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ORIGINAL ARTICLE **OPEN ACCESS**

Effect of Organic Fertilizers on Growth and Yield of *Allium sativum* L. under *Populus deltoides* L. based Agroforestry System

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ABSTRACT

In order to studies the effect of different organic fertilizers level on the growth and yield of garlic, a field experiment was conducted at the Forest Nursery, College of Forestry, SHUATS, Prayagraj Uttar Pradesh India, during Rabi season 2019-20. Agroforestry system can be advantageous over conventional agricultural and forest production method in the aspect of production, economic benefits, socio-economic outcomes and the ecological goods and services provided. The experiment was carried out in form of randomized block design. Comprised of 9 treatments and 3 replications. For each experiment, the various treatments were distributed at random. The best combination of organic fertilizers and their effect on garlic was T_3 (100% poultry manure) having highest plant height (64.53 cm), highest leaf length (63.37 cm), highest leaf width (2.40 cm), highest Number of leaves/plant (11.83), highest Number of clove per bulb (25.09), highest bulb weight (23.24 gm.), highest bulb diameter (4.72 cm) and highest yield (12.55 t/ ha). The result obtained in this research work was found significant.

Keywords: *Allium sativum*, *Populus deltoides*, growth, yield, Poultry Manure, FYM, Vermicompost, Mustard Oil Cake.

INTRODUCTION

Agroforestry is an integrated approach using the interactive benefits from combining trees & shrubs with annual crops or livestock. Agroforestry integrates trees into farmland and rangeland and in so doing diversifies and sustains production for increase benefits for farmers and the environment (Nair, 1993). The agroforestry benefits are compatible and complimentary seek to emulate natural recycling mechanism and other ecosystem services found in forests, promote soil health and biodiversity that enhance productive capacity. Agroforestry system produces nutrients browse which can alleviate pressure on cover crops. Agroforestry system complement conservation agriculture system in the provision of soil cover, animal feed, nutrients, household fuel, hillside protection against soil erosion control through shelter belts.

Poplar (*Populus deltoides* L.) belongs to the family Salicaceae holds a place of great significance in India as they are among the most preferred tree species in the unique agroforestry systems in northern part of the country. Poplar is a large tree with a clear bole and an open spreading crown resulting in a somewhat vase like shape. Smooth bark, when young, grey to yellow-green. Twig, stout, slightly angled and yellowish; buds are 3/4 inches long and covered with several brown, resinous scales. The leaves are alternating; simple, pinnate veined, 3 to 6 inches long, triangular (deltoid) in a crenate / serrate margin

form. The petiole is smooth, and at the end of the petiole are glands. Poplar wood is primarily used for items made from engineered materials (Naithani *et al* (2001).

Garlic originated from Central Asia however the origin of the plant is difficult to trace as some believe that it originated in the southwest of Siberia, whence it spread to southern Europe. Garlic is now growing wild in most Mediterranean countries and where it has a long historical association. Characteristic for Allium species are herbaceous, perennial bulbous plants with a typical leek odour. The bulb of Garlic, *Allium sativum* L., is of a compound nature, consisting of numerous bulbets, so-called cloves, of different size, the whole surrounded by layers of white scale leaves. The ovoid cloves are 3-4 sided with an acute summit, narrowed into a thread like portion of fiber, and the base truncate. Each clove is separately enclosed in a white scale and covered with a pinkish-white skin. From the central clove, the plant shoots a quill-like, round, hollow, and unbranched stalk, which is encased at the bottom by long, narrow and flat, grass-like leaves. The whitish flowers are placed at the end of a stalk rising direct from the bulb, and grouped together in a globular head. The flowers develop numerous egg-shaped bulbils, which have an important function in the propagation of the plant (Lardo and Kreuter, 2009).

MATERIALS AND METHODS

The studies entitled "Effect of Organic Fertilizers on the Growth and Yield of Garlic (*Allium sativum* L.) Under Poplar (*Populus deltoides* L.) based Agroforestry System". The field experiment was carried out during 2019-20 at Forest Nursery, College of Forestry: Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj. The experimental research site (Research and Nursery area) situated at the forestry research farm, Department of Silviculture and Agroforestry, Sam Higginbottom University of Agricultural, Technology and Sciences, Prayagraj, 211007 (U.P.). Prayagraj is situated in the south-eastern part of Uttar Pradesh. Geographically, Allahabad is located at 25^0C 45' North latitude $81^0$85' East longitude and at an altitude of 98 m (322 ft.) above mean sea level (MSL).Prayagraj has a semi-arid climate, with both the winter and summer temperature extremes. The temperature may drop to as low as 2ºC during December-January, while it will reach 47ºC during the months of May-June. The temperature may drop to as low as 2ºC during December-January, while it will reach 47ºC during the months of May-June. The experiment with 9 treatments and 3 replications was fully carried out in Randomized Block Design (Factorial).The data were the statistical analysis according to the method of variance analysis by Fisher (1950) seeds were being sown in the poplar based agroforestry system with spacing involved plant to plant 10×10 and row to row 15×15cm.To see the performance of garlic following parameters were recorded- Plant height (cm), Leaf length (cm), Leaf width (cm), No. of leaves/plant No. of cloves per bulb, Bulb weight (gm.),Bulb diameter (cm), Yield (t ha^{-1}).

