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Effect of FYM and micronutrient for plant growth and development of litchi (Litchi chine sis Sonn.)

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Abstract
The present investigation entailed "Effect of FYM and micronutrient for plant growth and development of litchi (Litchi chine sis Sonn.)" was conducted during season, 2018-2020 at the under Prayagraj agro climatic conditions at the Horticulture Research Farm, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Science and Technology, Prayagraj in randomized block design with 9 treatments in 3 replications and variety Purvi. Various doses of FYM and micro nutrients (T_1 F.Y.M 1.0 Kg + 0.2% Zinc sulfate, T_2 F.Y.M 1.0 Kg + 0.2% Boron,T_3 F.Y.M 1.0 Kg + 0.2% Ferrous sulfate, T_4 F.Y.M 1.0 Kg + 0.2% Boron + 0.2% Copper sulfate, T_5 F.Y.M 1.0 Kg + 0.2% Zinc sulfate + 0.1% Boron, T_6 F.Y.M 1.0 Kg + 0.2% Boron + 0.1% Zinc sulfate, T_7 F.Y.M 1.0 Kg + 0.2 Zinc sulfate + 0.1% Ferrous sulfate, T_8 F.Y.M 1.0 Kg + 0.1 Zinc sulfate + + 0.2% Ferrous sulfate, T_9 F.Y.M 1.0 Kg +0.2% Copper sulfate +0.1% Boron) were taken along with untreated control. Broadcasting was done at different days. Observations were recorded at 30, 60, 90, 120, 150 and 180 DAS. Vegetative growth parameters like Plant height (cm), Plant spread (cm) per plant, Numbers of leaves per plant, No. of Branch per plant, Stem girth (cm), Leaf area (cm^2). Broadcasting of different doses of FYM and micro nutrients influenced on all characters of litchi.

Keywords: litchi, micronutrient, Fym, plant growth

Introduction
The Litchi (*Litchi Chinese* L) is an important subtropical evergreen fruit crop grow nine the foothills of Himachal Pradesh. It belongs to the family Sapindaceae and 2n-30, is believed to have originated from Southern China particularly the province of Kwan tong. It is highly specific to climatic requirements and due to this reason its cultivation is restricted to few countries in the world. India is the second largest producer of litchi in the world after china, among fruit crops, litchi rank seven thin areas and ninth in production. Litchi was introduced the 18^{Th} century through Burma and from there, it spread to many countries. India and China account for 91 per cent of the world litchi production, but it is mainly marketed locally. In India total area covered by fruit crop is 6.53 M ha, production is 96.75million metric ton and per unit area production of fruit crop is 11.6 MT/ha (Indian Horticos-2018-19) In India, litchi fruit crop covered area is 0.09Mha, production is 0.71 million metric ton and productivity of litchi crop is 7.0 MT/ha (Indian Horticos-2018-19) and in Himachal Pradesh area under litchi cultivation is 3,362 hectare the production of3, 702MT (Anonymous, 2016). In India, litchi is successfully grown in Assam, Bihar, Orissa, and West Bengal, Tripura, Punjab Uttaranchal, Himachal Pradesh and Chhota Nagpur belts of the country. Bihar is the leading producer in litchi and accounts for the 74 per cent production of the country. The probable reasons for low yield are the narrow genetic base of the crop, non availability of superior cultivars, traditional production systems, poor technological support and high incidence of insect pests coupled with poor post-harvest management practices. Litchi being a non-climacteric fruit, does not improve in quality after harvesting, but has to ripen on the tree. It is a fruit with sweet, translucent and juicy flesh. Sugar content in different cultivars ranges from 6.74 to 18.86 per cent. Besides sugar, litchi contains (0.8-0.9%) protein, 0.3% fat, 0.7% minerals and vitamin C (40-60 mg/100g pulp). Which is immediately beneath the skin? Flavour of the aril varies with cultivar, which is distinctive. Seeds are bold but in some cultivars seeds are partially developed, due to failure of pollination, referred to as 'chicken-tongue' seed. The trees with small seeded fruits are prized because of the greater portion of pulp. Relative ratios between these sugars may be different in various cultivars, stage of maturity and invert's activity (Kumar, 2014). Micronutrients plays specific role in improving the growth, yield and quality of litchi even through these elements are needed in small quantities. Zinc is essential required for growth and development in litchi and is involved in diverse range of enzyme system.

The functional role of zinc includes auxin meta bolism, influence on activating enzyme synthesis and stability of ribosomal fractions (Tisdale *et al*, 1985).

