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Harnessing potential yield of mango (*Mangifera indica* L.) cv. Dashehari by adopting efficient system of planting under Lucknow condition

B. Lal, D. Mishra[1] and P. Barman*

Division of Crop Production,
ICAR–Central Institute for Subtropical Horticulture, Lucknow – 226 101, Uttar Pradesh, India.
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ABSTRACT

A field experiment was conducted to evaluate the impact of planting systems on tree canopy volume and fruit yield in mango cv. Dashehari under Lucknow condition. The treatments were comprised of five planting systems viz., square system (100 plants ha^{-1}), hedgerow system (166 plants ha^{-1}), double hedgerow system (222 plants ha^{-1}), cluster system (178 plants ha^{-1}) and paired row system (133 plants ha^{-1}). The experiment was laid out in a randomized block design with four replications. The pooled data from the year 2004-05 to 2012-13 indicated that, vegetative growth in terms of tree canopy volume was found higher under hedge row and double hedge row system of planting. Maximum cumulative fruit yield and also mean yield were obtained in double hedge row system of planting (55.72 and 6.19 t ha^{-1}, respectively).

Key words: Canopy volume, Mango, Planting systems, Yield.

Mango (*Mangifera indica* L.) is rightly termed as 'King of fruits' in India because of its wide adoptability, delicious taste, high nutritive value, cultural and religious importance. However, poor yield of orchards is also one of the important problems that can be attributed to traditional system of planting with wide tree spacing and the subsequent time lag in filling the allocated tree space. Therefore, minimizing the yield gap by adopting closer spacing along with suitable system of planting could be the major options for enhancing productivity of mango. High density orcharding is a modern method of fruit cultivation involving planting of trees densely, allowing small or dwarf trees with modified canopy for better light interception and distribution and ease of mechanised field operations.

It has been widely used in mango orchards worldwide to sustain higher yield per area, to improve handling and cultural practices, and to reduce cost of cultivation (Oosthuyse, 2009). The square system of planting is the most popular in mango. Medium density plantation and high density plantation in mango can help shorten the gestation period of the crop, while also improving its yield (Jasmine, 2011). Further there is a good scope for establishing dwarf mango varieties in hedge rows for optimal light utilization and easy cultural operations. The terminal-shoots, inflorescences and fruits on such trees will be within easy reach of farm workers and the fruits can be specifically targeted for fungicide or pesticide application. Among North Indian varieties, Dashehari exhibits better performance in terms of fruit set and also it has minimum fruit drop (Bakshi *et al*. 2012). Hence, experiments were conducted in an effort to evolve a suitable system of planting for higher productivityin Dashehari mango.

There are five treatments with four replications having two samples per replication. The experimental design is randomised block design. The treatments were comprised of five planting systems *viz*., square system (100 plants ha^{-1}), hedgerow system (166 plants ha^{-1}), double hedgerow system (222 plants ha^{-1}), cluster system (178 plants ha^{-1}) and paired row system (133 plants ha^{-1}). Plantation was done during the monsoon 2002. During the initial stage, plants were provided training and pruning to make dwarf stature of the plants. Normal planting distance was maintained in square system of planting (10 m x 10 m). Hedge row planting was done by keeping distance between row-to-row and plant to-plant at 10 m and 5 m, respectively and attaining the dwarf stature of plants like hedges bycutting plants down to 45-60cm above the ground with secateurs at one year after planting. In double hedgerow system, two rows of hedges were planted at a distance of 5 m, in which plants were adjusted at 5 m, and the double rows were separated from otherdouble rows by 10 m spacing. In case of paired row system, planting was done in pair of rows, in which each row was separated from other by 5 m, plants within the row was separated by 10 m, and each pair of rows was separated from other by 10 m. In cluster system, planting was done in row of clusters, in which each row was separated from other by 10 m, each cluster within the row was separated by 10 m, and four plants were accommodated at each cluster at a spacing of 5 m x 5 m. Fruiting started from fourth year on wards. Observations on plant height, canopy spread (North-South & East-West orientation) were recorded from 2004-05 to 2012-13 and tree

*Corresponding author's e-mail: prananath.india@gmail.com
[1] ICAR– Indian Institute of Farming Systems Research, Modipuram – 250 110, U.P., India.

canopy volume was calculated as per the formula of Castle (1983). Fruit yield were also recorded from 2004-05 to 2012-13 and pooled mean were obtained.

The experimental data revealed increase in tree canopy volume, with span of time, regardless of system of planting. The cumulative and mean canopy volume over the period of nine years from 2004-05 to 2012-13 were maximum in hedge row system of planting (68.05 and 7.56 m^3 $tree^{-1}$, respectively) followed by and double hedge row system of planting (63.79 and 7.09 m^3 $tree^{-1}$, respectively), while minimum values were recorded in paired row system of planting (59.06 and 6.56 m^3 $tree^{-1}$, respectively) and square system of planting (59.73 and 6.64 m^3 $tree^{-1}$, respectively) (Fig. 1 & 3). Generally crown development has a linear relationship with tree spacing, indicating competition amongst trees for below ground resources (water and nutrients) at

