ISSN: 0974 - 0376

The Ecoscan : Special issue, Vol. IX: 609-613: 2016
AN INTERNATIONAL QUARTERLY JOURNAL OF ENVIRONMENTAL SCIENCES
www.theecoscan.com

EFFECT OF PRUNING AND CHLORMEQUATE CHLORIDE (CCC) ON PLANT GROWTH, YIELD AND FRUIT QUALITY OF PHALSA (*GREWIA SUBINAEQUALIS* L.)

Mahendra Bairwa *et al.,*

KEYWORDS

Grewia
Subinaequalis
Chlormequate Chloride
Pruning

Proceedings of National Conference on Harmony with Nature in Context of Resource Conservation and Climate Change
(HARMONY - 2016)
October 22 - 24, 2016, Hazaribag,
organized by
Department of Zoology, Botany, Biotechnology & Geology
Vinoba Bhave University,
Hazaribag (Jharkhand) 825301
in association with
National Environmentalists Association, India
www.neaindia.org

The Ecoscan
AN INTERNATIONAL QUARTERLY JOURNAL OF ENVIRONMENTAL SCIENCES

MAHENDRA BAIRWA*[1], S. SARAVANAN[1], SANDEEP SINGH[1], SURESH YADAV[1]AND PRAVIN SINGH[2]
[1]Department of Horticulture, Allahabad School of Agricultur,
Sam Higginbottom Institute of Agriculture, Technology and Sciences,(Deemed-To-Be-University)Allahabad - 211 007 (U.P.)
[2]Department of Vegetable Science,
College of Horticulture and Forestry (Agriculture University, Kota) Jhalawar - 326 023 (Rajasthan), INDIA
e-mail: mahendraphd102@gmail.com

ABSTRACT

A field experiment was conducted to study the effect of pruning and foliar application of chlormequate chloride on plant growth, yield and fruit quality of phalsa during 2013-14. The experiments was consisted twelve treatments of two levels of pruning (50 and 75 cm) and three level of chlormequate chloride (1500, 2000, and 2500 ppm) laid out in Randomized Block Design with thrice replication. The application of treatment T_8 (Pruning-50 cm + Chlormequate chloride-2500 ppm) decreased the days to sprouting of shoots (18.34), maximum number of shoots/ plant at 60 days (24.67), shoot length at 60 days (145.00 cm), day taken to first flowering (77.33), number of fruiting nodes per shoot (17.00), number of fruits per node (9.33), fruit yield per plant (3.55 kg), Total soluble solids (21.40 %), yield per hector (56.80 q). as compare to other treatments. Further, the treatment T_8 (Pruning-50cm + Chlormequate chloride- 2500 ppm) gave the maximum net return (Rs. 4, 94, 277/ha) and B: C ratio (7.70).From the study it was concluded that treatment of Pruning-50 cm + Chlormequate chloride- 2500 ppm was found most effective on phalsa plants.

***Corresponding author**

INTRODUCTION

Phalsa (*Grewia subinaequalis* L.) which is also known as star apple is a subtropical fruit of India. It belongs to the family "Tiliaceae". This family has about 41 genera and 400 species which are mostly distributed in the tropical and subtropical region of the world. In India, it is commercially grown in Punjab, Haryana, Rajsthan, Uttar Pradesh and Madhya Pradesh. Besides these states, it is also cultivated on limited scale in the states of Maharashtra, Gujarat, Andhra Pradesh, Bihar and West Bengal. An unripe phalsa fruit alleviates inflammation and is administered in respiratory, cardiac and blood disorders, as well as in fever reduction. Ripe fruits of Phalsa are consumed fresh, as desserts, or processed into refreshing fruit and soft drinks enjoyed in India during hot summer months as it has cooling tonic and aphrodisiac effects which overcomes thirst and sensation as well as they are rich source of vitamin A and C with fair amount of minerals major being Phosphorus and Iron. Fruit contains 50-60 per cent juice, 10-11 per cent sugar and 2- 2.5 per cent acid (Morton, 1987 and Kumar, *et al.,* 2014). Phalsa plant is small bushy and hardy in nature and preferred as an ideal crop for growing in hot and arid regions. It is also preferred for dry land horticulture and silvihorticulture. Some of the problems which restrict its popularity are uneven ripening; small fruits and high perish ability of fruits. A balanced fertilization comparing both of macro and micro nutrients can well enhance yield potential of phalsa bushes. Considering the importance of phalsa there is dire need to initiate the nutrient management and pruning intensity programmers to increased vegetative growth, fruit size, uniform ripening, fruit yield and quality of phalsa. It has been found that tall-growing wild phalsa plants produce fruits which are of marginal quality and are not relished by most consumers. While low-growing dwarf or bushy type of phalsa plants, which develop a good blend of sugar and acid in the fruit flesh, are preferred for cultivation (Hays, 1953). Phalsa bears fruit on current season's growth and for good yield; there is a need for regular annual pruning to cut the old growth and to enhance the new growth. Hence, a regular annual pruning is necessary to induce a good healthy growth which will provide maximum fruit bearing area on the tree. Pruning is an essential operation to maintain vigour of trees, fruit productivity and quality of ber (Singh *et al.,* 2004). Moreover, annual pruning is required to replace old and unproductive wood by new one, in unpruned trees, the old wood goes on accumulating every year and leads to barren centre, reduced productivity and poor fruit quality owing to shading and related problems. It is essential practice to maintain their vigour and productivity as well as to improve the fruit size and fruit quality (Ghosal, 2013 and Singh and Sharma, 1961). The objective of pruning is to produce more number of fruits with high quality marketable fruits at a low cost. Apart from these, pruning also lead to rejuvenation, better ventilation and higher penetration of sun light and also become feasible in application of plant protection chemicals (Bakhshi *et al.,* 1997).