Material and Methods

The present investigation entailed "Effect of FYM and micro nutrients on growth, and development of Litchi (Litchi chine sis Sonn.)" was carried out under Prayagraj agro climatic conditions at the Horticulture Research Farm, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Science and Technology, Prayagraj. The experimental site is situated between latitude 25º57' North and longitude of 80º 5' east and at an altitude of 98 meters above mean sea level (MSL). The experimental land is situated in the river basin of the Ganga and the Yamuna. The experiment was conducted in Randomized Block Design having 9 treatments in 3 replications. The allocation of the different treatments of the individual newly growth litchi planted plots of field using random number in each replication. The treatments were using for measuring the effect of FYM and micronutrient, treatment viz, T_0 (control), T_1 (F.Y.M 1.0 Kg + 0.2% Zinc sulfate), T_2 (F.Y.M 1.0 Kg + 0.2% Boron), T_3 (F.Y.M 1.0 Kg + 0.2% Ferrous sulfate), T_4 (F.Y.M 1.0 Kg + 0.2% Boron + 0.2% Copper sulfate), T_5 (F.Y.M 1.0 Kg + 0.2% Zinc sulfate + 0.1% Boron), T_6 (F.Y.M 1.0 Kg + 0.2% Boron + 0.1% Zinc sulfate), T_7 (F.Y.M 1.0 Kg + 0.2 Zinc sulfate + 0.1% Ferrous sulfate), T_8 (F.Y.M 1.0 Kg + 0.1 Zinc sulfate + + 0.2% Ferrous sulfate), T_9 (F.Y.M 1.0 Kg +0.2% Copper sulfate +0.1% Boron). To keep experimental plot free from the weed manually hand weeding should be done and for the control of insect and pest using chlorpyriphos 2ml/ltt. The observation were recorded Plant height (cm), plant spread (cm^2 per plant), Numbers of leaves per plant, No. of Branch per plant, Stem girth (cm) at 30, 60, 90, 120, 150 and 180 DAS, Leaf area (cm^2).

Result and Discussion

The maximum plant height was recorded from 30th day T_9:FYM1.0kg+0.2% Copper sulfate +0.1% Boron (93.86cm) followed by T5:FYM1.0kg+0.2% Zinc sulfate+ 0.1% Boran, T6:FYM1.0kg+0.2% Boron+0.1% Zinc sulfate, T7:FYM1.0kg+0.2%Zinc sulfate+0.1% Ferrous sulfate and T4:FYM1.0kg+0.2% Copper sulfate. However minimum plant height was recorded T_0 control (77.77 cm). At 60th day T_9:FYM1.0kg+0.2% Copper sulfate +0.1% Boron (99.73cm) followed byT_7:FYM1.0kg+0.2%Zinc sulfate+0.1% Ferrous sulfate, T6:FYM1.0kg+0.2% Boron+0.1% Zinc sulfate and T_8:FYM1.0kg+0.2% Ferrous sulfate +0.1% Zinc sulfate. However minimum plant height was recorded T_0 control (88.47cm). At 90th day T_9:FYM1.0kg+0.2% Copper sulfate +0.1% Boron (106.96cm) followed byT_8:FYM1.0kg+0.2% Ferrous sulfate +0.1% Zinc sulfate, T5:FYM1.0kg+0.2% Zinc sulfate+ 0.1% Boron and T_3:FYM1.0kg+0.2% Ferrous sulfate. However minimum plant height was recorded T_0 control (98.44). At 120th day T_9:FYM1.0kg+0.2% Copper sulfate +0.1% Boron (117.13cm) followed byT_7:FYM1.0kg+0.2%Zinc sulfate+0.1% Ferrous sulfate.T_6:FYM1.0kg+0.2% Boron+0.1% Zinc sulfate and T8:FYM1.0kg+0.2% Ferrous sulfate +0.1% Zinc sulfate. However minimum plant height was recorded T_0 control (107.38). At 150th day T_9:FYM1.0kg+0.2% Copper sulfate +0.1% Boron (130.46cm) followed byT_7:FYM1.0kg+0.2%Zinc sulfate+0.1% Ferrous sulfate.T_6:FYM1.0kg+0.2% Boron+0.1% Zinc sulfate and T8:FYM1.0kg+0.2% Ferrous sulfate +0.1% Zinc sulfate. However minimum plant height was recorded T_0 control (115.58). maximum plant canopy was recorded for 30th day T_9:FYM1.0kg+0.2% Copper sulfate +0.1% Boron (44.39cm) followed by T_4:FYM1.0kg+0.2% Copper sulfate, T2: FYM+1.0kg+0.2% Boron, T3:FYM1.0kg+0.2% Ferrous sulfate and T8:FYM1.0kg+0.2% Ferrous sulfate +0.1% Zinc sulfate. However minimum plant height was recorded T_0 control (26.33 cm).