RESULTS AND DISCUSSION

Growth attributes:

Results obtained from the investigation under taken to study the effect of organic fertilizers on the growth of garlic (*Allium sativum* L.) cropT_0 (Control) plant height (58.26cm), leaf length (48.20cm),leaf width (1.01cm) and number of leaves (9.23), T_1 (Vermicompost 100%) plant height (60.70cm), leaf length (54.23cm), leaf width (1.53cm) and number of leaves (10.19), T_2 (FYM 100%) plant height (59.31cm), leaf length (50.98cm), leaf width (1.26cm) and number of leaves (9.58), T_3 (Poultry Manure 100%) plant height (64.53cm), leaf length (63.37cm), leaf width (2.40cm) and number of leaves (11.83), T_4

(Mustard Oil Cake 100%) plant height (62.78cm),leaf length (59.79cm),leaf width (2.00cm) and number of leaves (10.99), T_5 (Vermicompost 50% + Mustard Oil Cake 50%) plant height (61.47cm), leaf length (56.31cm), leaf width (1.67cm) and number of leaves (10.43), T_6 (Vermicompost 50% + FYM 50%) plant height (62.04cm), leaf length (58.36cm), leaf width (1.82cm) and number of leaves (10.66), T_7 (Poultry Manure 50% + FYM 50%) plant height (59.61cm), leaf length (52.17cm), leaf width (1.39cm) and number of leaves (9.79), T_8 (Poultry Manure 50% + Mustard Oil Cake 50%) plant height (63.12cm),leaf length (61.73cm), leaf width (2.21cm) and number of leaves (11.40), at Poplar based Agroforestry system. The result obtained in this research work was found significant.

Table 1: Effect of Organic Fertilizers on the Growth of *Allium sativum* L

Growth Attributes				
Treatments	**Plant Height (cm)**	**Leaf Length (cm)**	**Leaf Width (cm)**	**Number of Leaves**
T_0	58.26	48.20	1.01	9.23
T_1	60.70	54.23	1.53	10.19
T_2	59.31	50.98	1.26	9.58
T_3	**64.53**	**63.37**	**2.40**	**11.83**
T_4	62.78	59.79	2.00	10.99
T_5	61.47	56.31	1.67	10.43
T_6	62.04	58.36	1.82	10.66
T_7	59.61	52.17	1.39	9.79
T_8	63.12	61.73	2.21	11.40
C.D.	0.773	0.80	0.063	0.217
SE(m)	0.255	0.27	0.021	0.072
SE(d)	0.361	0.38	0.030	0.102
C.V.	0.722	0.82	2.130	1.191

YIELD ATTRIBUTES:

Effect of organic fertilizers on the yield of *Allium sativum* L. crop T_0 (Control) Number of Cloves per bulb (15.56), Bulb weight (15.07g), Bulb diameter (2.34cm) and Bulb yield (8.14t/ha), T_1 (Vermicompost 100%) Number of Cloves per bulb (18.58), Bulb weight (19.01g), Bulb diameter (3.18cm), and Bulb yield (10.26t/ha), T_2 (FYM 100%) Number of Cloves per bulb (17.01), Bulb weight (17.17g), Bulb diameter (2.72cm), and Bulb yield (9.27t/ha), T_3 (Poultry Manure 100%) Number of Cloves per bulb (25.09), Bulb weight (23.24g), Bulb diameter (4.72cm), and Bulb yield (12.55t/ha), T_4 (Mustard Oil Cake 100%), Number of Cloves per bulb (21.2), Bulb weight (21.61g), Bulb diameter (4.08cm), and Bulb yield (11.67t/ha),T_5 (Vermicompost 50%+Mustard Oil Cake 50%) Number of Cloves per bulb (19.17), Bulb weight (19.99g), Bulb diameter (3.46cm), and Bulb yield (10.80t/ha), T6 (Vermicompost 50%+FYM 50%) Number of Cloves per bulb (20.14), Bulb weight (21.01g), Bulb diameter

(3.70cm), and Bulb yield (11.34t/ha), T_7 (Poultry Manure 50%+FYM 50%) Number of Cloves per bulb (18.04), Bulb weight (18.22g), Bulb diameter (2.94cm), and Bulb yield (9.84t/ha), T_8 (Poultry Manure 50%+Mustard Oil Cake 50%) Number of Cloves per bulb (22.94), Bulb weight (22.64g), Bulb diameter (4.32cm), and Bulb yield (12.23t/ha) at Poplar based Agroforestry system. The result obtained in this research work was found significant.

Table 2: Effect of Organic Fertilizers on the Yield of *Allium sativum*

	Yield Attributes			
Treatments	**Number of cloves per bulb**	**Bulb weight (g)**	**Bulb diameter (cm)**	**Bulb yield (t/ha)**
T_0	15.56	15.07	2.34	8.14
T_1	18.58	19.01	3.18	10.26
T_2	17.01	17.17	2.72	9.27
T_3	**25.09**	**23.24**	**4.72**	**12.55**
T_4	21.02	21.61	4.08	11.67
T_5	19.17	19.99	3.46	10.80
T_6	20.14	21.01	3.70	11.34
T_7	18.04	18.22	2.94	9.84
T_8	22.94	22.64	4.32	12.23
C.D.	0.674	0.548	0.374	0.318
SE(m)	0.223	0.181	0.124	0.105
SE(d)	0.315	0.256	0.175	0.149
C.V.	1.956	1.587	6.133	1.707

CONCLUSION

Based on the field experiment conducted, It is concluded that the best combination of organic fertilizers and their effect on Garlic was T_3 (100% poultry manure) during Rabi season in Prayagraj. For growth and yield parameters of garlic in treatment T_3 (Poultry manure 100%), highest plant height 64.53cm and highest seed yield 12.55t/h and minimum in T_0 (Control) plant height 58.26cm and seed yield 8.14t/h respectively.

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