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# Mango fruit yield and quality improvement through fertigation along with mulch*

RASHMI PANWAR[1], SANJAY KUMAR SINGH[2], C P SINGH, and P K SINGH[3]

*G B Pant University of Agriculture and Technology, Pantnagar, Uttarakhand 263 145*

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In India, mango (*Mangifera indica* L.) is grown on the area of 1.52 million hectare with an annual production of 10.23 million tonnes with productivity of 6.7 tonnes/ha (NHB 2003). It occupies first position among farmers who grow fruit crops and 'Dashehari' is one of the choicest cultivar of North India. As being a deep rooted tree do equally well on Alluvial as well as Lateritic soil but well drained fairly deep, slightly acidic loamy soil is considered best. The nutrition and water requirements of mango depend upon climate, soil type and age of the tree. Irrigation is imperative especially during fruit bud differentiation and during vegetative phase. Micro irrigation provides a good tool for horticulturist to regulate plant growth and development in a manner to augment yield with quality fruits (Glenn 2000). Nutrients through fertigation is the most effective for concentrating root activity and convenient means of maintaining optimum fertility level in the soil and water supply as per requirement of the plants (Shirgure *et al.* 2001). Furthermore fertigation with plastic mulch keeps moisture level optimum in growing zone, regulates soil temperature, and improves soil fertility besides controlling soil erosion and weed population. Therefore, the present investigation was carried out on 6-year-old 'Dashehari' mango (10 m × 10 m) for studying the effect of fertigation with plastic mulch on yield and quality in tarai condition of Uttarakhand.

The treatments replicated thrice and 3 trees served as a unit of treatment in each replication under factorial randomized block design. The treatments were irrigation and fertilizers level used in irrigation with mulch and their combinations comprised $T_1$, irrigation applied at 'V'(estimated volume of water to be applied to the plants in liter/day/plant) level through drip irrigation system + plastic mulch; $T_2$, irrigation applied at '0.8 V' level through drip irrigation system + plastic mulch; $T_3$, irrigation applied at '0.6 V' level through drip irrigation system + plastic mulch; $T_4$, irrigation applied at 'V' level through surface irrigation system + plastic mulch; $T_5$, irrigation applied at 'V' level through drip irrigation system;$T_6$, irrigation applied at '0.8 V' level through drip irrigation system; $T_7$, irrigation applied at '0.6 V' level through drip irrigation system and $T_8$, irrigation applied at 'V' level through surface irrigation system (control). The fertilizers levels used in irrigation water were: $F_1$,100 % of normal dose (380 g; 380 g; 380 g); $F_2$, 75% of normal dose (285 g : 285 g : 285 g); $F_3$, 50% of normal dose(190 g:190g:190 g) and control (normal dose) (500 g:750 g:375 g).The combination of treatments were: $I_1F_1$, drip irrigation at V level with mulch + 100% dose of fertilizer application through fertigation; $I_1F_2$, drip irrigation at V level with mulch + 75% dose of fertilizer application through fertigation; $I_1F_3$, drip irrigation at V level with mulch + 50% dose of fertilizer application through fertigation; $I_2F_1$, drip irrigation at 0.8 V level with mulch + 100% dose of fertilizer application through fertigation; $I_2F_2$, drip irrigation at 0.8 V level with mulch + 75 % dose of fertilizer application through fertigation; $I_2F_3$, drip irrigation at 0.8 V level with mulch + 50% dose of fertilizer application through fertigation; $I_3F_1$, drip irrigation at 0.6 V level with mulch + 100 % dose of fertilizer application through fertigation;$I_3F_2$, drip irrigation at 0.6 V level with mulch + 75 % dose of fertilizer application through fertigation; $I_3F_3$, drip irrigation at 0.6 V level with mulch + 50% dose of fertilizer application through fertigation; $I_4F_1$, surface irrigation at V level with mulch + 100% dose of fertilizer application through conventional practices; $I_4F_2$, surface irrigation at V level with mulch + 75% dose of fertilizer application through conventional practices; $I_4F_3$, surface irrigation at V level with mulch + 50% dose of fertilizer application through conventional practices; $I_5F_1$, drip irrigation at V level without mulch + 100% dose of fertilizer application through fertigation; $I_5F_2$, drip irrigation at V level without mulch + 75% dose of fertilizer application through fertigation; $I_5F_3$, drip irrigation at V level without mulch + 50 % dose of fertilizer application through fertigation; $I_6F_1$, drip irrigation at 0.8 V level without mulch + 100% dose of fertilizer application through fertigation; $I_6F_2$, drip irrigation at 0.8 V level without mulch + 75% dose of fertilizer application through fertigation; $I_6F_3$, drip irrigation at 0.8 V level without