At 60th day T_9:FYM1.0kg+0.2% Copper sulfate +0.1% Boron (46.76cm) followed byT_4:FYM1.0kg+0.2% Copper sulfate, T2: FYM+1.0kg+0.2% Boron, T3:FYM1.0kg+0.2% Ferrous sulfate, T8:FYM1.0kg+0.2% Ferrous sulfate +0.1% Zinc sulfate and T7:FYM1.0kg+0.2%Zinc sulfate+0.1% Ferrous sulfate. However minimum plant canopy (cm) was recorded T_0 control (28.42cm). At 90th day T_9:FYM1.0kg+0.2% Copper sulfate +0.1% Boron (48.57) followed byT_4:FYM1.0kg+0.2% Copper sulfate, T7:FYM1.0kg+0.2%Zinc sulfate+0.1% Ferrous sulfate, T8:FYM1.0kg+0.2% Ferrous sulfate +0.1% Zinc sulfate and T_2: FYM+1.0kg+0.2% Boron. However minimum plant canopy (cm) was recorded T_0 control (31.16). At 120th day T_9:FYM1.0kg+0.2% Copper sulfate +0.1% Boron (53.11cm) followed byT_4:FYM1.0kg+0.2% Copper sulfate, T7:FYM1.0kg+0.2%Zinc sulfate+0.1% Ferrous sulfate, T8:FYM1.0kg+0.2% Ferrous sulfate +0.1% Zinc sulfate, T2: FYM+1.0kg+0.2% Boron and T3:FYM1.0kg+0.2% Ferrous sulfate. However minimum plant canopy (cm) was recorded T_0 control (37.49). At 150th day T_9:FYM1.0kg+0.2% Copper sulfate +0.1% Boron (56.54cm) followed byT_4:FYM1.0kg+0.2% Copper sulfate, T7:FYM1.0kg+0.2%Zinc sulfate+0.1% Ferrous sulfate, T8:FYM1.0kg+0.2% Ferrous sulfate +0.1% Zinc sulfate, T_2: FYM+1.0kg+0.2% Boron and T3:FYM1.0kg+0.2% Ferrous sulfate. However minimum plant canopy (cm) was recorded T_0 control (40.49). maximum stem diameter (cm) was recorded for 30th day T_9:FYM1.0kg+0.2% Copper sulfate +0.1% Boron (2.08) followed by T_8:FYM1.0kg+0.2% Ferrous sulfate +0.1% Zinc sulfate,T_2:FYM+1.0kg+0.2% Boron, T_1:FYM+1.0kg +0.2% Zinc sulfate, T_6:FYM1.0kg+0.2% Boron+0.1% Zinc sulfate and T_7:FYM1.0kg+0.2%Zinc sulfate+0.1% Ferrous sulfate. However minimum stem diameter (cm) was recorded T_0 control (1.47). At 60th day T_9:FYM1.0kg+0.2% Copper sulfate +0.1% Boron (2.21) followed byT_8:FYM1.0kg+0.2% Ferrous sulfate +0.1% Zinc sulfate, T6:FYM1.0kg+0.2% Boron+0.1% Zinc sulfate, T5:FYM1.0kg+0.2% Zinc sulfate+ 0.1% Boron and T3:FYM1.0kg+0.2% Ferrous sulfate. However minimum stem diameter (cm) was recorded T_0 control (1.62cm). At 90th day T_3:FYM1.0kg+0.2% Ferrous sulfate (2.44) followed byT_9:FYM1.0kg+0.2% Copper sulfate +0.1% Boron, T6:FYM1.0kg+0.2% Boron+0.1% Zinc sulfate, T2: FYM+1.0kg+0.2% Boron and T7:FYM1.0kg+0.2%Zinc sulfate+0.1% Ferrous sulfate. However minimum stem diameter (cm) was recorded T_0 control (1.94). At 120th day T_9:FYM1.0kg+0.2% Copper sulfate +0.1% Boron (2.47cm) followed byT_3:FYM1.0kg+0.2% Ferrous sulfate, T5:FYM1.0kg+0.2% Zinc sulfate+ 0.1% Boron and T6:FYM1.0kg+0.2% Boron+0.1% Zinc sulfate. However minimum stem diameter (cm) was recorded T_0 control (2.01). At 150th day T_9:FYM1.0kg+0.2% Copper sulfate +0.1% Boron (2.51) followed byT_3:FYM1.0kg+0.2% Ferrous sulfate, T5:FYM1.0kg+0.2% Zinc sulfate+ 0.1% Boron, T_6:FYM1.0kg+0.2% Boron+0.1% Zinc sulfate, T8:FYM1.0kg+0.2% Ferrous sulfate +0.1% Zinc sulfate and T2: FYM+1.0kg+0.2% Boron. However minimum stem

