1 t/ha) + Poultry manure (1 t/ha) along with mulch treatment was applied followed by manure (2 t/ha) + biofertiloizers with mulch treatment (80.60 q/ ha).

3.8 Length of roots. (cm)

The maximum root length was found out in T_1 FYM with11.18cm.The minimum length of root was found in T_0 control With 9.15 cm.

Table 1: Effect of different types of organic manure on growth and yield of pea (*Pisum sativum*) under *Jatropha curcas* based Agroforestry System" at 90 DAS

Treatments	Plant height (cm)	Number of branch	Days taken to flower	Pods per plant (no)	Peas per pod (no)	Length of root	Test weight (thousand seeds) in gram	Pods yield (q/ha)	Cost benefit ratio (C:B)
T0	52.61	12.80	56.74	10.63	7.07	9.15	487.00	38.63	1:1.80
T1	58.15	15.50	54.57	15.21	9.43	11.18	502.33	51.50	1:2.38
T2	55.07	14.57	56.50	13.13	7.53	10.03	496.33	46.04	1:2.14
T3	53.45	15.13	56.15	14.79	9.03	9.59	489.33	48.07	1:2.17
T4	53.53	14.87	54.88	12.47	8.13	9.51	500.67	44.67	1:2.08
T5	53.73	14.27	55.67	12.93	8.03	9.84	482.00	43.52	1:2.03
T6	56.05	13.00	55.14	13.40	7.87	11.13	491.33	47.47	1:2.21
T7	57.02	14.27	55.00	14.10	9.13	10	498.67	45.26	1:2.09
T8	56.71	15.13	55.10	14.84	9.03	11.01	495.33	47.59	1:2.17
Tab F	S	S	S	S	S	S	S	S	
S.E.d	0.58	0.43	0.57	0.48	0.37	0.32	0.98	0.96	
C.D (5%)	1.22	0.92	1.21	1.02	0.78	0.68	2.8	2.04	

4. Conclusion

In view of the findings and results presented above, it is concluded that among all the nine different treatments, the treatment FYM had emerge the best on the growth parameter like plant height, number of branch, number of pods per plant, number of peas per pod, root length, and pod yield. The plant under FYM found out to be the most effective for the marketable yield of pea than the other treatment. The FYM treatment gives the highest marketable yield of 51.50 q /ha. T_1 FYM emerged best for the growth and yield attributes of pea *(Pisum sativum)* and as well as for Jatropha based to suite the environmental conditions of Allahabad region.

Trials in Uttar Pradesh, India, found that pea (*Pisum sativum*) could be grown successfully between lines of Jatropha trees spaced 3.0 metres apart. The pea (*Pisum sativum*) were planted in the dry season with limited irrigation, when there was no leaf cover from the Jatropha. It was found that this system helped with weed control of the plantation and that the growth of intercropped Jatropha was better, however since this is based on one – year experiment, further trails may be needed to substantiate the results.

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