Phalsa is generally grown on poor lands where nutrient availability is limited. Under these circumstances, it would be better with foliar feeding of vital nutrient for sustaining the plant against any nutrient deficiency. The foliar application of nutrient

is considered beneficial when growing soil fail to support plant growth and yield.In recent years, scientists have given attention to the idea of regulating plant growth as third most important factor in improving the growth, yield and quality with the application of plant growth substances in various ways (Cathey, 1964).Chlormequat is a quartemary ammonium plant growth retardant, which inhibits intemode elongation in plants without inhibiting the function of the apical meristem and without causing loss of apical dominance (Tolbert, 1960). It helps in efficient utilization of metabolites in certain physiological process going in plant systems. The role of cycocel has been found to retard the plant height by reducing inter nodal length and simultaneously induce the formation of lateral shoots thereby, plant possess more number of fruit bearing shoots. Sarmah *et al.,* 2009 reported that foliar applications of CCC in varying concentration exhibited better growth and increased the yield. There fore, the present study was undertaken with the motives to find out and determine the effect of pruning and chlormequate chloride on plant on growth, yield and fruit quality from phalsa.

MATERIALS AND METHODS

The present studies on the was carried out during the winter season of the year 2013-2014 at pomology research field department of Horticulture, Sam Higginbottom Institute of Agricultural, Technology and Sciences. The experimental area had sandy loam soil with pH of 7.2, the soil was moderately fertile. The details pertaining to the materials and methods adopted are presented here; The experimental site is situated at of a latitude of 20° and 15° North and longitude of 60° 3" East and at an altitude of 98 meters above mean sea level (MSL).The area of Allahabad district comes under subtropical belt in the South East of Uttar Pradesh, which experience extremely hot summer and fairly cold winter. The maximum temperature of the location reaches up to 46° C - 48° C and seldom falls as low as 4° C - 5° C. The relative humidity ranged between 20 to 94 percent. The average rainfall in this area is around 1013.4 mm annually. The experiment comprised of twelvetreastments of phalsa viz., T_0 (Control), T_1 (Pruning height-50cm), T_2 (Pruning height-75cm), T_3 (Chlormequate chloride-1500 ppm), T_4 (Chlormequate chloride-2000ppm), T_5 (Chlormequate chloride-2500ppm), T_6 (Pruning height-50cm + Chlormequate chloride 1500ppm), T_7 (Pruning height-50cm + Chlormequate chloride-2000ppm), T_8 (Pruning height-50cm + Chlormequate chloride-2500ppm), T_9 (Pruning height-75cm + Chlormequate chloride-1500ppm), T_{10} (Pruning height -75cm + Chlormequate chloride - 2000 ppm) and T_{11} (Pruning height -75cm + Chlormequate chloride-2500ppm). The experiment was laid out in a Randomized Block Design with three replications. Data was analyzed using analysis of variance (ANOVA) according to the procedure described by Panse and Sukhatme (1985) Critical difference (CD) with in the treatment was calculated in order to compare the treatment at 5% level of significance only.