diameter (cm) was recorded T_0 control (2.06). maximum number of leaves plant^{-1} was recorded for 30th day T_9:FYM1.0kg+0.2% Copper sulfate +0.1% Boron (125.49) followed by T_8:FYM1.0kg+0.2% Ferrous sulfate +0.1% Zinc sulfate,T_2:FYM+1.0kg+0.2% Boron, T_1:FYM+1.0kg +0.2% Zinc sulfate, T_6:FYM1.0kg+0.2% Boron+0.1% Zinc sulfate and T_7:FYM1.0kg+0.2%Zinc sulfate+0.1% Ferrous sulfate. However minimum number of leaves plant^{-1} was recorded T_0 control (96.07). At 60th day T_9:FYM1.0kg+0.2% Copper sulfate +0.1% Boron (142.06) followed byT_8:FYM1.0kg+0.2%Ferrous sulfate +0.1% Zinc sulfate, T6:FYM1.0kg+0.2% Boron+0.1% Zinc sulfate, T5:FYM1.0kg+0.2% Zinc sulfate+ 0.1% Boron and T3:FYM1.0kg+0.2% Ferrous sulfate. However minimum number of leaves plant^{-1} was recorded T_0 control (115.89). At 90th day T_9:FYM1.0kg+0.2% Copper sulfate +0.1% Boron (160.54) followed byT_9:FYM1.0kg+0.2% Copper sulfate +0.1% Boron, T6:FYM1.0kg+0.2% Boron+0.1% Zinc sulfate, T2: FYM+1.0kg+0.2% Boron and T7:FYM1.0kg+0.2%Zinc sulfate+0.1% Ferrous sulfate. However minimum number of leaves plant^{-1} was recorded T_0 control (130.59). At 120th day T_9:FYM1.0kg+0.2% Copper sulfate +0.1% Boron (182.95) followed byT_3:FYM1.0kg+0.2% Ferrous sulfate, T5:FYM1.0kg+0.2% Zinc sulfate+ 0.1% Boron and T6:FYM1.0kg+0.2% Boron+0.1% Zinc sulfate. However minimum number of leaves plant^{-1} was recorded T_0 control (150.14). At 150th day T_9:FYM1.0kg+0.2% Copper sulfate +0.1% Boron (183.55) followed byT_3:FYM1.0kg+0.2% Ferrous sulfate, T5:FYM1.0kg+0.2% Zinc sulfate+ 0.1% Boron, T_6:FYM1.0kg+0.2% Boron+0.1% Zinc sulfate, T8:FYM1.0kg+0.2% Ferrous sulfate +0.1% Zinc sulfate and T2: FYM+1.0kg+0.2% Boron. However minimum number of leaves plant^{-1} was recorded T_0 control (228.81). maximum Leaf area (cm) was recorded for 30th day T_9:FYM1.0kg+0.2% Copper sulfate +0.1% Boron (25.38) followed by T_1:FYM+1.0kg +0.2% Zinc sulfate, T_2:FYM+1.0kg+0.2% Boron, T_3:FYM1.0kg+0.2% Ferrous sulfate, T_4:FYM1.0kg+0.2% Copper sulfate, T_5:FYM1.0kg+0.2% Zinc sulfate+ 0.1% Boron, T_6:FYM1.0kg+0.2% Boron+0.1% Zinc sulfate, T_7:FYM1.0kg+0.2%Zinc sulfate+0.1% Ferrous sulfate and T_8:FYM1.0kg+0.2% Ferrous sulfate +0.1% Zinc sulfate. However minimum Leaf area (cm) was recorded T_0 control (20.17). At 60th day T_9:FYM1.0kg+0.2% Copper sulfate +0.1% Boron (25.76) followed byT_1:FYM+1.0kg +0.2% Zinc sulfate, T_2:FYM+1.0kg+0.2% Boron, T_3:FYM1.0kg+0.2% Ferrous sulfate, T_4:FYM1.0kg+0.2% Copper sulfate, T_5:FYM1.0kg+0.2% Zinc sulfate+ 0.1% Boron, T_6:FYM1.0kg+0.2% Boron+0.1% Zinc sulfate, T_7:FYM1.0kg+0.2%Zinc sulfate+0.1% Ferrous sulfate and T_8:FYM1.0kg+0.2% Ferrous sulfate +0.1% Zinc sulfate. However minimum Leaf area (cm) was recorded T_0 control (20.70). At 90th day T_9:FYM1.0kg+0.2% Copper sulfate +0.1% Boron (26.52) followed T_1:FYM+1.0kg +0.2% Zinc sulfate, T_2:FYM+1.0kg+0.2% Boron, T_3:FYM1.0kg+0.2% Ferrous sulfate, T_4:FYM1.0kg+0.2% Copper sulfate, T_5:FYM1.0kg+0.2% Zinc sulfate+ 0.1% Boron, T_6:FYM1.0kg+0.2% Boron+0.1% Zinc sulfate, T_7:FYM1.0kg+0.2%Zinc sulfate+0.1% Ferrous sulfate and T_8:FYM1.0kg+0.2% Ferrous sulfate +0.1% Zinc sulfate. However minimum Leaf area (cm) was recorded T_0 control (26.52). At 120th day T_9:FYM1.0kg+0.2% Copper sulfate +0.1% Boron (27.36) followed byT_1:FYM+1.0kg +0.2% Zinc sulfate, T_2:FYM+1.0kg+0.2% Boron, T_3:FYM1.0kg+0.2% Ferrous sulfate, T_4:FYM1.0kg+0.2% Copper sulfate, T_5:FYM1.0kg+0.2% Zinc