*Short note

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[1]Senior Research Fellow, [2]Research Scholar, [3-4]Associate Professor, Department of Horticulture

Table 1 Effect of fertigation and plastic mulch on fruit set, fruit retention and yield of 'Dashehari' mango

| Treatment** | Average fruit set and fruit retention per panicle | | | | | | Average fruit yield per tree | | | | Average fruit weight (g) | | Average fruit (ml) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | April (Ist week) | | May (Ist week) | | June (Ist week) | | No. of fruits | | Weight (kg) | | | | | |
| | 2002 | 2003 | 2002 | 2003 | 2002 | 2003 | 2002 | 2003 | 2002 | 2003 | 2002 | 2003 | 2002 | 2003 |
| $I_1F_1$ | 96.67 | 87.33 | 2.33 | 2.66 | 1.33 | 1.66 | 328.33 | 273.33 | 41.18 | 44.93 | 126.27 | 165.00 | 129.33 | 129.33 |
| $I_1F_2$ | 59.33 | 135.00 | 2.00 | 5.33 | 2.33 | 2.33 | 210.67 | 251.00 | 26.73 | 33.19 | 126.67 | 132.33 | 120.00 | 152.33 |
| $I_1F_3$ | 49.33 | 58.66 | 1.67 | 2.66 | 1.00 | 1.66 | 245.67 | 192.00 | 31.62 | 32.63 | 125.00 | 170.00 | 121.33 | 129.00 |
| $I_2F_1$ | 38.67 | 109.30 | 2.00 | 4.66 | 1.00 | 2.66 | 271.33 | 65.66 | 32.23 | 11.20 | 118.33 | 171.67 | 116.67 | 142.66 |
| $I_2F_2$ | 81.67 | 75.66 | 2.67 | 4.00 | 1.33 | 2.00 | 228.67 | 243.33 | 27.49 | 31.13 | 120.00 | 142.00 | 116.00 | 136.33 |
| $I_2F_3$ | 77.33 | 85.33 | 3.00 | 4.33 | 1.67 | 3.33 | 239.00 | 161.66 | 28.27 | 25.43 | 122.33 | 157.00 | 118.67 | 142.33 |
| $I_3F_1$ | 67.33 | 64.66 | 2.67 | 2.66 | 2.00 | 2.00 | 275.00 | 215.33 | 38.27 | 39.10 | 141.67 | 182.00 | 138.67 | 152.00 |
| $I_3F_2$ | 26.00 | 76.33 | 1.67 | 5.00 | 1.33 | 2.00 | 226.33 | 243.33 | 28.81 | 37.20 | 135.00 | 153.00 | 128.00 | 132.00 |
| $I_3F_3$ | 43.00 | 103.00 | 2.00 | 5.00 | 1.00 | 2.33 | 245.33 | 88.66 | 28.66 | 20.37 | 125.00 | 173.67 | 120.00 | 129.33 |
| $I_4F_1$ | 22.00 | 41.66 | 1.67 | 7.00 | 1.00 | 2.33 | 258.33 | 247.33 | 31.61 | 37.30 | 125.00 | 151.00 | 121.33 | 142.33 |
| $I_4F_2$ | 57.33 | 31.33 | 2.33 | 7.00 | 1.67 | 2.66 | 235.67 | 204.33 | 30.26 | 31.63 | 128.33 | 155.67 | 124.00 | 143.66 |