RESULTS AND DISCUSSION

The results of the effect of pruning and chlormequate chloride on different characters are presented in Table 1 and Table 2. Significant differences were recorded among the treatments for all the characters. The character wise result has been discussed below.

Day to sprouting of shoots

The data regarding day to sprouting of shoots are presented in (Table 1). Perusal of data revealed that minimum of days to sprouting of shoots (10.67) was found with treatment T_{11}, where as the treatment T_8 took maximum days (18.33) to sprouting of shoots. Treatment T_7, T_0, T_4, T_3 and T_9, T_2, T_2 were statistically at par treatment T_8 was significantly superior to all other treatments.Ghaffoor *et* al. (2001) various pruning dates significantly affected the days taken to sprouting, number of leaves/branch and number of branch/plant. Similar, Trtiary ammonium compounds like CCC produced reduction in height without any malformation by reducing cell elongation and also by lowering cell division (Rademacher and Jung, 1986).

Table 1: Effect of pruning and chlormequate chloride on plant growth, yield and fruit quality parameter of phalsa.

Treatments	Days to sprouting of shoots	Number of shoot/plan			Shoot length (cm			Days taken to first flowering	Number of fruiting nodes per shoot	Number of fruit per node	Fruit yield per plant (kg)	T.S.S
		30 DAS	45 DAS	60 DAS	30 DAS	45 DAS	60 DAS					
T_0	15.00	7.00	16.33	19.67	35.00	74.33	140.67	67.67	15.33	7.00	2.02	20.30
T_1	13.00	7.00	16.33	21.33	33.67	74.00	142.33	66.33	14.00	7.00	1.52	20.63
T_2	12.67	6.33	16.33	21.33	33.67	77.00	142.67	57.67	16.33	6.67	3.00	21.25
T_3	14.33	7.67	15.33	22.00	34.00	75.00	142.33	71.00	15.67	6.67	1.58	20.30
T_4	15.33	7.00	16.67	20.33	35.33	75.67	131.33	61.67	16.67	6.00	1.33	20.27
T_5	13.33	6.00	16.67	21.33	35.33	75.33	140.00	65.00	14.67	7.33	1.45	20.19
T_6	14.00	8.00	16.33	21.67	33.33	76.33	137.33	61.33	16.33	7.00	2.28	20.37
T_7	17.00	8.33	17.33	22.67	36.00	76.33	144.67	69.00	16.34	8.00	2.82	21.17
T_8	18.33	8.34	18.33	24.67	37.00	77.67	145.00	77.33	17.00	9.33	3.55	21.40
T_9	14.67	7.00	14.67	19.67	35.67	74.00	140.67	59.33	16.33	8.00	1.92	20.70
T_{10}	12.67	6.67	16.33	21.33	35.33	74.33	139.00	60.00	15.67	7.00	1.42	20.58
T_{11}	10.67	6.33	16.00	22.00	33.67	73.33	139.00	54.67	14.00	5.67	1.23	20.18
S. Ed. (±)	1.868	0.737	0.834	1.094	0.967	1.145	2.681	1.405	0.875	0.680	0.410	0.144
C.D. (P = 0.05)	3.856	1.522	1.721	2.258	1.995	2.364	5.533	2.900	1.806	1.404	0.845	0.296

Table 2: Gross profit cost of cultivation, net profit and benefit cost ratio of phalsa influenced by various treatments

Treatment	Fruit yield(q/ha)	Gross Return(Rs/ha)	Cost of Cultivation	Net return	Benefit cost ratio
T_0	32.32	323200	55057	268143	5.87
T_1	24.32	243200	55057	188143	4.41
T_2	48.00	480000	55057	424943	8.71
T_3	25.28	252800	66257	186543	3.81
T_4	21.28	212800	69990	142810	3.04
T_5	23.20	232000	73723	158277	3.14
T_6	36.48	364800	66257	298543	5.50
T_7	45.12	451200	69990	381210	6.45
T_8	56.80	568000	73723	494277	7.70
T_9	30.72	307200	66257	240943	4.64
T_{10}	22.72	227200	69990	157210	3.25
T_{11}	19.68	196800	73723	123077	2.67

Sale price 10000 Rs per ha

Number of shoots/plant at 30, 45 and 60 days

The Number of shoots/plant recorded at 30, 45 and 60 days after pruning are presented in Table - 1. At 60 days, the maximum number of shoot/plant (24.67) was recorded treatment T_8 followed by T_7 with (22.67) and the minimum (19.67) remained with T_0 (control). Sontakke *et al*. (1976) reported that the two years old plants were cut at ground level and maximum number of shoots and fruits were produced on plants pruned at 90 cm in phalsa.