sulfate+ 0.1% Boron, T_6:FYM1.0kg+0.2% Boron+0.1% Zinc sulfate, T_7:FYM1.0kg+0.2%Zinc sulfate+0.1% Ferrous sulfate and T_8:FYM1.0kg+0.2% Ferrous sulfate +0.1% Zinc sulfate. However minimum Leaf area (cm) was recorded T_0 control (22.36). At 150th day T_9:FYM1.0kg+0.2% Copper sulfate +0.1% Boron (28.73) followed byT_1:FYM+1.0kg +0.2% Zinc sulfate, T_2:FYM+1.0kg+0.2% Boron, T_3:FYM1.0kg+0.2% Ferrous sulfate, T_4:FYM1.0kg+0.2% Copper sulfate, T_5:FYM1.0kg+0.2% Zinc sulfate+ 0.1% Boron, T_6:FYM1.0kg+0.2% Boron+0.1% Zinc sulfate, T_7:FYM1.0kg+0.2%Zinc sulfate+0.1% Ferrous sulfate and T_8:FYM1.0kg+0.2% Ferrous sulfate +0.1% Zinc sulfate. However minimum Leaf area (cm) was recorded T_0 control (23.20). maximum number of branches per plant was recorded for 30th day T_9:FYM1.0kg+0.2% Copper sulfate +0.1% Boron (6.15) followed byT_1:FYM+1.0kg +0.2% Zinc sulfate, T_2:FYM+1.0kg+0.2% Boron, T_3:FYM1.0kg+0.2% Ferrous sulfate, T_4:FYM1.0kg+0.2% Copper sulfate, T_5:FYM1.0kg+0.2% Zinc sulfate+ 0.1% Boran, T_6:FYM1.0kg+0.2% Boron+0.1% Zinc sulfate, T_7:FYM1.0kg+0.2%Zinc sulfate+0.1% Ferrous sulfate and T_8:FYM1.0kg+0.2% Ferrous sulfate +0.1% Zinc sulfate. However minimum number of branches per plant was recorded T_0 control (4.41). At 60th day T_9:FYM1.0kg+0.2% Copper sulfate +0.1% Boron (5.84) followed byT_1:FYM+1.0kg +0.2% Zinc sulfate, T_2:FYM+1.0kg+0.2% Boron, T_3:FYM1.0kg+0.2% Ferrous sulfate, T_4:FYM1.0kg+0.2% Copper sulfate, T_5:FYM1.0kg+0.2% Zinc sulfate+ 0.1% Boran, T_6:FYM1.0kg+0.2% Boron+0.1% Zinc sulfate, T_7:FYM1.0kg+0.2%Zinc sulfate+0.1% Ferrous sulfate and T_8:FYM1.0kg+0.2% Ferrous sulfate +0.1% Zinc sulfate. However minimum number of branches per plant was recorded T_0 control (7.96). At 90th day T_9:FYM1.0kg+0.2% Copper sulfate +0.1% Boron (9.32) followed T_1:FYM+1.0kg +0.2% Zinc sulfate, T_2:FYM+1.0kg+0.2% Boron, T_3:FYM1.0kg+0.2% Ferrous sulfate, T_4:FYM1.0kg+0.2% Copper sulfate, T_5:FYM1.0kg+0.2% Zinc sulfate+ 0.1% Boran, T_6:FYM1.0kg+0.2% Boron+0.1% Zinc sulfate, T_7:FYM1.0kg+0.2%Zinc sulfate+0.1% Ferrous sulfate and T_8:FYM1.0kg+0.2% Ferrous sulfate +0.1% Zinc sulfate. However minimum number of branches per plant was recorded T_0 control (7.96). At 120th day T_9:FYM1.0kg+0.2% Copper sulfate +0.1% Boron (12.86) followed byT_1:FYM+1.0kg +0.2% Zinc sulfate, T_2:FYM+1.0kg+0.2% Boron, T_3:FYM1.0kg+0.2% Ferrous sulfate, T_4:FYM1.0kg+0.2% Copper sulfate, T_5:FYM1.0kg+0.2% Zinc sulfate+ 0.1% Boran, T_6:FYM1.0kg+0.2% Boron+0.1% Zinc sulfate, T_7:FYM1.0kg+0.2%Zinc sulfate+0.1% Ferrous sulfate and T_8:FYM1.0kg+0.2% Ferrous sulfate +0.1% Zinc sulfate. However minimum number of branches per plant was recorded T_0 control (9.82). At 150th day T_9:FYM1.0kg+0.2% Copper sulfate +0.1% Boron (16.49) followed byT_1:FYM+1.0kg +0.2% Zinc sulfate, T_2:FYM+1.0kg+0.2% Boron, T_3:FYM1.0kg+0.2% Ferrous sulfate, T_4:FYM1.0kg+0.2% Copper sulfate, T_5:FYM1.0kg+0.2% Zinc sulfate+ 0.1% Boran, T_6:FYM1.0kg+0.2% Boron+0.1% Zinc sulfate, T_7:FYM1.0kg+0.2%Zinc sulfate+0.1% Ferrous sulfate and T_8:FYM1.0kg+0.2% Ferrous sulfate +0.1% Zinc sulfate. maximum plant spread (cm) (N-S) was recorded for 30th day T_9:FYM1.0kg+0.2% Copper sulfate +0.1% Boron (42.89) followed by T_1:FYM+1.0kg +0.2% Zinc sulfate, T_2:FYM+1.0kg+0.2% Boron, T_3:FYM1.0kg+0.2% Ferrous sulfate, T_4:FYM1.0kg+0.2% Copper sulfate, T_5:FYM1.0kg+0.2% Zinc sulfate+ 0.1% Boron, T_6:FYM1.0kg+0.2% Boron+0.1% Zinc sulfate,