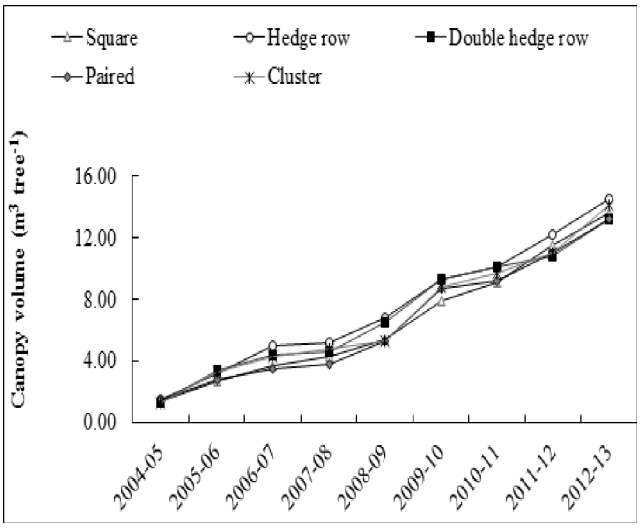

Fig. 1: Tree canopy voume of high density cum system of planting in mango cv Dashehari

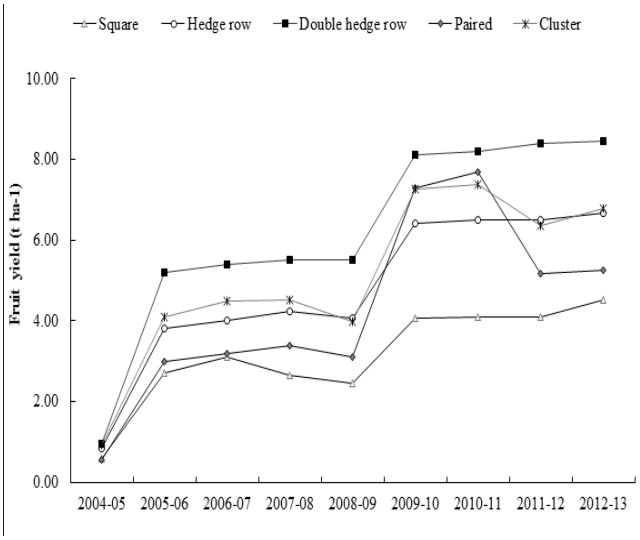

Fig. 2: Fruit yield of high density cum system of planting in mango cv Dashehari

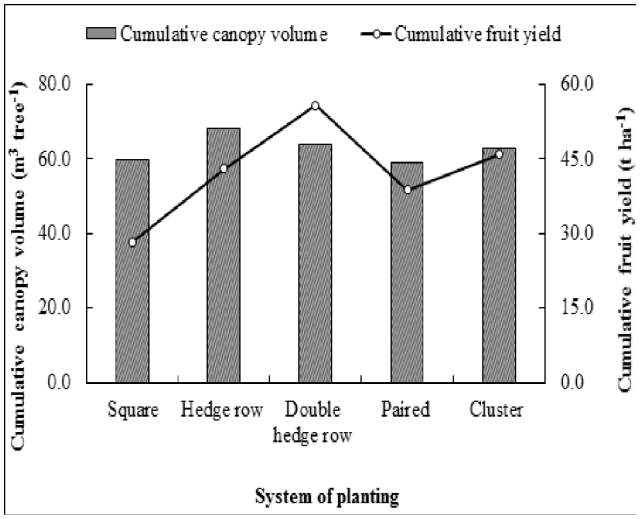

Fig. 3: Cumulative canopy volume and cumulative fruit yield of high density cum system of planting in mango cv Dashehari

closer spacing, however, in present study, hedge row and double hedge row system of planting had higher canopy volume, which could be attributed to the fact that plants in closer spacing had the tendency to grow tall with less lateral growth and plant became columnar in shape due to poor light interception or shading effect (Dalal *et al*. 2013). Maximum cumulative fruit yield and also mean yield were obtained in double hedge row system of planting (55.72 and 6.19 t ha^{-1}, respectively), while minimum values were recorded in square system of planting (28.24 and 3.14 t ha^{-1}, respectively) (Fig. 2 & 3). Though in case of lower plant densities, limited competition existed among plants for sunlight and nutrients, however, yield was decreased due to the lack of the number of plants per unit area. Thus it was observed that yield on hectare basis increased with increasing plant population during all years. This may be because under wider spacing plant has comparatively higher vegetation, high leaf fruit ratio. Trees with bigger vegetative dimension normally give larger number of fruit per tree. However, if productivity per unit area basis is considered, it is clear that yield per ha had given significantly higher yield under closest spacing due to higher plant population per unit area. The results clearly revealed that accommodation of more plant population in closest spacing led to almost more production than wider spacing. Such an increase in production through higher number of plants per unit area has been demonstrated in fruit trees by various authors (Beyhan, 2007; Nath *et al*. 2007; Rathor *et al*. 2003).

It is concluded from above studies that double hedge row system of planting technology can be transferred to the farmers through extension agencies so that they can adopt the spacing of 5m x 5m within double rows and 10m between successive double rows, thus accommodating 222 plants ha^{-1} in mango cv. Dashehari under Lucknow condition for maximising fruit yield. It is also evident from the findings that closely spaced trees yielded significantly higher fruits per unit area than wider spacing during both the season.

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