| $I_4F_3$ | 40.00 | 57.33 | 1.67 | 7.66 | 1.00 | 2.66 | 126.33 | 130.33 | 16.80 | 16.77 | 135.00 | 129.67 | 133.33 | 137.66 |
| $I_5F_1$ | 52.00 | 31.83 | 2.33 | 2.66 | 1.33 | 2.33 | 195.00 | 154.66 | 25.28 | 24.57 | 125.00 | 169.00 | 126.67 | 151.66 |
| $I_5F_2$ | 117.33 | 37.30 | 2.67 | 2.66 | 1.67 | 1.66 | 115.00 | 129.00 | 14.19 | 17.49 | 131.67 | 160.67 | 126.67 | 151.66 |
| $I_5F_3$ | 70.33 | 16.66 | 2.00 | 1.00 | 1.33 | 1.00 | 189.00 | 103.66 | 24.05 | 17.17 | 133.33 | 159.00 | 130.67 | 152.66 |
| $I_6F_1$ | 84.33 | 109.33 | 2.33 | 6.00 | 1.33 | 3.66 | 141.67 | 177.66 | 18.83 | 27.43 | 135.00 | 155.00 | 132.00 | 157.66 |
| $I_6F_2$ | 70.67 | 119.66 | 2.00 | 5.00 | 1.33 | 2.66 | 181.00 | 235.00 | 24.18 | 38.07 | 138.33 | 161.67 | 139.33 | 156.00 |
| $I_6F_3$ | 68.33 | 92.00 | 2.00 | 4.00 | 1.00 | 1.66 | 185.00 | 192.33 | 24.53 | 29.57 | 138.33 | 154.33 | 128.00 | 163.33 |
| $I_7F_1$ | 86.00 | 93.00 | 2.00 | 2.66 | 1.00 | 1.66 | 237.00 | 213.33 | 34.17 | 34.53 | 133.33 | 162.00 | 131.33 | 168.00 |
| $I_7F_2$ | 66.33 | 81.33 | 2.00 | 4.00 | 1.33 | 2.00 | 145.67 | 167.33 | 19.48 | 27.40 | 135.00 | 164.00 | 131.33 | 165.33 |
| $I_7F_3$ | 39.67 | 68.66 | 2.67 | 2.00 | 1.67 | 1.33 | 240.00 | 177.66 | 28.88 | 27.97 | 120.00 | 157.67 | 117.33 | 135.66 |
| $I_8F_1$ | 30.00 | 31.33 | 1.67 | 5.33 | 0.67 | 3.33 | 126.00 | 88.66 | 15.47 | 7.33 | 123.33 | 168.33 | 120.67 | 158.33 |
| $I_8F_2$ | 44.00 | 118.66 | 2.00 | 7.66 | 1.33 | 2.66 | 136.67 | 133.00 | 18.67 | 24.40 | 133.33 | 185.67 | 128.00 | 159.00 |
| $I_8F_3$ | 27.00 | 97.33 | 1.33 | 7.33 | 0.67 | 3.33 | 120.00 | 43.00 | 42.27 | 12.23 | 130.00 | 160.00 | 126.67 | 159.33 |
| CD ($P = 0.05$) | | | | | | | | | | | | | | |
| a | 32.26 | 39.94 | NS | 1.71 | NS | 0.87 | NS | 79.48 | NS | 12.78 | NS | 7.30 | NS | 7.91 |
| b | NS | NS | NS | NS | NS | NS | NS | 48.67 | NS | NS | NS | 4.40 | NS | 4.84 |
| a × b | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | 12.65 | NS | 13.70 |
| SEm± | 57.68 | 54.76 | 41.10 | 40.36 | 55.49 | 39.63 | 48.54 | 49.57 | 59.17 | 49.52 | 13.32 | 4.78 | 12.27 | 5.64 |

