Optimization of canopy management and training systems in Phalsa (*Grewia subinaequalis* Lin.) under semi-arid zone

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ABSTRACT : The experiment was conducted on multipurpose fruit plant in department of horticulture at Chandra Shekhar Azad University of Agricultural and Technology, Kanpur (India) with an objective to optimize the canopy management and training system to achieve sustainable produce. Canopy of plants was headed back in different heights (CM_0 = Control, CM_1 = 50 cm, CM_2 =100 cm and CM_3 = 150 cm) and plants trained with two training systems (Single shoot and Multi shoots system). Phalsa bush topped at 100 cm above ground with single and multi-shoot training system (CM_2 T_1 and CM_2 T_2) have increased significantly all the vegetative growth parameters of plant height, average plant spread, pruned dry shoot biomass, pruned dry leaf biomass and fruit yield by 23.4 & 25 %, 12.74 & 17.19%, 11.08 & 14.66 %, 18.51 & 25.5% and 25.54 & 43.26%, respectively as compare to control. Nutrients added to the field as total nitrogen, phosphorus, potash, calcium and magnesium was recorded as 9.52 & 11.62, 0.73 & 0.90, 3.54 & 4.32, 3.26 & 3.98 and 3.26 & 3.98 kg.ha^{-1} under CM_2 T_1 & CM_2 T_2 treatments, respectively whereas lowest values of total nutrients added back to the soil were observed in control treatments.

Key words: Canopy management, fruit yield, nutrients buildup, training system and vegetative growth.

Phalsa (*Grewia subinequalis* Lin.) is a multipurpose bush and is mainly known for fruits but also mitigate the requirement of fodder, fuel, etc. It is an under utilized fruit species and can be grown successfully on wastelands with least investment under rainfed conditions. It bears small pinkish fruits called berry, which is used as medicinal and in processing as sharbat and squash. It is a perishable fruit which limits its production around cities and towns. Its productivity can be improved through canopy management as well as training system. The present study was initiated with objective to optimize canopy management with training system for improved growth, fruit yield and nutrients recycling in Phalsa (*Grewia subinequalis* L.) under semi-arid zone.

The study was conducted in division of horticulture at Chandra Shekhar Azad University of Agricultural and Technology, Kanpur (India) located between latitude 25.26^0 and 26.38^0 NS and longitude 79.31^0 and 80.34^0 SW at 179 average mean sea level. The average rainfall was 850 mm and maximum and minimum temperature varies from 42.7 and 12.2 ^{0}C, respectively. Physical and chemical properties of soil at sites were : pH 7.9, E.C. 5 dS/m, available nitrogen (101 kg ha^{-1}), phosphorus (81 kg ha^{-1}) and potash (127 kg ha^{-1}). Plants were established during rainy season in 1999 at 2 x 2 m in the square system. Organic manure @ 10 kg and inorganic fertilizers @ 100:40:60 g NPK bush^{-1} were applied in two split doses in the month of February – March and September-October. Phalsa bushes were managed by topping of shoots at the age of four years at various heights from ground level. Leaf biomass was incorporated back in to the soil as mulch. Treatments employed were four levels of canopy managements through heading back (CM_0 = Control, CM_1 = 50 cm, CM_2 =100 cm and CM_3 = 150 cm) and two systems of training as T_1 = Single shoot system and T_2 = Multi shoots system. Treatments laid in a factorial randomized block design with four replications. The experimental unit was comprises of four bushes in each treatment. Total nitrogen, phosphorus, potash, calcium and magnesium in pruned leaf biomass of phalsa were 3.5, 0.27, 1.3, 1.2 and 1.2%, respectively. The observations were recorded from experimental unit in each treatment at weekly interval on plant height, plant spread, collar diameter, fruit yield and pruned leaf biomass All the bushes received uniform cultural and management practices like weeding, chemical sprayings, watering, fertilizer application etc except canopy management and training system.

Data depicted in Table 1 reveal that vegetative growth parameters and fruit yield (plant height, plant spread, collar diameter, pruned dry shoot and leaf biomass) enhanced significantly by interaction of canopy management practices and training systems. The maximum plant height (4.08 m and 4.20 m), average plant spread (2.39 and 3.34 m), collar diameter (29 and 34 cm), pruned dry shoot biomass harvested (7.82 and 10.79 t.ha^{-1}), pruned dry leaf biomass added to the field (2.72 and 3.32 t.ha^{-1}) and fruit yield (4.08 and 5.10 kg bush^{-1}) were observed in treatments of CM_2 T_1 and CM_2 T_2 treatment followed by CM_3 T_1 and CM_3T_2, respectively whereas minimum plant height (3.25 m and 3.36 m), average plant spread (2.12 and 2.85 m), collar diameter (17 and 25 cm), pruned

Table 1. Effect of canopy management and training systems on growth parameters and fruit yield of phalsa.