Shoot length at 30, 45 and 60 days

The shoot length was recorded at 30, 45 and 60 days after pruning is presented in Table 1 significantly influenced the length of shoots at 30, 45 and 60 days after pruning.Perusal of the table would reveal that number of shoots percent steadily increased at successive stages of growth, *i*.e. at 30, 60 and 45 days after pruning.At 60 days, the maximum length of shoots (144.67) was with treatment T_7 (pruning 50cm + followed by (145.0) with T_8 whereas the minimum (131.33) remained with T_4. Said and Ali shah (1988) reported that the plant height, shoot length increased at 90 cm as compared to light pruning in phalsa

Days taken to first flowering

The data regarding the number of days taken to first flowering are presented in Table 1. The shortest time taken to flower (54.67 days) was found in treatment T_{11} whereas the treatment T_8 took least days (77.33) to first flowering.Singh *et al*. (1984)reported that pruning operation in peach should be compared within specific period, because flowering may be delayed by early or late pruningand also reported in pharbitis nil plants the application of cycocel decrease of days taken to first flowering (Zeevaart, 1964).

Number of fruiting nodes per shoot

The numbers of fruiting nodes per shoot of phalsa were visually observed, recorded and presented in Table 4.1 Different treatment significantly influenced the number of fruiting nodes per shoot. At the maximum number of fruiting nodes (17.00) was should by treatment T_8(pruning 50 cm + Chlormequale Chloride -2500ppm) as compared to control. Application of pruning and cycocel increased number of fruiting nodes per shoot in phalsa.

Number of fruits per node

The number of fruits per node are presented in Table 4.6 Different treatments significantly influenced the number fruits per node. Perusal of the table reveals that the Maximum number of fruits per node (9.33) were recorded with treatment T_8 (Pruning 50cm + Chlormequate Chloride-2500 ppm), followed by (8.00) T_7 (Pruning 50cm + Chlormequate Chloride-2000 ppm), which were statistically at par. Foliar application of chlorocholine chloride at the time of flower initiation stage improved the number of pods per plant in soybean (Sing *et al*., 1987).

Fruit yield of phalsa per plant (kg.) and per hector (q)

A perusal of the data presented in Table 1 indicated that significant increased in fruit yield per plant and fruit yield perhector was recorded in treatments over control.. Maximum fruit yield per plant (3.55kg) and fruit yield (56.48q/ha) was recorded with treatment T_8 (Pruning 50cm + Chlormequate Chloride-2500 ppm) in over control. These results are in conformity with the findings of Ali *et al*. (2001) and Ghaffoor*et al*. (2001).treatment T_8 (pruning 50cm + Chlormequate Chloride-2500 ppm) was significantly superior to all other treatments.Singh and Singh (2003) found that pruning at 75 cm above ground gave highest yield in Kanpur conditions. On the basis of the various experiments, it can be summarized that pruning at an height of 75 to 100cm during winter improve yield and quality of fruits. Apart from improving yield and quality of fruits, regular pruning control the tree size and fruiting zone remains with the reachand harvesting became easier.Also reported similar results In Phalsa, bySarmah, *et al.,* 2009 noted that the foliar application of CCC increased the yield and yield components.

Total Soluble Solids

The data relating to total soluble solid (^{o}Brix) are presented in Table 1. The total soluble solid of fruits was significantly influenced by different treatments.Perusal of the table reveals that the maximum T.S.S. (21.40^{o}Brix) was recorded with treatment T_8 (Pruning 50cm + Chlormequate Chloride - 2500ppm), followed by 21.17^0 Brix with treatment T_7 (pruning 50cm + Chlormequate Chloride -2000 ppm). The increase in T.S.S. might be attributed to application of at Chlormequate Chloride -2500ppm on pruned plants. The total soluble solidsincreased with the application of Chlormequate Chloride and increase in severity of pruning. It may possibly be due to small fruits obtained from lightly pruned bushes than the heavy pruned ones. The present finding is in close agreement with

earlier workers obtained by Kuma *et al*. (2014) in ber and Brar *et al*. (1997) in Phalsa.