a, irrigation and mulching level; b, fertilizers level used with irrigation water

**Details of the treatment are given in text

mulch + 50 % dose of fertilizer application through fertigation; $I_7F_1$, drip irrigation at 0.6 V level without mulch + 100% dose of fertilizer application through fertigation; $I_7F_2$, drip irrigation at 0.6 V level without mulch + 75% dose of fertilizer application through fertigation; $I_7F_3$, drip irrigation at 0.6 V level without mulch + 50% dose of fertilizer application through fertigation; $I_8F_1$, surface irrigation at V level without mulch + 100% dose of fertilizer application through conventional practices; $I_8F_2$, surface irrigation at V level without mulch + 75% dose of fertilizer application through conventional practices and $I_8F_3$, surface irrigation at V level without mulch + 50% dose of fertilizer application through conventional practices. Total requirement of urea, single super phosphate and muriate of potash was 32 kg,182 kg and 15 kg respectively. The NPK (water soluble) requirement was 36 kg ($F_1$), 27 kg ($F_2$), and 18 kg ($F_3$).Thus the total requirement of water-soluble fertilizers (N:P:K::19:19:19) is 81 kg (36 + 27 + 18) for the fulfillment of fertigation.

The observations were recorded on fruit set in April, May, June (Ist week of each month) and malformed panicles. Average fruit yield determined by counting the number of fruits per tree and weighed by physical balance. Average fruit width, fruit length were recorded with the help of vernier calipers. The total soluble solid of the pulp was recorded with a hand refractrometer. Total N, P and K content of leaves were determined by the methods given in AOAC (1970). The physiological loss in weight (g) was recorded when fruits were stored at room temperature (25–34°C). β-carotene was estimated with the help of standard procedure. Data were statistically analyzed for analysis of variance using factorial randomized block design (Snedicor and Cochran 1987).

Fruit set and fruit retention was maximum in the month of April under the treatment $I_1F_1$ (96.67) during 2002 while during 2003 it was maximum in the treatment $I_1F_2$ (135.0). These characters were having minimum value in the treatment $I_4F_1$ (22.0) and $I_5F_3$ (16.66) during 2002 and 2003 respectively.

Table 2 Effect of fertigation and plastic mulch on panicle malformation and fruit quality of mango cv Dashehari