T_7:FYM1.0kg+0.2%Zinc sulfate+0.1% Ferrous sulfate and T_8:FYM1.0kg+0.2% Ferrous sulfate +0.1% Zinc sulfate. However minimum plant spread (cm) (N-S) was recorded T_0 control (36.10). At 60th day T_9:FYM1.0kg+0.2% Copper sulfate +0.1% Boron (51.48) followed byT_1:FYM+1.0kg +0.2% Zinc sulfate, T_2:FYM+1.0kg+0.2% Boron, T_3:FYM1.0kg+0.2% Ferrous sulfate, T_4:FYM1.0kg+0.2% Copper sulfate, T_5:FYM1.0kg+0.2% Zinc sulfate+ 0.1% Boron, T_6:FYM1.0kg+0.2% Boron+0.1% Zinc sulfate, T_7:FYM1.0kg+0.2%Zinc sulfate+0.1% Ferrous sulfate and T_8:FYM1.0kg+0.2% Ferrous sulfate +0.1% Zinc sulfate. However minimum plant spread (cm) (N-S) was recorded T_0 control (44.86). At 90th day T_9:FYM1.0kg+0.2% Copper sulfate +0.1% Boron (61.29) followed T_1:FYM+1.0kg +0.2% Zinc sulfate, T_2:FYM+1.0kg+0.2% Boron, T_3:FYM1.0kg+0.2% Ferrous sulfate, T_4:FYM1.0kg+0.2% Copper sulfate, T_5:FYM1.0kg+0.2% Zinc sulfate+ 0.1% Boron, T_6:FYM1.0kg+0.2% Boron+0.1% Zinc sulfate, T_7:FYM1.0kg+0.2%Zinc sulfate+0.1% Ferrous sulfate and T_8:FYM1.0kg+0.2% Ferrous sulfate +0.1% Zinc sulfate. However minimum plant spread (cm) (N-S) was recorded T_0 control (48.64). At 120th day T_9:FYM1.0kg+0.2% Copper sulfate +0.1% Boron (69.95) followed byT_1:FYM+1.0kg +0.2% Zinc sulfate, T_2:FYM+1.0kg+0.2% Boron, T_3:FYM1.0kg+0.2% Ferrous sulfate, T_4:FYM1.0kg+0.2% Copper sulfate, T_5:FYM1.0kg+0.2% Zinc sulfate+ 0.1% Boron, T_6:FYM1.0kg+0.2% Boron+0.1% Zinc sulfate, T_7:FYM1.0kg+0.2%Zinc sulfate+0.1% Ferrous sulfate and T_8:FYM1.0kg+0.2% Ferrous sulfate +0.1% Zinc sulfate. However minimum plant spread (cm) (N-S) was recorded T_0 control (54.81). At 150th day T_9:FYM1.0kg+0.2% Copper sulfate +0.1% Boron (80.40) followed byT_1:FYM+1.0kg +0.2% Zinc sulfate, T_2:FYM+1.0kg+0.2% Boron, T_3:FYM1.0kg+0.2% Ferrous sulfate, T_4:FYM1.0kg+0.2% Copper sulfate, T_5:FYM1.0kg+0.2% Zinc sulfate+ 0.1% Boron, T_6:FYM1.0kg+0.2% Boron+0.1% Zinc sulfate, T_7:FYM1.0kg+0.2%Zinc sulfate+0.1% Ferrous sulfate and T_8:FYM1.0kg+0.2% Ferrous sulfate +0.1% Zinc sulfate. However minimum plant spread (cm) (N-S) was recorded T_0 control (60.33). maximum plant spread (cm) (N-S) was recorded for 30th day T_9:FYM1.0kg+0.2% Copper sulfate +0.1% Boron (28.20) followed by T_1:FYM+1.0kg +0.2% Zinc sulfate, T_2:FYM+1.0kg+0.2% Boron, T_3:FYM1.0kg+0.2% Ferrous sulfate, T_4:FYM1.0kg+0.2% Copper sulfate, T_5:FYM1.0kg+0.2% Zinc sulfate+ 0.1% Boron, T_6:FYM1.0kg+0.2% Boron+0.1% Zinc sulfate, T_7:FYM1.0kg+0.2%Zinc sulfate+0.1% Ferrous sulfate and T_8:FYM1.0kg+0.2% Ferrous sulfate +0.1% Zinc sulfate. However minimum plant spread (cm) (N-S) was recorded T_0 control (23.78). At 60th day T_9:FYM1.0kg+0.2% Copper sulfate +0.1% Boron (39.17) followed byT_1:FYM+1.0kg +0.2% Zinc sulfate, T_2:FYM+1.0kg+0.2% Boron, T_3:FYM1.0kg+0.2% Ferrous sulfate, T_4:FYM1.0kg+0.2% Copper sulfate, T_5:FYM1.0kg+0.2% Zinc sulfate+ 0.1% Boron, T_6:FYM1.0kg+0.2% Boron+0.1% Zinc sulfate, T_7:FYM1.0kg+0.2%Zinc sulfate+0.1% Ferrous sulfate and T_8:FYM1.0kg+0.2% Ferrous sulfate +0.1% Zinc sulfate. However minimum plant spread (cm) (N-S) was recorded T_0 control (30.88). At 90th day T_9:FYM1.0kg+0.2% Copper sulfate +0.1% Boron (49.57) followed T_1:FYM+1.0kg +0.2% Zinc sulfate, T_2:FYM+1.0kg+0.2% Boron, T_3:FYM1.0kg+0.2% Ferrous sulfate, T_4:FYM1.0kg+0.2% Copper sulfate, T_5:FYM1.0kg+0.2% Zinc sulfate+ 0.1% Boron, T_6:FYM1.0kg+0.2% Boron+0.1% Zinc sulfate, T_7:FYM1.0kg+0.2%Zinc sulfate+0.1% Ferrous sulfate and T_8:FYM1.0kg+0.2% Ferrous sulfate +0.1% Zinc sulfate. However minimum plant spread (cm) (N-S) was recorded T_0 control (38.67). At 120th day T_9:FYM1.0kg+0.2% Copper sulfate +0.1% Boron (56.31) followed byT_1:FYM+1.0kg +0.2% Zinc sulfate, T_2:FYM+1.0kg+0.2% Boron, T_3:FYM1.0kg+0.2% Ferrous sulfate, T_4:FYM1.0kg+0.2% Copper sulfate, T_5:FYM1.0kg+0.2% Zinc sulfate+ 0.1% Boron, T_6:FYM1.0kg+0.2% Boron+0.1% Zinc sulfate, T_7:FYM1.0kg+0.2%Zinc sulfate+0.1% Ferrous sulfate and T_8:FYM1.0kg+0.2% Ferrous sulfate +0.1% Zinc sulfate. However minimum plant spread (cm) (N-S) was recorded T_0 control (47.42). At 150th day T_9:FYM1.0kg+0.2% Copper sulfate +0.1% Boron (66.47) followed byT_1:FYM+1.0kg +0.2% Zinc sulfate, T_2:FYM+1.0kg+0.2% Boron, T_3:FYM1.0kg+0.2% Ferrous sulfate, T_4:FYM1.0kg+0.2% Copper sulfate, T_5:FYM1.0kg+0.2% Zinc sulfate+ 0.1% Boron, T_6:FYM1.0kg+0.2% Boron+0.1% Zinc sulfate, T_7:FYM1.0kg+0.2%Zinc sulfate+0.1% Ferrous sulfate and T_8:FYM1.0kg+0.2% Ferrous sulfate +0.1% Zinc sulfate. However minimum plant spread (cm) (N-S) was recorded T_0 control (57.75).