Data depicted in Table 2 showed that maximum net returns (Rs. 494277/ha) and B:C ration (7.70) from phalsa was obtained with Pruning 50cm + Chlormequate Chloride - 2500 ppm.

REFERENCES

Ali, H. S., Ghaffor, A., Waseem, K. and Nadeem, M. A. 2001. Growth and yield response of phalsa (*Grewiaasiatica* L.) to various pruning intensities and dates. *J. Biological Sciences*.**1(7):** 548-550.

Bakshi, J. C. and Somdutt 1986. Hissar has potencial fruit growing dist. *Punjab Hort. J.* **6(3-4):** 139.

Bankanidge, M. S. and Dmetradze, T. Y. 1972. Effect of head pruning on the formation of physiological activity and composition of tea leaves.*Hort. Abst*. **42(3):** 7150.

Boswell, S. B. and Lee, B. W. 1964. Response of mature Valencia orange tree to hedging and top. ing. *Califorina-Citrog*. **53:** 292- 318.

Brar, S. S., Bajwa, G. S. Gurcharan Singh and Minhas, P. P. S. 1997. Studies on training and pruning systems of phalsa (*Grewiaasiatica*) were conducted from 1992 to 1994 at the Punjab Agricultural University, Ludhiana, India.

Cathey, H. G. 1964. Physiology of growth retarding chemicals. *Annual Review of Plant Physiology*. pp. 271-3

Ghaffoor, A., Waseem, K. and Ali, H. S. 2001 Growth and yield response of phalsa (Grewia *asiatico* L.) to various pruning intensities and dates. *Pakistan J. Forestry*. **51(2):** 49-61.

Hayes, W. B. 1960. Fruit growing in India, Kitadistan, Allahabad, pp. 394-398.

Kumar, H., Katiyar, P. N., Singh, A. K. and Raj Kumar, B. V. 2014. Effects of different pruning severity on physicochemical properties of ber (*Zizyphusmauritiana*Lamk.) cv. Banarasi Karaka, *The Ecoscan* **8(3&4):** 203-206.

Kumar, M., Dwivedi, R., Anand, A. K. and Kumar, A. 2014. Effect of nutrient on physico-chemical characteristics of phalsa (*Grewiasu binaequalis* D.C.) fruits.*G.J.B.B*. **3(3):** 320-323

Morton, J. F. 1987. *Phalsa In Fruits of Warm Climates,* Julla Morton, Miami, FL, pp. 276-277.

Panse, V. G. and Sukhatme, P. V. 1985. Statistical method of Agricultural workers. *ICAR*, New Delhi. pp. 143-147.

Radajewska, B. 1987. Effect of the methods of tree pruning on the growth, flowering and cropping in Peaches. **63:** 173-182

Rathore, S. V., Sharma, J. P. and Singh, R. V. 1981. Response of phalsa to severity of pruning and levels of nitrogen. Agra Univercity *J. Research*. **24(3):** 151-158.

Said, M. and Ali shah, S. M. 1989. Pruning requirement of peach tree, variety 6-A, *Agri. Pakistan*. **10:** 65-72.

Salomon, E. 1980. Effect of CCC on growth distribution and fruiting in citrus. *Actahorti culturae*. pp 114-20.

Sarmah, K. C. and Sarma, C. M. 2009. Foliar application of CCC and ethrel in varying concentration was tried. *International J. Plant Sciences*. **4(2):** 440-443.

Singh J. P. and Sharma, H. C. 1961. Effect of time and severty of pruning on growth, yield and quality of phalsa. *Indian J. Hort*. **18(1):** 20-27.

Singh, G., Sharma, K. K. and Jawand, J. S. 1984. Pruning operation in peach. Punjab *hort. J*. **24:** 92-95.

Singh, H., Chandra, S., Jolly, R. S. and Kolar, I. S. 1987. Influence of chlorocholine chloride and ethrelon he grain yield and uptake of nitrogen, phosphorus and potassium in soybean. *Crop mprovement*. **14:** 79-83.

Sontakke, M. B. Shinde, N. N. and Warke, D. C. 1976. Effect of pruning at different periods on growth and yield of phalsa under Parbhani, MH. Condition *J. Maharastra Agriculture University*. **1(2-6):** 157-158.

Zeevaart, J. A. D. 1964. Effects of the Growth Retardant CCC on Floral Initiation and Growth in Pharbitis nil. *Plant Physiology*. **39:** 402-408.