| Treatment | Average fruit length (cm) | | Average fruit width (cm) | | Average malformed panicle (%)/tree | | Average TSS (°B) | | Average β-carotene (mg/100 g pulp) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2002 | 2003 | 2002 | 2003 | 2002 | 2003 | 2002 | 2003 | 2002 | 2003 |
| $I_1F_1$ | 9.17 | 10.13 | 5.70 | 5.63 | 1.33(3.85) | 13.66(20.10) | 18.47 | 14.40 | 1.95 | 1.91 |
| $I_1F_2$ | 8.70 | 9.46 | 6.33 | 5.46 | 8.67(16.88) | 6.00(12.56) | 19.20 | 14.01 | 1.87 | 1.88 |
| $I_1F_3$ | 8.90 | 11.06 | 5.70 | 5.67 | 0.33(1.91) | 5.66(12.84) | 17.33 | 15.68 | 1.78 | 1.77 |
| $I_2F_1$ | 8.53 | 10.51 | 5.53 | 5.94 | 21.33(22.90) | 10.33(16.98) | 18.87 | 15.20 | 2.01 | 1.99 |
| $I_2F_2$ | 8.70 | 9.94 | 5.60 | 5.30 | 21.00(24.51) | 22.66(26.00) | 18.50 | 13.88 | 1.87 | 1.95 |
| $I_2F_3$ | 8.83 | 10.20 | 5.76 | 5.62 | 7.00(11.70) | 6.00(13.99) | 19.70 | 13.86 | 1.75 | 1.67 |
| $I_3F_1$ | 9.13 | 9.89 | 6.03 | 5.70 | 22.67(25.24) | 12.00(15.79) | 19.73 | 11.80 | 1.85 | 1.87 |
| $I_3F_2$ | 8.83 | 9.94 | 5.67 | 5.57 | 28.33(29.01) | 10.00(18.37) | 19.20 | 14.08 | 1.76 | 1.73 |
| $I_3F_3$ | 9.00 | 9.71 | 5.57 | 5.51 | 15.33(17.80) | 5.33(10.60) | 19.60 | 14.26 | 1.61 | 1.61 |
| $I_4F_1$ | 9.03 | 9.45 | 6.03 | 5.68 | 13.00(20.58) | 9.33(16.48) | 21.10 | 13.61 | 1.72 | 1.74 |
| $I_4F_2$ | 8.97 | 9.90 | 5.53 | 5.66 | 4.67(12.43) | 11.66(16.45) | 20.10 | 11.03 | 1.84 | 1.86 |
| $I_4F_3$ | 9.09 | 9.32 | 5.57 | 5.27 | 31.67(25.69) | 8.33(13.16) | 18.80 | 13.50 | 1.72 | 1.71 |
| $I_5F_1$ | 8.60 | 10.13 | 5.63 | 5.48 | 7.33(14.49) | 4.00(6.75) | 18.73 | 15.10 | 2.02 | 2.00 |
| $I_5F_2$ | 9.17 | 10.70 | 5.63 | 5.71 | 37.33(37.03) | 2.33(6.63) | 18.43 | 15.30 | 1.85 | 1.81 |
| $I_5F_3$ | 8.93 | 9.22 | 5.77 | 5.48 | 7.00(15.24) | 1.00(4.62) | 17.87 | 14.30 | 1.60 | 1.57 |
| $I_6F_1$ | 9.13 | 9.94 | 6.03 | 5.66 | 13.33(14.79) | 5.66(13.16) | 19.33 | 12.66 | 1.90 | 1.93 |
| $I_6F_2$ | 9.20 | 10.32 | 5.80 | 5.57 | 7.67(15.23) | 21.33(26.84) | 18.40 | 15.85 | 1.78 | 1.78 |
| $I_6F_3$ | 8.73 | 9.82 | 5.70 | 5.72 | 7.00(9.09) | 8.00(13.51) | 18.97 | 13.46 | 1.70 | 1.70 |
| $I_7F_1$ | 9.13 | 10.27 | 5.53 | 5.52 | 3.00(9.73) | 11.00(18.02) | 18.87 | 16.45 | 1.93 | 1.95 |
| $I_7F_2$ | 9.09 | 10.72 | 5.67 | 5.95 | 50.67(45.14) | 11.00(19.27) | 19.27 | 15.25 | 1.68 | 1.62 |
| $I_7F_3$ | 8.40 | 9.94 | 5.57 | 5.30 | 5.33(9.51) | 10.66(17.37) | 17.93 | 13.12 | 1.61 | 1.60 |
| $I_8F_1$ | 8.70 | 10.53 | 5.40 | 5.73 | 6.33(11.44) | 8.00(15.92) | 22.93 | 15.26 | 1.80 | 1.81 |
| $I_8F_2$ | 8.93 | 11.19 | 5.90 | 6.01 | 7.00(14.67) | 15.00(21.90) | 19.63 | 11.70 | 1.75 | 1.75 |
| $I_8F_3$ | 8.97 | 10.04 | 5.50 | 5.40 | 22.33(20.62) | 36.66(36.14) | 19.46 | 12.65 | 1.77 | 1.74 |
| CD ($P = 0.05$) | | | | | | | | | | |
| a | NS | 0.11 | NS | NS | NS | 9.02(9.03) | NS | 1.23 | NS | 0.036 |
| b | NS | 0.068 | NS | NS | NS | NS | NS | NS | 0.81 | 0.059 |
| a × b | NS | 0.19 | NS | NS | NS | NS | NS | 2.14 | NS | 0.10 |
| SEm± | 7.64 | 1.16 | 8.11 | 8.58 | 142.82(95.34) | 90.44(58.07) | 10.26 | 9.40 | 7.77 | 3.50 |

a, Irrigation and mulching level; b, fertilizers level used with irrigation water

The number of fruits reduced during May and June. In May and June maximum fruit retention was observed under the treatment $I_2F_3$ (3.0), $I_4F_3$ (7.66) and $I_1F_2$ (2.33), $I_2F_3$ (3.33) during the years 2002 and 2003 respectively. Cassagnes (1982) and Hipps (1992) reported effect of fertigation in increasing fruit set and retention in 'Golden Delicious' apple. At the harvest time the number of fruits (328.33, 273.33) and fruit yield (41.18, 44.93) were maximum in both the years under the treatment $I_1F_1$ while average fruit weight was maximum in $I_3F_1$ (141.67 g) and $I_8F_2$ (185.67 g) in the year 2002 and 2003 respectively. These results are in conformity with the crop pomegranate (Firake and Deolanker 2000) and apple (Konsgrud 1992). Fruit volume during 2002 was maximum under treatment $I_6F_2$ (139.33 ml) and in 2003 it was under the treatment $I_7F_1$ (168.00 ml). Our findings regarding fruit weight, volume and yield was supported by Srinivas *et al.* (2001) in 'Anab-e-Shahi' grape treated with polythene mulch or no mulch. For most of the characters interactions were found non-significant. However, fruit weight and volume were significantly affected by irrigation, fertilizer, mulch application and their combination during the year 2003 (Table 1).

