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EFFECT OF PRUNING ON ROOT DISTRIBUTION IN GUAVA CV. ALLAHABAD SAFEDA UNDER ULTRA HIGH DENSITY ORCHARDING SYSTEM

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ABSTRACT

Investigations were carried out during 2009-10 at ICAR RCER, Research Centre, Ranchi, Jharkhand, India to study the effect of shoot pruning on pattern of root distribution in guava plants of cv. Allahabad Safeda in ultra-high density planting growing under alfisols of eastern India. Root samples were collected from rhizosphere of guava plants treated with six different pruning treatment during the previous two years. The pruning treatments consisted of combinations of different time of pruning (pruning once in May, Pruning once in October and pruning thrice a year in March, May and October) and different levels of pruning (pruning to 60% of canopy height, pruning to 80% of canopy height and pruning to 50% shoot length) and control (no pruning). Root samples were collected from two different depths of soil (0-15 cm and 15-30 cm) at the distances of 30 cm and 60 cm from trunk. Different pruning treatments differed significantly with respect to total weight of Grade-3 roots (diameter > 3mm) and pruning to 50% of shoot length, thrice a year resulted in significant reduction in the total weight of Grade-3 roots. Significant effect of different treatments could be recorded only in case of content of grade-3 roots at a distance of 30 cm from trunk at both the soil depths, total weight of Grade 3 roots at a distance of 30 cm from trunk, total weight of root at a distance of 30 cm from trunk and total root weight at a soil depth of 0-15 cm. With respect to root weight at 0-15 cm soil depth at a distance of 30 cm from the trunk, pruning thrice a year to 50% of shoot length resulted in the minimum weight of Grade-3 roots. Hence the study clearly indicated a drastic reduction in the partitioning of biomass towards root thickening in case of the treatment, pruning thrice a year to 50% of shoot length which resulted in the maximum fruit yield per plant.

Key words: Guava, Root distribution, Pruning, High density planting

Guava (*Psidium guajava*) is an important traditional guava growing region. However low fruit crop which is successfully grown over a productivity of guava plants owing to low soil range of climatic conditions due to its wide fertility, makes guava orcharding unprofitable adaptability. The Chotanagpur region of Eastern under traditional system (planted at a spacing of plateau and hills agro-climatic zone has been a 5 x 5m accommodating 400 plants per ha).

Pruning is one of the most effective strategies for the improvement of yield and control of plant size of this crop. Beneficial effects of pruning on yield and fruit quality of guava have been reported by various workers (9,17,3,20,4,5). Guava, being a current season bearing plant, responds favourably to different pruning practices. This growth behaviour of guava provides opportunity for planting under high density orcharding and harvesting maximum yield per unit area by means of control of plant vigor by different pruning treatments. Ultra-high density orcharding is a system of planting the plants at a closer spacing (1m× 2m) in order to accommodate relatively larger number of plants per unit area (5000plants/ha). Keeping this in view, an experiment was conducted to standardise time and level of pruning of guava plants planted under ultra high density orcharding.

A proper knowledge of root distribution pattern is important for standardization of methods of fertilizer application in any fruit crops. A meager number of research work have been undertaken to study root distribution pattern in guava (6,18,22,19,1). Altered root distribution under closer planting system have been reported in different fruit crops (12,13,14,15). Reduction in root biomass as a result of pruning has been reported in different crops. (21) have reported alteration in the partitioning of root biomass among different root classes as a result of pruning in grape. At present, no information is available on effect of shoot pruning on root distribution of guava particularly under ultra-high density orcharding. Keeping this in view, an investigation was undertaken to study the effect of shoot pruning on pattern of root distribution in guava plants of cv. Allahabad Safeda in ultra high density planting growing under alfisols of eastern India.

MATERIALS AND METHODS

The investigations were carried out at ICAR Research Complex for Eastern region Research center, Plandu, Ranchi, Jharkhand during 2009-10. The soil of the experimental site was with pH 4.8-5.2, organic carbon 0.37-0.45%, available nitrogen 250-290 kg/ha, available phosphorus 7.1-11.0 kg/ha and available potassium 150-165kg/ha. The study was conducted in four years old guava plants (cv. Allahabad Safeda) planted under ultra high density orcharding system (2 m x 1 m). Root samples were collected from rhizosphere of guava plants treated with six different pruning treatment during the previous two years. The pruning treatments consisted of combinations of different time of pruning (pruning once in May, Pruning once in October and pruning thrice a year in March, May and October) and different levels of pruning (pruning to 60% of canopy height, pruning to 80% of canopy height and pruning to 50% shoot length) and control (no pruning). The treatments were imposed in four replications with 12 plants per replication. Root samples were collected by inserting a core sampler (diameter 6.25cm) vertically downwards at the distance of 30 cm and 60 cm. Root samples were collected from two different depths of soil (0-15 cm and 15-30 cm) at the distances of 30 cm and 60 cm from trunk. The collected samples were washed through sieve to separate the roots from the soil particles. After air drying, the root samples were separated into different grades under laboratory conditions based on root diameter viz. Grade-1 (diameter <1mm), Grade-2 (diameter 1-3 mm) and Grade-3 (diameter >3 mm) and then root biomass was measured. Hence, the root weight for each sample indicated total root weight per 3683 cc volume of soil. The data were subjected to Analysis of variance.

