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***Short communication***

# Effect of nitrogen and spacing on growth, yield and quality of tomato

**SHRUTI SINGH, T.K. SINGH AND K.N. NAMDEO***

*Department of Horticulture, JNKVV College of Agriculture, Rewa (M.P.) 486 001*

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Tomato (*Lycopersicon esculentum Mill*) belongs to the family Solanaceae and is the most important vegetable crop. It ranks second among the vegetables next only to potato in area and production. In Madhya Pradesh, tomato is grown in 65.72 thousand hectares with the production upto 1937 thousand MT and productivity 29.47 MT $ha^{-1}$. It is grown under different sets of climatic conditions in farms, garden, small garden, polyhouse and market gardens for fresh consumption as well as for processing purposes. Tomato is rich in A, B, and C vitamins, minerals, iron, phosphorus, ascorbic acid and lycopene. Nitrogen is one of the most important major nutrients. It encourages the plant foliage and boosts plant growth at every stage, because it is an integral part of the chlorophyll, all proteins, enzymes and structural materials (Balasubramanian and Palaniappan, 2004). The optimum spacing between the plants is very important for higher productivity of tomato per unit area. The optimum spacing avoids the strong competition between plants for growth factors such as space, solar radiation, moisture and nutrients. Hence, the optimum combination of plant spacing and nitrogen may prove beneficial in securing maximum productivity from tomato cv. H-86. Keeping all these points in view, the present research was undertaken.

The field experiment was conducted at the Horticulture Nursery, College of Agriculture, Rewa (M.P.) during *rabi* season 2017-18. The field soil was clay-loam in texture having pH 7.5, electrical conductivity 0.39 $dSm^{-1}$, organic carbon 5.6 g $kg^{-1}$, available N, $P_2O_5$ and $K_2O$ 338, 18, and 360 kg $ha^{-1}$, respectively. The experiment was laid out in randomized block design (factorial) with three replications. The treatments comprised of four nitrogen levels (0, 60, 80 and 100 kg $ha^{-1}$) three plant spacing (60 x 35, 60 x 45 and 60 x 55 cm). Well rotted FYM @ 20 t $ha^{-1}$ was applied at the time of field preparation. The common dose of 50 kg $P_2O_5$ and K2O $ha^{-1}$ each was applied in all the treatments. The four weeks old seedlings were transplanted on 5 November, 2017. The crop was grown under the recommended package of practices.

Table 1 Growth and yield attributes of tomato as influenced by Nlevels and plant spacings

| Treatments | Plant height (cm) 90 DAT | Branches/ plant 90 DAT | Flower clusters /plant | Flowers/ cluster | Fruits /cluster | Fruits weight/ plant (kg) |
|---|---|---|---|---|---|---|
| N-levels (kg/ha) | | | | | | |
| 0 | 55.05 | 11.39 | 10.81 | 5.79 | 3.18 | 1.03 |
| 60 | 56.54 | 11.70 | 11.83 | 6.38 | 3.66 | 1.15 |
| 80 | 57.50 | 12.00 | 12.40 | 6.79 | 4.52 | 1.20 |
| 100 | 60.39 | 12.41 | 13.49 | 7.33 | 5.65 | 1.27 |
| C.D. (P=0.05) | 0.024 | 0.006 | 0.021 | 0.050 | 0.037 | 0.176 |
| Plant spacings (cm) | | | | | | |
| 60 × 35 | 57.10 | 11.69 | 11.76 | 6.47 | 4.04 | 0.97 |
| 60 × 45 | 57.38 | 11.93 | 12.16 | 6.63 | 4.23 | 1.20 |
| 60 × 55 | 57.69 | 12.00 | 12.98 | 6.71 | 4.49 | 1.32 |
| C.D. (P=0.05) | 0.027 | 0.007 | 0.024 | 0.058 | 0.032 | 0.152 |

A perusal of data (Table 1) indicated that the increasing levels of nitrogen upto 100 kg $ha^{-1}$, significantly increased the plant height and number of branches $plant^{-1}$, yield attributes and yield over the lower N levels. The maximum plant height was 60.39 cm, branches 12.41 plant-