Fruit length, fruit width, number of malformed panicles, TSS and β-carotene were not affected significantly by irrigation and fertilizer application with or without mulch during both the years. However, fruit length was maximum under the treatment $I_1F_1$, $I_5F_2$ (9.17 cm) and $I_8F_2$ (11.19 cm) during 2002 and 2003 respectively. Fruit width was recorded maximum in $I_1F_2$ (6.33 cm) in 2002 and in $I_7F_2$ (5.95 cm) in 2003. Similar results with regard to fruit length and width (fruit size) were recorded in raspberry by Callesen (1991). The minimum percentage of malformed panicles was recorded under the treatment $I_1F_3$ (1.91 %) in 2002 while it was minimum in $I_5F_3$ (4.62 %) with mulch during 2003. The reason may be that fertigation maintains balanced supply of nutrients from root zone between flowering to fruit set because imbalanced fertilizers applications aggravates the menace and destabilized the C : N ratio which is also a causative factor for floral malformation. TSS of the fruit was recorded maximum under the treatment $I_8F_1$ (22.93 °B) in 2002 and in 2003 the value was highest in $I_7F_1$ (16.45 °B) higher TSS content in citrus was noted through application of water

Table 3 Effect of fertigation and plastic mulch on nutrient status of the leaves and shelf life of fruits at room temperature