The increase in vegetative growth due to application of boric acid and zinc sulfate are in agreement with the work of Awasthi *et al*. (1975) [2] and Hoda. These findings are also in congruence with work of Sharma (2001) on apple, Khan *et al*. (2012) [5] on citrus, Meena *et al*. (2014) on Aonla and Prakash *et al*. (2017) [8] on Capegoose berry, of Das *et al*., (2006) in sapota and Putulndriyani (2011) in pineapple.

Table 1: Effect of FYM and micro nutrients on growth of Litchi (*Litchi chine sis* L.) cv. Purvi

Treatment No.	Treatments Combinations	Plant height (cm)						Plant canopy (cm)						Stem diameter (cm)					
		Initial	30 Days	60 Days	90 Days	120 Days	150 Days	Initial	30 Days	60 Days	90 Days	120 Days	150 Days	Initial	30 Days	60 Days	90 Days	120 Days	150 Days
T0	Control	65.23	77.77	88.47	98.44	107.38	115.58	24.55	26.33	28.42	31.16	37.49	40.49	1.30	1.47	1.62	1.94	2.01	2.06
T1	FYM+1.0kg +0.2% Zinc sulfate	76.03	82.50	91.04	101.77	106.67	120.20	32.58	34.49	36.50	38.33	42.17	44.68	1.80	2.00	2.13	2.24	2.33	2.39
T2	FYM+1.0kg+0.2% Boron	81.05	87.58	93.50	102.40	112.17	122.66	39.45	42.49	43.59	47.41	49.23	51.38	1.83	2.01	2.16	2.35	2.41	2.46
T3	FYM1.0kg+0.2% Ferrous sulfate	77.15	88.93	96.96	102.49	109.67	124.69	38.99	40.36	42.78	45.68	49.01	52.54	1.67	1.94	2.05	2.44	2.46	2.48
T4	FYM1.0kg+0.2% Copper sulfate	82.80	91.33	95.10	102.02	112.99	128.92	39.44	43.32	46.72	48.34	51.10	53.50	1.40	1.93	2.07	2.22	2.36	2.39
T5	FYM1.0kg+0.2% Zinc sulfate+ 0.1% Boron	66.65	93.41	98.26	102.51	112.64	124.50	30.51	33.71	36.76	38.54	40.82	43.47	1.71	1.93	2.12	2.24	2.33	2.38
T6	FYM1.0kg+0.2% Boron+0.1% Zinc sulfate	73.55	92.53	99.31	101.06	114.02	125.16	34.84	36.32	38.44	40.95	44.03	46.72	1.82	1.98	2.10	2.29	2.30	2.35
T7	FYM1.0kg+0.2%Zinc sulfate+0.1% Ferrous sulfate	76.52	91.23	98.63	101.09	114.99	133.33	36.82	38.37	40.60	42.69	46.05	49.52	1.84	1.98	2.15	2.23	2.28	2.34
T8	FYM1.0kg+0.2% Ferrous sulfate +0.1% Zinc sulfate	84.48	91.71	96.89	102.80	112.83	129.13	40.97	42.34	44.34	46.52	49.88	51.44	1.81	2.02	2.10	2.22	2.32	2.47
T9	FYM1.0kg+0.2% Copper sulfate +0.1% Boron	86.63	93.86	99.73	106.96	117.13	130.46	42.57	44.39	46.76	48.57	53.11	56.54	1.95	2.08	2.21	2.36	2.47	2.51
F-Test		S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S

C.D.at 0.5%	3.044	3.044	1.583	4.148	1.976	2.580	2.888	0.403	0.833	0.912	0.980	0.316	0.100	0.070	0.107	0.112	0.075	0.075
S.Ed (±)	1.449	0.754	1.449	0.754	1.974	0.941	1.374	0.192	0.397	0.434	0.466	0.150	0.048	0.033	0.051	0.053	0.036	0.036