RESULTS AND DISCUSSION

Bringing about a balance in the root:shoot ratio can be attributed to one of the reasons of pruning effects on plants. Alteration in rooting behavior in response to pruning have been observed in crops like apple and plum (Head, 1967) and pear (Head, 1968). In the present investigation, the different pruning treatments differed significantly with respect to total weight of Grade-3 roots (diameter > 3mm) whereas the treatmental effects were non-significant with respect to total weight of other grades of roots. As evident in Fig. 1, pruning to 50% of shoot length, thrice a year resulted in significant reduction in the total weight of Grade-3 roots whereas the weight of Grade-3 roots in other treatments were at par. Data on effect of pruning on distribution of different grades of roots of guava cv. Allahabad Safeda is given in table 1. As evident from the table, significant effect of different treatments could be recorded only in case of content of grade-3 roots at a distance of 30 cm from trunk at both the soil depths, total weight of Grade 3 roots at a distance of 30 cm from trunk, total weight of root at a distance of 30 cm from trunk and total root weight at a soil depth of 0-15 cm. With respect to root weight at 0-15 cm soil depth at a distance of 30 cm from the trunk, pruning thrice a year to 50% of shoot length resulted in the minimum weight of Grade-3 roots which was at par with pruning to 60% of canopy in October, control (no pruning) and pruning to 80% of canopy in May. Pruning to 80% of the canopy in October resulted in the maximum weight of Grade-3 roots at 0-15 cm soil depth at a distance of 30 cm from the trunk. With respect to weight of grade 3 root at 15-30 cm soil depth at a distance of 30 cm from the trunk, the maximum root weight was recorded in case of pruning to 80% of the canopy in May. Pruning thrice a year to 50% of shoot length and control resulted in significantly lower weight of Grade 3 roots at

15-30 cm soil depth at a distance of 30 cm from the trunk than the other treatments.

The maximum total root weight at a distance of 30 cm from the trunk was recorded in case of pruning to 60% of canopy height in May which was at par with pruning to 80% of canopy in May and pruning to 80% of canopy in October. The minimum value was recorded in case of pruning thrice a year to 50% of shoot length. With respect to total root weight at a soil depth of 0-15 cm, the minimum value was recorded in case of pruning thrice a year to 50% of shoot length and all the other treatments recorded significantly higher root weight and were at par with each other. Hence the study clearly indicated a drastic reduction in the partitioning of biomass towards root thickening in case of the treatment, pruning thrice a year to 50% of shoot length. Although, all roots in tree crops, rather than just those newly produced are apparently effective in absorption of nutrient and water (21) have classified roots of diameter > 2 mm as conducting roots. Reduction in root dry weight in response to shoot pruning have been reported by several workers (12,10,16). Slavtcheva and Pourtchev (2003) reported increased dry root mass of feeding roots ($d < 2$ mm) of grape with heavier pruning and increased amount of conducting roots ($d > 2$ mm) with lighter pruning. The process of root thickening can be considered as an in-built mechanism in the plant for storage of assimilates. A look at the yield pattern obtained in case of different pruning treatments (Fig. 2) indicated greater amount of partitioning of biomass towards fruit yield in case of the treatment, pruning thrice a year to 50% of shoot length. Non-significant difference among the treatments with respect to total root biomass also substantiate to the hypothesis of shift in the biomass partitioning towards fruit yield than root development in case of the treatment pruning thrice a year to 50% of shoot length.

