## (II)

## EFFECT OF INORGANIC NUTRIENTS AND FARM YARD MANURE ON GROWTH OF JATROPHA (*JATROPHA CURCAS*) IN NURSERY

The sharp increase in the prices of petroleum products, the finite nature of fossil fuels, growing danger of environmental pollution from such fuels thereby causing innumerable health hazards have forced the search for alternative fuels. Use of food crops such as corn, rapeseed, sugarcane, etc. for production of biofuels by developed countries might endanger the food security of the world (Anon., 2008). Therefore, attempts have been made to use the non-edible oil yielding plants, such as Jatropha (*Jatropha curcas*) for generating substitute of diesel. As India is deficient in edible oils, so the use of the non-edible oil is the main choice for production of such biodiesel. On the other hand, India has a vast tract of marginal and wastelands. The production potential of these lands can be enhanced by planting Jatropha and other oil bearing tree plants. However, the healthy and quality planting material is still a major dificiency in the production of high yielding Jatropha plantations. A study was, therefore conducted to observe the effect of three major essential elements (N, P and K) with and without organic manure on the growth of Jatropha in nursery, so that healthy and vigorous planting stock can be produced.

The study was conducted in the research area of the Department of Forestry and Natural Resources, Punjab Agricultural University, Ludhiana. Depthwise basic physico-chemical properties of the site viz. soil texture, pH, electrical conductivity (EC), organic carbon (OC), available P and available K were determined. The pH and EC were determined in the soil: water ratio of 1:2, OC by Wet digestion method, available P by Olsen method and available K by Ammonium acetate extraction method (Jackson, 1973). Depthwise texture of the soil varied from loamy sand to sandy loam (Table 1). The pH of the soil varied from 8.2 to 8.3 and EC from 0.24 to 0.34 dS/m. The OC content varied from low to medium (0.32 to 0.44%) and available P from low to high (10.3 to 24.4 kg/ha). The available K content varied from 124 to 281 kg/ha, which is in medium to high range. Various combinations of nitrogen, phosphorus and potassium with and without farmyard manure were tested. These combinations were :

$T_1$: Control,
$T_2$: 37.5-25-6.25 kg/ha N-$P_2O_5$-$K_2O$,
$T_3$: 37.5-25-6.25 kg/ha N-$P_2O_5$-$K_2O$+5 t/ha FYM,
$T_4$: 75-50-12.5 kg/ha N-$P_2O_5$-$K_2O$,
$T_5$: 75-50-12.5 kg/ha N-$P_2O_5$-$K_2O$+5 t/ha FYM,
$T_6$: 112.5-75-18.75 kg/ha N-$P_2O_5$-$K_2O$,
$T_7$: 112.5-75-18.75 kg/ha N-$P_2O_5$-$K_2O$+5 t/ha FYM,
$T_8$: 150-100-25 kg/ha N-$P_2O_5$-$K_2O$,
$T_9$: 150-100-25 kg/ha N-$P_2O_5$-$K_2O$+5 t/ha FYM.

The N, P and K were applied as urea (46% N), single super phosphate (SSP, 16%

**Table 1**

*Soil texture, pH, EC, OC and available P and K in the soil profile*

| Depth (cm) | Soil Texture | pH | EC (dS/m) | OC (%) | Avail. P (kg/ha) | Avail. K (kg/ha) |
|---|---|---|---|---|---|---|
| 0-15 | Sandy loam | 8.2 | 0.24 | 0.44 | 17.5 | 208 |
| 15-30 | Sandy loam | 8.3 | 0.27 | 0.40 | 16.2 | 274 |
| 30-45 | Loamy sand | 8.2 | 0.34 | 0.35 | 10.3 | 124 |
| 45-60 | Sandy loam | 8.3 | 0.25 | 0.42 | 24.4 | 268 |
| 60-90 | Sandy loam | 8.2 | 0.26 | 0.32 | 12.3 | 281 |

$P_2O_5$) and muriate of potash (MOP, 60% $K_2O$), respectively. Half nitrogen and full P and K were applied after one month of planting of cuttings when they were fully established and the remaining half after one and half month of the first split. The entire amount of FYM was applied before planting the cuttings. Thirty cm long cuttings of Jatropha were planted at a spacing of 50 x 50 cm, keeping half of the length of cutting in soil and the other half above ground surface. The experiment was established in randomized block design with a plot size of 36 cuttings/plot and three replications. The collar diameter and height of main stem of Jatropha plants were measured after 5 months of planting. These parameters were statistically analysed and compared amongst different treatments.