| Treatments | Nitrogen (%) | | Phosphorus (%) | | Potassium (%) | | Avereage total weight loss (g) after 8 days of harvesting at room temperature (25–34°C) 2002-2003 |
|---|---|---|---|---|---|---|---|
| | 2002 | 2003 | 2002 | 2003 | 2002 | 2003 | |
| $I_1F_1$ | 1.50(6.99) | 1.50(7.05) | 0.10(1.82) | 0.11(1.95) | 0.60(4.41) | 0.59(4.42) | 45.33 |
| $I_1F_2$ | 1.53(7.10) | 1.50(7.05) | 0.12(1.96) | 0.13(2.10) | 0.39(3.60) | 0.38(3.54) | 42.66 |
| $I_1F_3$ | 1.37(6.69) | 1.34(6.66) | 0.13(2.06) | 0.13(2.08) | 0.55(4.22) | 0.55(4.25) | 53.00 |
| $I_2F_1$ | 1.40(6.78) | 1.40(6.80) | 0.11(1.90) | 0.12(1.99) | 0.42(3.69) | 0.40(3.64) | 65.66 |
| $I_2F_2$ | 1.50(7.03) | 1.51(7.05) | 0.93(1.74) | 0.85(5.30) | 0.47(3.93) | 0.47(3.94) | 56.00 |
| $I_2F_3$ | 1.57(7.16) | 1.57(7.21) | 0.10(1.85) | 0.10(1.86) | 0.50(4.02) | 0.50(4.08) | 57.33 |
| $I_3F_1$ | 1.30(6.54) | 1.30(6.55) | 0.10(1.83) | 0.10(1.83) | 0.59(4.35) | 0.59(4.40) | 66.00 |
| $I_3F_2$ | 1.43(6.87) | 1.42(6.85) | 0.88(1.70) | 0.85(5.28) | 0.38(3.53) | 0.37(3.50) | 44.00 |
| $I_3F_3$ | 1.53(7.10) | 1.51(7.07) | 0.14(2.17) | 0.14(2.19) | 0.41(3.63) | 0.43(3.77) | 45.33 |
| $I_4F_1$ | 1.27(6.45) | 1.26(6.45) | 0.98(1.80) | 0.96(5.62) | 0.47(3.93) | 0.47(3.93) | 49.00 |
| $I_4F_2$ | 1.37(6.71) | 1.38(6.74) | 0.83(1.63) | 0.83(5.23) | 0.46(3.83) | 0.45(3.87) | 45.00 |
| $I_4F_3$ | 1.33(6.58) | 1.33(6.62) | 0.95(1.77) | 0.95(5.61) | 0.47(3.93) | 0.49(4.01) | 46.33 |
| $I_5F_1$ | 1.33(6.56) | 1.32(6.61) | 0.99(1.79) | 0.96(5.62) | 0.51(4.09) | 0.51(4.10) | 55.00 |
| $I_5F_2$ | 1.57(7.19) | 1.95(7.15) | 0.10(1.84) | 0.11(1.93) | 0.55(4.23) | 0.56(4.28) | 60.33 |
| $I_5F_3$ | 1.57(7.16) | 1.57(7.19) | 0.39(3.17) | 0.37(3.51) | 0.51(4.08) | 0.51(4.12) | 45.66 |
| $I_6F_1$ | 1.07(5.89) | 1.07(5.94) | 0.99(1.80) | 0.97(5.67) | 0.52(4.14) | 0.51(4.10) | 42.66 |
| $I_6F_2$ | 1.47(6.94) | 1.47(6.97) | 0.89(1.71) | 0.90(5.45) | 0.38(3.53) | 0.39(3.59) | 45.00 |
| $I_6F_3$ | 1.10(6.01) | 1.12(6.07) | 0.11(1.93) | 0.10(1.86) | 0.51(4.09) | 0.50(4.05) | 43.33 |
| $I_7F_1$ | 1.07(5.91) | 1.06(5.92) | 0.36(3.10) | 0.36(3.47) | 0.63(4.55) | 0.64(4.60) | 50.66 |
| $I_7F_2$ | 1.33(1.33) | 1.32(6.60) | 0.11(1.86) | 0.13(2.07) | 0.72(4.86) | 0.72(4.87) | 47.00 |
| $I_7F_3$ | 1.30(6.54) | 1.29(6.53) | 0.90(1.72) | 0.91(5.48) | 0.57(4.34) | 0.55(4.27) | 51.00 |
| $I_8F_1$ | 1.40(6.77) | 1.41(6.82) | 0.11(1.89) | 0.12(1.99) | 0.60(4.37) | 0.61(4.47) | 52.33 |
| $I_8F_2$ | 1.70(7.46) | 1.71(7.52) | 0.84(1.66) | 0.83(5.24) | 0.37(4.50) | 0.36(3.45) | 64.66 |
| $I_8F_3$ | 1.47(1.47) | 1.48(6.98) | 0.85(1.66) | 0.82(5.20) | 0.51(4.10) | 0.48(3.98) | 59.00 |
| CD ($P = 0.05$) | | | | | | | |
| a | 0.23(0.57) | 0.015(0.061) | NS | 0.019(0.17) | 0.10(0.40) | 0.015(0.10) | 3.06 |
| b | 0.14(0.35) | 0.024(0.037) | NS | 0.031(0.10) | 0.61(0.25) | 0.025(0.065) | 5.02 |
| a × b | NS | 0.043(0.10) | NS | 0.054(0.30) | NS | 0.044(0.18) | 8.66 |
| SEm± | 17.58(8.95) | 1.87(0.95) | 102.69(30.61) | 6.69(4.96) | 20.97(10.49) | 5.38(2.78) | 10.22 |

a, Irrigation and mulching level; b, fertilizers level used with irrigation water

soluble fertilizers by Koo and Smajstrla (1985) which confirmed the results. Value of β-carotene was recorded maximum in treatment $I_5F_1$ (2.02 and 2.0 mg/100 g of pulp) during 2002 and 2003 respectively. Fertigation in peach increased the vitamin A content as reported by Almela *et al.* (1984) Interactions revealed that irrigation and fertilizer application alone and in combination did not affect the most of the characters. Although β-carotene content and fruit length was significantly affected by these two factors and their interactions during the year 2003 (Table 2).

The irrigation and fertilizer application with or without mulch increased the nutrient status of leaves whether applied singly or in combination with regard to N, P and K during 2002 and 2003. Similar results were obtained in 'Khiew Sawoey' mango (Prasittikhet *et al.* 2000). Average weight loss after 8 days of storage was recorded maximum in the treatment $I_2F_1$ (65.66 g) while it was least in the treatment $I_6F_1$ and $I_1F_2$ (42.66 g). Higher physiological weight loss may be due to the oxidation of stored food material in the fruits of the trees applied with higher level of fertigation with mulch (Table 3).It was concluded that to receive maximum fruit yield with quality fruits, 'Dashehari' mango trees should be provided with 100% followed by 75% fertilizers of recommended doses + 'V' level of irrigation with mulch.