Treatment No.	Treatments Combinations	Number of leaves per plant						Leaf area (cm)					Number of branches per plant					
		Initial	30 Days	60 Days	90 Days	120 Days	150 Days	30 Days	60 Days	90 Days	120 Days	150 Days	Initial	30 Days	60 Days	90 Days	120 Days	150 Days
T0	Control	70.41	96.07	115.89	130.59	150.14	183.55	20.17	20.70	21.23	22.36	23.20	2.91	4.41	5.84	7.96	9.82	11.71
T1	FYM+1.0kg +0.2% Zinc sulfate	84.78	98.16	122.42	132.74	156.56	192.80	23.70	24.11	25.76	26.65	27.43	4.03	5.23	6.99	8.49	11.05	15.06
T2	FYM+1.0kg+0.2% Boron	91.50	98.31	127.08	140.59	169.62	198.42	23.49	24.09	25.75	26.83	26.81	4.06	5.98	7.51	8.44	11.72	15.32
T3	FYM1.0kg+0.2% Ferrous sulfate	90.98	112.13	131.29	144.90	162.73	187.20	24.50	24.21	26.20	27.23	27.65	3.44	5.57	7.50	8.76	12.53	14.98
T4	FYM1.0kg+0.2% Copper sulfate	92.57	105.79	129.51	147.19	171.58	195.42	24.69	24.41	25.76	26.35	27.75	3.78	5.31	7.52	8.40	12.22	15.21
T5	FYM1.0kg+0.2% Zinc sulfate+ 0.1% Boron	96.19	110.85	135.80	150.86	174.85	196.29	23.42	24.09	25.24	26.75	27.79	3.55	6.08	8.18	9.02	11.57	14.89
T6	FYM1.0kg+0.2% Boron+0.1% Zinc sulfate	94.21	111.23	135.83	155.17	180.53	207.79	23.82	24.30	25.49	26.73	27.28	3.53	5.91	6.95	9.00	12.84	16.16
T7	FYM1.0kg+0.2%Zinc sulfate+0.1% Ferrous sulfate	94.29	114.89	132.52	151.60	174.80	216.45	24.15	24.66	25.22	26.84	28.27	3.73	5.52	7.79	8.49	12.52	15.69
T8	FYM1.0kg+0.2% Ferrous sulfate +0.1% Zinc sulfate	92.11	112.51	135.19	143.55	181.15	220.19	24.34	24.54	25.80	26.80	28.31	3.47	5.81	7.52	9.22	12.13	15.59
T9	FYM1.0kg+0.2% Copper sulfate +0.1% Boron	98.85	125.49	142.06	160.54	182.95	228.81	25.38	25.76	26.52	27.36	28.73	4.28	6.15	7.96	9.32	12.86	16.49
F-Test		S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
C.D.at 0.5%		3.087	5.263	4.636	2.568	1.852	5.491	0.540	0.188	0.165	0.192	0.197	0.510	0.934	0.514	0.663	1.064	1.084
S.Ed (±)		1.469	2.505	2.207	1.222	0.881	2.614	0.257	0.089	0.079	0.091	0.094	0.243	0.444	0.245	0.315	0.506	0.516

Treatment No.	Treatments Combinations	Plant spread (cm) (N-S)						Plant spread (cm) (E-W)					
		Initial	30 Days	60 Days	90 Days	120 Days	150 Days	Initial	30 Days	60 Days	90 Days	120 Days	150 Days
T0	Control	28.39	36.10	44.86	48.64	54.81	60.33	18.30	23.78	30.88	38.67	47.42	57.75
T1	FYM+1.0kg +0.2% Zinc sulfate	30.72	37.94	48.71	56.32	63.82	70.37	21.17	27.86	35.85	43.27	52.47	63.08
T2	FYM+1.0kg+0.2% Boron	31.43	39.14	46.48	58.31	68.08	78.54	21.58	26.65	36.51	46.18	51.52	60.55
T3	FYM1.0kg+0.2% Ferrous sulfate	31.31	38.31	48.75	59.32	68.72	74.34	20.69	27.38	37.51	48.28	55.28	61.32
T4	FYM1.0kg+0.2% Copper sulfate	32.64	39.53	48.50	60.34	61.63	79.61	19.27	27.21	38.47	48.90	53.28	61.98
T5	FYM1.0kg+0.2% Zinc sulfate+ 0.1% Boron	31.87	38.56	48.65	61.32	70.04	78.38	20.17	27.64	37.18	48.95	54.52	63.04
T6	FYM1.0kg+0.2% Boron+0.1% Zinc sulfate	33.59	39.84	49.16	58.36	67.36	78.34	21.45	27.39	36.14	44.55	54.42	63.74
T7	FYM1.0kg+0.2%Zinc sulfate+0.1% Ferrous sulfate	31.44	40.51	50.54	59.41	67.40	79.24	22.19	27.14	37.78	45.80	54.76	63.83
T8	FYM1.0kg+0.2% Ferrous sulfate +0.1% Zinc sulfate	30.09	41.22	50.31	58.51	68.41	79.52	22.20	27.10	37.31	48.35	54.72	65.57
T9	FYM1.0kg+0.2% Copper sulfate +0.1% Boron	33.78	42.89	51.48	61.29	69.95	80.40	22.68	28.20	39.17	49.57	56.31	66.47
F-Test		S	S	S	S	S	S	S	S	S	S	S	S
C.D.at 0.5%		1.851	0.819	0.526	0.573	0.951	1.909	0.801	1.419	2.160	1.001	3.056	8.531
S.Ed (±)		0.881	0.390	0.250	0.273	0.453	0.909	0.381	0.675	1.028	0.447	1.455	4.060

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