Treatments	Plant height (m)		Average plant spread (m)		Collar dia. (cm)		Pruned shoot dry biomass (t.ha^{-1})		Pruned dry leave biomass (t.ha^{-1})		Fruit yield (kg.bush^{-1})	
	T_1	T_2	T_1	T_2	T_1	T_2	T_1	T_2	T_1	T_2	T_1	T_2
CM_0	3.20	3.36	2.12	2.85	17	25	7.04	9.41	2.15	2.81	3.25	3.56
CM_1	3.35	3.65	2.22	3.01	23	30	7.24	9.85	2.43	2.95	3.55	3.95
CM_2	3.95	4.20	2.39	3.34	29	34	7.82	10.79	2.72	3.32	4.08	5.10
CM_3	3.46	3.91	2.30	3.10	24	29	7.27	9.95	2.49	3.05	3.76	4.09
CD at 5%	0.24	0.45	0.23	0.29	6.0	7.0	1.5	2.0	0.12	0.29	0.32	0.45

T_1=Single shoot system and T_2=Multi shoot system

dry shoot biomass (7.04 and 9.41 t .ha^{-1}), pruned dry leaf biomass (2.15 and 2.81 t.ha^{-1}) and fruit yield (3.25 and 3.56 kg. bush^{-1}) were recorded in bush under CM_0 T_1 and CM_0 T_2. Plant height, plant spread, pruned dry shoot biomass, pruned dry leaf biomass and fruit yield was increased by 23.4 & 25%, 12.74 & 17.19%, 11.08 & 14.66%, 18.51 & 25.5% and 25.54 & 43.26%, respectively as compare to control. This is probably due to good vegetative growth in term of plant height, collar diameter bush spread and more recycling of pruned material along with leaf litter fall to bushes encouraging more supply of nutrients, growth and more food material in the shoots; which gave rise to maximum number of shoot in bush having canopy managed at 100 cm plant height as compare to all other levels of canopy management. Tomkins and Shaulis (1988) reported in grape that cane of large size has greater capacity to manufacture more food than small or weak cane. Kumar and Reddy (2001) have also given similar findings in grape with alternate pruning at Banglore conditions. Denial (2002) has also said that in phalsa fruit yield increased by pruning.

Data presented (Table 2) reveals that nutrients (N, P, K, Ca and Mg) added back to the field improved significantly by interaction of different canopy management practices and training systems. Maximum nutrients added to the field as total nitrogen, phosphorus, potash, calcium and magnesium was recorded 9.52 & 11.62, 0.73 & 0.90, 3.54 & 4.32, 3.26 & 3.98 and 3.26 & 3.98 kg.ha^{-1} with treatments of CM_2 T_1 & CM_2 T_2, respectively followed by CM_3T_1 & CM_3T_2 and CM_1T_1 & CM_1 T_2 whereas, lowest values of total nutrients added back to the soil were observed in bushes received canopy management with CM_0T_1 & CM_0T_2 treatments. Canopy management at 100 cm in bushes trained in single and multi shoot system have added maximum nutrients like total nitrogen, phosphorus, potash, calcium and magnesium through pruned dry leaf biomass including leaf litter fall in to the soil. This not only improves fertility status of the soil but also improve porosity, bulk density and other physical properties of the soil after decomposition. Carl *et.al.* (1979) reported that biomass addition in the form of litter fall improved soil properties and fertility status through nutrients released in to the soil. Das et. al. (1997) also endorsed that litter fall and nutrient returned back to the soil improved physical, biological properties and fertility status of soil.

It can be concluded that interaction of canopy management at 100 cm above the ground level and training with multi shoot system (CM_2T_2) improved the vegetative growth and added back more nutrients to the soil through pruned materials and leaf litterfall. This resulted in significant increase in fruit yield and its contributing characters.

Table 2. Effect of canopy management and training systems on nutrients recycled by pruned leaf biomass in the field (kg.ha^{-1}).

Treatments	Nutrients recycled (kg.ha^{-1})									
	Total N		Total P		Total K		Ca++		Mg++	
	T_1	T_2	T_1	T_2	T_1	T_2	T_1	T_2	T_1	T_2
Cm_0	7.53	9.84	0.58	0.76	2.80	3.65	2.58	3.37	2.58	3.37
CM_1	8.51	10.33	0.66	0.80	3.16	3.84	2.92	3.59	2.92	3.59
Cm_2	9.52	11.62	0.73	0.90	3.54	4.32	3.26	3.98	3.26	3.98
Cm_3	8.72	10.68	0.67	0.82	3.24	3.97	2.99	3.66	2.99	3.66
CD at 5%	1.4	3.5	0.02	0.05	0.82	0.99	0.23	0.20	0.23	0.20

T_1=Single shoot system and T_2=Multi shoot system

REFERENCES

Balkrishanan, R. 1998. Effect of severity of pruning on growth, flowering, yield and fruit quality of grape (*Vitis vinifera* L.). *South Indian Hort.*, 11: 143-44.

Danial, S.S. 2002. Influence of pruning severity on fruit bud initiation & method for estimating fruit potential. *Madras agril. J.* 52:364-65

Kumar, B.P. and Reddy, Y.N. 2001. Effect of alternate pruning on yield and quality of phalsa (*Grewia asiatica* L.) under Bangalore conditions. *Indian J. Hort.*, 54 (1): 14-18.

Tomkins, J. and Shaulis, N. 1988. The Catawa grape in New York. Some fruiting characteristics of the cane on shoot. Proc. Amer. Soc. *Hort. Sci.* 66: 209-213.

Carl L. Frederick B. Turner, Richard Castetter, 1979. Biomass and litter fall from shrubs in the Northern Mojave Desert. *Ecology*: Vol. 60, No. 5, pp. 891-900.

Das, D.K., Chaturvedi, O.P. and Jha, A.N. 1997. Litter fall and nutrient return in 4- year- old plantations of different tree species in North Bihar. *J. Trop. For.* 13:19-24.