## SUMMARY

Improvement in fruit yield and quality with fertigation and plastic mulch as against the conventional method of application of surface irrigation without mulch was studied in 'Dashehari' mango (*Mangifera indica* L.). Maximum fruit yield, ie 328.33, 273.33 in numbers and 41.18, 44.93 kg/tree was recorded in the treatment combination $I_1F_1$ (drip irrigation at 'V' level with mulch + full dose of fertilizer through fertigation). In the first week of April, May and June, maximum fruit set was observed with different levels of irrigation and mulch ($I_1$ $F_1$, $I_1$ $F_2$ during 2002 and 2003).

Nitrogen, phosphorus and potassium contents of leaves were also significantly influenced by drip irrigation with mulch and different doses of fertilizers including their interaction without any fixed trend. With the treatment combination $I_3F_1$ (drip irrigation at 'V' level without mulch + full dose of fertilizers), maximum β-carotene content, ie 2.02 g, 2.0 g/ 100 g of pulp was recorded during 2002 and 2003 respectively. Average fruit weight ($I_3$ $F_1$ and $I_8$ $F_2$) and fruit volume($I_6$ $F_2$ and $I_7$ $F_1$) were also increased during 2002 and 2003 respectively. To receive maximum fruit yield with quality fruits, 'Dashehari' mango trees should be provided with 100% followed by 75% fertilizers of recommended doses + 'V' level of irrigation with mulch.

## REFERENCES

AOAC. 1970. *Official Methods of Analysis*, 11th edn. Association of Official Agricultural Chemists, Washington DC, USA.

Almela L, Lopez Roca, J R and Madrid, R. 1984. Localized fertigation in Prunus. II. Seasonal evolution of nutrients and photosynthetic pigments in leaves and fruits. *Proceedings of VIth International Colloquium for the Optimization of Plant Nutrition*, pp 713–20.

NHB. 2003. *Horticulture Data Base.* National Horticulture Board, Ministry of Agriculture, Gurgaon, Haryana.

Callesen O. 1991. Drip irrigation and fertigation of raspberry. *Tidsskrift for Planteavl* **95**(4): 411–5.

Cassagnes P. 1982. Contribution to the study of fertigation by microjet on the yield and quality of the fruits of apple cultivar Golden Delicious. *Colloque sur les recherches fruitieres, Resumes des Communications* **21**.

Firake N N and Deolankar K P. 2000. Response of pomegranate to soluble fertilizers through drip. *Journal of Maharashtra Agricultural Universities* **25** (2): 196–7.

Glenn D M. 2000. Physiological effects of incomplete root-zone wetting on plant growth and their implications for irrigation management. Proceedings of the colloquim 'Water management and water relations of horticultural crops', USA. *Hortscience* **35** (6): 1041–3.

Hipps N A. 1992. Fertigation of newly planted 'Queen Cox'/M9 apple trees: establishment, early growth and precocity of cropping. *Journal of Horticultural Science* **67** (1): 25–32.

Konsgrud K L. 1992. Effect of fertigation and soil covering with brown plastic for three apple cultivars. *Norsk Landbruksforsking* **6**(4): 401–12.

Koo R C J and Smajstrla A G. 1985. Effects of trickle irrigation and fertigation on fruit production and juice quality of 'Valencia' orange. *Proceedings of Florida State Society* **97:** 8–10.

Shirgure P S, Srivastava A K, Shyam Singh and Singh S. 2001. Growth, yield and quality of Nagpur mandarin (*Citrus reticulata* Blanco) in relation to irrigation and fertigation. *Indian Journal of Agricultural Sciences* **71** (8) : 547–50.

Snedicor G W and Cochran G W. 1987. *Statistical Method.* Oxford and IBH, New Delhi.

Srinivas K, Reddy B M C, Kumar S S C, Gowda S T, Raghupati H B and Padma P. 2001. Growth,yield and nutrient uptake of Robusta banana in relation to N and K fertigation. *Indian Journal of Horticulture* **58**(4): 287–93.