Table 2 indicates a significant influence of application of inorganic fertilizers and farm yard manure on the growth parameters. Treatment $T_2$ produced significantly more height (1.32 m) over control $T_1$ (1.11 m) which enhanced further significantly at $T_4$ (1.49 m) due to inorganic fertilizers. However, the application of farmyard manure along with the inorganic fertilizers i.e.$T_5$ (75-50-12.5 kg/ha N-$P_2O_5$-$K_2O$ + 5 t/ha FYM) produced the maximum height (1.61 m) of Jatropha. Similar were the results in case of collar diameter of the main stem, where $T_2$ produced significantly higher diameter (2.95 cm) over control $T_1$ (2.41 cm). The maximum collar diameter (3.39 cm) of the main stem was produced at $T_5$ (75-50-12.5 kg/ha N-$P_2O_5$-$K_2O$ + 5 t/ha FYM). The increase in growth of plants due to application of nutrients is obvious as the applied nutrients (N, P and K) are the three major essential elements required by plants for manufacturing of metabolically active compounds such as amino acids, proteins, enzymes, etc.; for formation of cell membranes, chloroplasts, sugar phosphates and stimulating root growth, and for maintenance of cellular organs and imparting resistance to plants against diseases, respectively. Similar findings were recorded by Prasad *et al.* (1990) in bamboo; Kaul *et al.* (1995) in *Bauhinia variegata*; Singh (2001) in Poplar (*Populus deltoides*) and Patil *et al.* (2006) in Jatropha seedlings. The increase in growth of plants with the application of farm yard manure along with inorganic fertilizers may be attributed to a slow release of macro as well as micro-nutrients from farm yard manure. Besides,

**Table 2**

*Effect of fertilizer treatments on growth parameters of Jatropha in nursery*

| Treatments | Height (m) | Collar dia. (cm) |
|---|---|---|
| $T_1$ (Control) | 1.11 | 2.41 |
| $T_2$ (37.5-25-6.25 kg/ha N-$P_2O_5$-$K_2O$) | 1.32 | 2.95 |
| $T_3$ (37.5-25-6.25 kg/ha N-$P_2O_5$-$K_2O$ + 5 t/ha FYM) | 1.39 | 3.07 |
| $T_4$ (75-50-12.5 kg/ha N-$P_2O_5$-$K_2O$) | 1.49 | 3.36 |
| $T_5$ (75-50-12.5 kg/ha N-$P_2O_5$-$K_2O$ + 5 t/ha FYM) | 1.61 | 3.39 |
| $T_6$ (112.5-75-18.75 kg/ha N-$P_2O_5$-$K_2O$) | 1.56 | 3.29 |
| $T_7$ (112.5-75-18.75 kg/ha N-$P_2O_5$-$K_2O$ + 5 t/ha FYM) | 1.60 | 3.35 |
| $T_8$ (150-100-25 kg/ha N-$P_2O_5$-$K_2O$) | 1.55 | 3.30 |
| $T_9$ (150-100-25 kg/ha N-$P_2O_5$-$K_2O$ + 5 t/ha FYM) | 1.53 | 3.27 |
| CD (P=0.05) | 0.21 | 0.49 |
| CV (%) | 8.91 | 9.61 |

application of organic manure to the soil improves the physical properties (like water holding capacity, bulk density, soil structure, etc.) of the soil and influences the plant growth positively. Significant effect of inorganic nutrients and organic manure on the growth of seedlings of *Acacia nilotica* and *Albizia procera* has been reported by Singh *et al.* (1995) and Deswal *et al.* (2001), respectively.

Further increase in the dose of inorganic nutrients with and without farm yard manure did not increase the growth of plants significantly. This might be attributed to accomplishment of nutrient requirement of plants as the organic carbon and available P of upper two soil layers (0-15 and 15-30 cm) were medium in their status (Table 1) and major mass of root system concentrates in these layers (Singh, 1994). Moreover, the site has loamy sand to sandy loam texture where the availability of applied nutrients is not hampered and plants can take up those nutrient elements from the applied inorganic fertilizers and farm yard manure.

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