Fig. 1. Effect of pruning on total weight of >3mm diameter root of guava cv. Allahabad Safeda under ultra high density planting

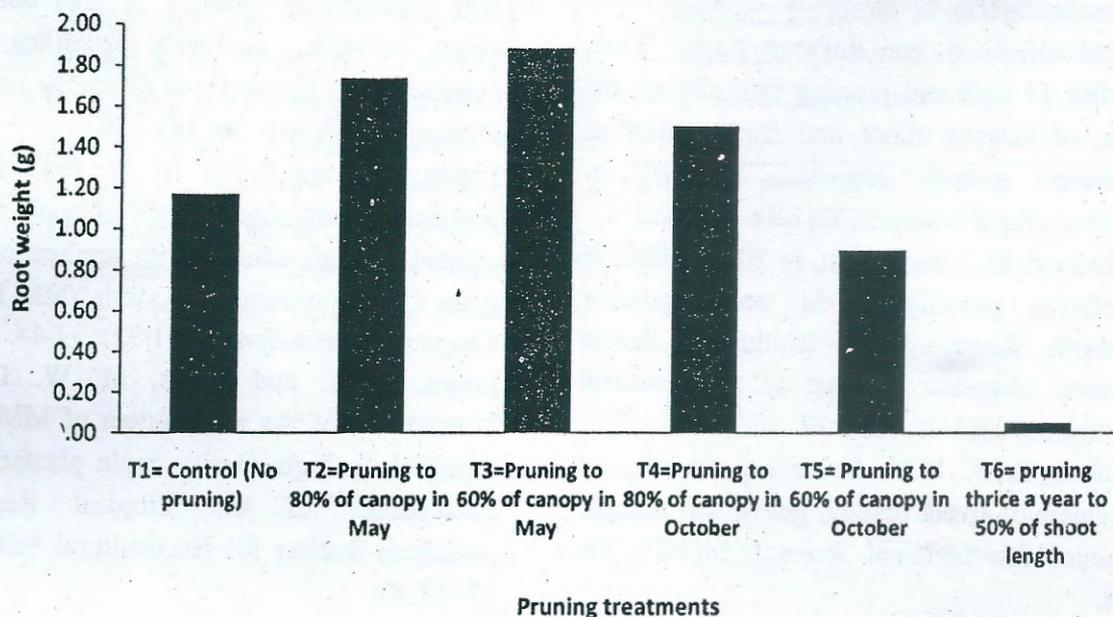
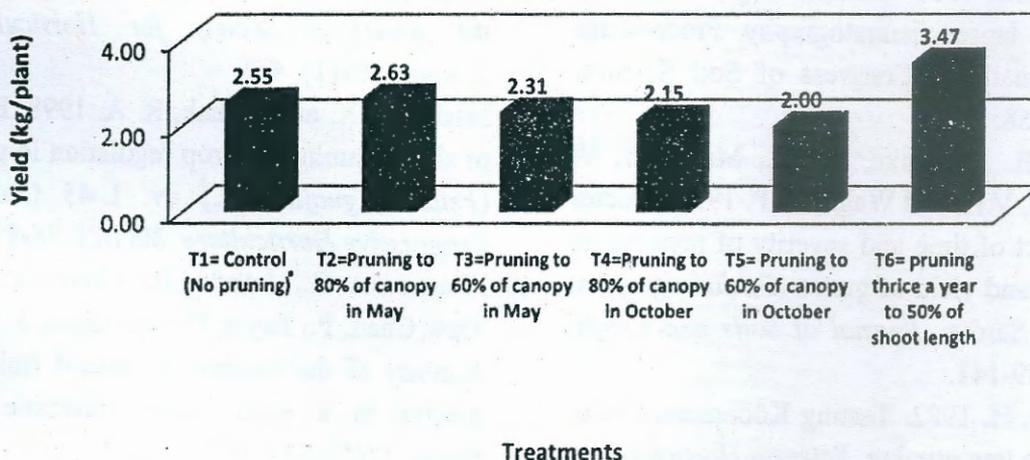


Fig. 2. Effect of truning on yield of guava (kg/plant) under ultra-high density orcharding



REFERENCES

1. Bassoi, L. H., Mourae Silva, J. A., Silva, E. E.G. da, Ferreira, M. de N. L., Maia, J.L.T. and Targino, E. de L. 2002. Information on root distribution of guava for management of irrigation. *Comunicado Tecnico da Embrapa Semi Arido*. (111): 4.
2. Boswell, S. B., McCarty, C. D., Hench, K. W. and Lewis, L. N. 1975. Effect of tree density in the first ten years of growth and production of 'Washington' navel orange trees. *Journal of the American Society for Horticultural Science*. 100(4): 370-373.