*Corresponding auther-Email-drknnamdeo@gmail.com

$^{1}$, flower clusters 13.49 plant$^{-1}$, flowers 7.33 cluster$^{-1}$, fruits 5.65 cluster$^{-1}$, fruit weight 1.27 kg plant$^{-1}$ and tomato yield 38.30 t ha$^{-1}$ as well as net income (Rs.102386 ha$^{-1}$ with 3.0 B:C ratio). The total soluble solids 5.26 $^{0}$Brix, pericarp thickness 10.42 mm, locules 4.86 fruit$^{-1}$) were also found highest. The beneficial effect of applied nitrogen on above mentioned parameters may be due to the fact that application of the maximum amount of nitrogen maintained the nitrogen requirement of the plant by supplying sufficient quantity of nutrients essential for their growth. Nitrogen is directly associated with the vegetative growth of the plant. It is the main constituent of protoplasm upon which the whole life of plant is dependent. This helped in the development of cell-size as well as in cell division. Quick cell enlargement and cell formation resulted in quick growth. Protein produced due to increased nitrogen allowed the plant leaves to have a larger surface available for photosynthesis and ultimately more carbohydrates were synthesized and translocated towards the reproductive organs. The findings are in close agreement with those of Erdal *et al.* (2007), Direkvandi *et al* (2008), Kirmi *et al.* (2011) and Haque et *al.* (2011).

Table 2 Effect of nitrogen and plant spacing on yield, quality and economics of tomato

| Treatments | Yield of tomato (t ha$^{-1}$) | TSS ($^{0}$Brix) | Pericarp thickness (mm) | No. of locules/ fruit | Net income (Rs ha$^{-1}$) | B:C ratio |
|---|---|---|---|---|---|---|
| N-levels(kg ha$^{-1}$) | | | | | | |
| 0 | 33.51 | 4.06 | 10.06 | 2.33 | 84839 | 2.72 |
| 60 | 34.55 | 4.33 | 10.21 | 2.82 | 88053 | 2.75 |
| 80 | 36.24 | 4.67 | 10.31 | 3.42 | 94479 | 2.86 |
| 100 | 38.29 | 5.26 | 10.42 | 4.86 | 102386 | 3.00 |
| C.D. (P=0.05) | 0.039 | 0.117 | 0.013 | 0.118 | - | - |
| Plant spacings (cm) | | | | | | |
| 60 × 35 | 39.17 | 4.38 | 10.21 | 3.06 | 106486 | 3.11 |
| 60 × 45 | 34.91 | 4.59 | 10.25 | 3.34 | 89466 | 2.77 |
| 60 × 55 | 32.88 | 4.78 | 10.29 | 3.67 | 81366 | 2.61 |
| C.D. (P=0.05) | 0.033 | 0.101 | 0.011 | 0.102 | - | - |

The wider spacing between plants (60 x 55 cm) resulted in significantly higher vegetative growth, yield-attributes and fruit quality. However, the yield (39.17 t ha$^{-1}$) and net income (Rs.10686 ha$^{-1}$) was found highest under closer plant spacing (60 x 35 cm). The higher yield under closer spacing was on account of higher plant population per unit area or per hectare as compared to wider spacing. The wider spacing between plants not only resulted in significantly increased growth and yield parameters but also the fruit quality. This was happened by synthesizing more carbohydrate and absorption of more nutrients from the larger area between plants provided to them. Thus the increase in yield parameters under wider (60 x 55 cm) spacing was due to less competition between plants for solar radiation, soil moisture and plant nutrients because of which plants developed maximum branching. As a result of which, carbon assimilation process increased rapidly hence maximum storage of carbohydrate occurred resulting in more yield per plant. Similar findings have been reported by Balemi (2007) and Kirmi *et al.* (2011).

It may be concluded from the results that the 100 kg Nha$^{-1}$ with 60 x 35 cm spacing resulted in the highest yield and net income from tomato var. H-86 under the existing agro-climatic conditions of Kymore plateau.

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