3. Dhaliwal, G.S., Rattanpal, H.S. and Gill, H.S. 2000. Effect of time and severity of pruning on cropping and physico-chemical properties of Sardar guava. *Haryana Journal of Horticultural Sciences*. 29(1/2): 17-20.
4. Dhaliwal, G. S. and Rajwant Kaur. 2003. Effect of time and pruning intensity on the age of bearing shoot and fruit quality of 'Sardar' guava. *Haryana Journal of Horticultural Sciences*. 32(1/2): 21-24.
5. Dhaliwal, G.S. and Singh, S. 2004. Effect of different pruning levels on vegetative growth, flowering and fruiting in Sardar guava. *Haryana Journal of Horticultural Sciences*. 33(3/4): 175-177.
6. Ghosh, S. P. 1974. Some aspects of root systems of sweet orange, guava and mango. *Punjab Horticultural Journal*. 14(1/2): 34-38.
7. Head, G.C. 1967. Effect of seasonal changes in the quantity of white unsuberized roots in fruit trees. *Journal of Horticultural Science*. 41:197-206.
8. Head, G.C. 1968. Studies of growing roots by time lapse cinematography. *Proceedings of International Congress of Soil Science*. 1:751-758.
9. Jadhao, B. J., Damke, M. M., Mahorkar, V. K., Dod, V.N. and Wagh, A. P. 1998. Studies on effect of time and severity of pruning on growth and yield of guava (*Psidium guajava* L.) cv. Sardar. *Journal of Soils and Crops*. 8(2): 139-141.
10. Jonkers, H. 1982. Testing Koopmann's rules of apple tree pruning. *Scientia Horticulturae*. 16(3): 209-215.
11. Kalinovskaya, T. L. 1975. Development of the root system in palmette trained apple trees in relation to spacing and fertilizer rates. *Trudy Kishinevskogo Sel' skokhozyaistvennogo Instituta*. 135: 69-72.
12. Kolesnikov, V. A., Nikitochkina, T. D. and Zharkova, I. V. 1974. The effect of rejuvenation pruning on the growth and development of black currant shoots and roots. *Izvestiya Timiryazevskoi Sel' skokhozyaistvennoi Akademii*. (5): 129-138.
13. Lazar, A., Pop, A. and Lazaroiu, P. 1983. Soil management systems in high density apple orchards. *Lucrarile Stiintifice ale Institutului de Cercetare si Productie pentru Pomicultura Pitesti*. 10: 143-156.
14. Lopez, J. A. and Borys, M. W. 1981. Root distribution and shoot length of apple trees planted at high density with application of Alar (local selection "Rayada"/MM.106). *Chapingo Nueva Epoca*. (31/32): 39-44.
15. Lopez, J. A. and Borys, M. W. 1986. Distribution of the root system of MM.106 rootstock in high density apple plantations. *Proceedings of the Tropical Region, American Society for Horticultural Science*. 23: 37-40.
16. Myers, S. C. and Ferree, D. C. 1983. Influence of summer pruning and tree orientation on net photosynthesis, transpiration, shoot growth, and dry-weight distribution in young apple trees. *Journal of the American Society for Horticultural Science*. 108(1): 4-9.
17. Mishra, H.K. and Pathak, R. A. 1998. Effect of shoot pruning on crop regulation in guava (*Psidium guajava* L.) cv. L-45 (Sardar). *Progressive Horticulture*. 30(1/2): 78-81.
18. Moutounet, B., Aubert, B., Gousseland, J., Tiaw Chan, P., Payet, O. and Joson, J. 1975. A study of the rooting of several fruit tree species in a deep brown ferrallitic soil. *Fruits*. 32(5): 321-333.
19. Patil, P. V. and Patil, V. K. 1999. Influence of different soil water regimes on root distribution in guava. *Journal of Maharashtra Agricultural Universities*. 24(1): 45-47.
20. Singh, A.K. and Singh, G. 2001. Influence of pruning date on fruit quality of guava (*Psidium guajava* L.). *Journal of Applied Horticulture Lucknow*. 3(2): 100-102.

21. Slavtcheva, T. and Pourtchev, P. 2003. Root system development with cv Dimiat grapevines planted on leached chernozem in relation to the pruning. *Pochvoznanie, Agrokimiya I Ekologiya*. 38(3): 49-53.
22. Thakur, R. S., Rajput, M. S. and Srivastava, K. C. 1981. Root distribution studies in some fruit crops with special reference to tracer technique -- a review. *Haryana Journal of Horticultural Sciences*. 10(1/2): 45-53.
23. Williamson, J. G., Coston, D. C. and Cornell, J. A. 1992. Root restriction affects shoot development of peach in a high-density orchard. *Journal of the American Society for Horticultural Science*. 117(3): 362-367.
24. Yadukumar, N., Rao, E. V. V. B. and Mohan, E. 2001. High density planting of cashew (*Anacardium occidentale* L.). *Tropical Agriculture*. 78(1): 19-28.

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