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Effect of pruning and different micronutrient on plant growth, fruit yield and quality of Phalsa (*Grewia asiatica* L.) c.v Sharbati

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Abstract
The present experiment was conducted to determine "Effect of Pruning and different micronutrient on Plant Growth, Fruit yield and quality of Phalsa (*Grewia asiatica* L.) c.v Sharbati" under Allahabad agro-climatic conditions in the Department of Horticulture, Sam Higginbottom University of Agriculture Technology and Science, Allahabad, (U.P.) during the year 2016-2017. The experiment was conducted in Randomized Block Design (R.B.D) with three replications and used different concentrations of Micro-nutrients [Zinc ($ZnSO_4$) (0.1%, 0.2%), Boron (Bo) (0.1%, 0.2%) and Cu ($CuSO_4$) (0.1%, 0.2%)] with 15 different treatments. The result reveals that was effective in improving pre and post-harvest parameters of Phalsa. Treatments influenced significantly No of canes bush^{-1}(15.46), Days of sprouting of shoots (38.59), Number of sprouted shoots cane^{-1} (25.32), Number of leaves shoots^{-1}(28.19), Length of shoots cane^{-1} (79.08cm) and Number of fruiting nodes shoots^{-1} (25.11). The data revealed that T_{14}-0.2% Boron + 0.1% Zinc Sulphate + 0.2% Copper significantly influenced the different post-harvest attributes in phalsa viz., Number of fruit bush^{-1}(25.11), Fresh weight of 10 fruits(9.17), Yield bush^{-1} (4.16kg) and Yield hectare^{-1} (68.86q/ha). Similarly, maximum 0.2% Boron + 0.1% Zinc Sulphate + 0.2% Copper and minimum was recorded with T_0-control.

Keywords: Pruning, Phalsa, Micro-nutrients (Zinc, Boron and Cu)

Introduction

Phalsa (*Grewia asiatica* L.) is subtropical fruit and has high nutrition value containing iron, vitamin A and C. Its fruits possess high medicinal properties. It is minor fruit and is being cultivated on very small scale in each state. However, in Punjab, Haryana and Uttar Pradesh it is cultivated near cities commercially. In Punjab area under Phalsa is only 30 hectares with annual production of 196 tones approximately. It is a crop of arid and semi-arid regions because of its hardy nature. It comes under minor fruit crops but it is a valuable fruit. Because of these, phalsa produces often use very large amounts of synthetic mineral nutrients which is not sustainable due to ill effects on soil and environment vis., a vis., much involvement of non-renewable energy in production input used, attempt to improve yield and quality of crop.

Phalsa is considered to be antioxidant in nature due to its coloured fruit and juice. Whole fruit is eaten along with the seeds. Its fruits having several traditional health benefits. It is an astringent, coolant, and stomachic in nature. In Vedic times, the bark was used as a demulcent and serves as a treatment for rheumatism. Ground leaves treat pustular infections, and possess strong antimicrobial and antibacterial properties capable of remedying E. coli. Its fruit and leaves exhibited significant anticancer activities against breast cancer cells and liver cancer cells.

Zinc (Zn) is one of the micro-elements whose deficiency prevails in citrus orchards. Zinc deficiency may affect yield by inducing shedding of flowers, leaves and fruit, as well as lowering their quality (Alloway, 2004) [2]. Similar to the deficiency of other micro-nutrients, Zinc deficiency is enhanced by high soil pH, reducing its absorption by the plant's roots. Zinc availability is lower in basic soils where it precipitates as a salt of low solubility, is absorbed by Calcium Carbonate (CaCO3), and fixated on silicates on the surface of clay particles (Neilsen and Neilsen. 1994) [8].

Copper (Cu) is the microelement, which it is necessary for plant life. Grace established it in 1844 during removing of chlorosis in grape via copper sulphate sparing. Copper is essential for the activity of several enzymatic systems and plant components. Copper significantly decreased the incidence of citrus canker on leaves and harvested fruits, and reduced the number of prematurely dropped fruits and increased yield. Disease incidence on leaves of untreated trees in each season peaked at 37, 51, and 43% of infected leaves, whereas the incidence of canker on foliage of copper-treated trees was no higher than 12, 16, and 11%, respectively. For the second and third year trials, when disease incidence was comparatively higher, the shorter the spray interval, the lower the disease incidence and number of dropped fruit and the higher the yield per tree. Citrus canker incidence on the leaves was inversely related in a linear fashion to the total number of copper sprays in each trial. Application of cupper, manganese and iron increased the yield of sweet orange trees but these materials had no influence on fruit internal quality (Alla *et al*., 1985).

Boron (B) is a micronutrient that is often thought to be toxic to many crops, even at low concentrations in leaves. However, deficiency of B is equally serious, and may be a problem in Arizona citrus. Certainly, many symptoms of B deficiency are apparent in Arizona citrus and especially on the Yuma Mesa. Prior research indicates that B application increases crop yield and quality. Boron application was correlated with increased yield of soybean (Schoen and BIevins, 1990) [13], alfalfa (Gizzard and Matthews, 1942), sour cherry (Hanson, 1991) [4], and canola (Porter, 1993) [9]. Boron deficiency reduced the yield of maize (Mozafar, 1989) [7], wheat (Rerkasem and Loneragan, 1994) [11], and reduced the yield and fruit quality of tomato (Lopez *et al.*, 1988).

Material and Methods

The present study entitled "Effect of pruning and different micronutrients on plant growth, fruiting and quality of phalsa (*Grewia astica* L)" comprise of a field experiment laid out at the Horticulture Research Farm, SHUATS. Allahabad during rabi season 2016-17 during following objectives:-

1. To find out the most suitable treatments on vegetative growth, yield and fruit quality of phalsa.
2. To workout the economics of different treatments.

Treatment Details

Micro-nutrients

- Zinc ($ZnSO_4$) (0.1%, 0.2%)
- Boron (Bo) (0.1%, 0.2%)
- Cu ($CuSO_4$) (0.1%, 0.2%)

Table 1

T_0	Control
T_1	0.1% Boron
T_2	0.2% Boron
T_3	0.1% Zinc Sulphate
T_4	0.2% Zinc Sulphate
T_5	0.1% Copper
T_6	0.2% Copper
T_7	0.1% Boron + 0.2% Zinc Sulphate
T_8	0.2% Boron + 0.1% Zinc Sulphate
T_9	0.1% Boron + 0.2% Copper
T_{10}	0.2% Boron + 0.1% Copper
T_{11}	0.1% Boron + 0.2% Zinc Sulphate + 0.1% Copper
T_{12}	0.2% Boron + 0.1% Zinc Sulphate + 0.1% Copper
T_{13}	0.1% Boron + 0.2% Zinc Sulphate + 0.2% Copper
T_{14}	0.2% Boron + 0.1% Zinc Sulphate + 0.2% Copper

Results and Discussion

From the (Table 2 & fig 1) it is observed that, the mean number of canes per bush. A critical analysis of appendix ANOVA table shows that number of canes per bush was significantly affected by different micronutrient treatment over control. Maximum number of canes per bush (15.46) was recorded in treatment T_{14}-0.2% Boron + 0.1% Zinc Sulphate + 0.2% Copper followed by T_{12}-0.2% Boron + 0.1% Zinc Sulphate + 0.1% Copper (15.06). Minimum number of canes per bush (7.79) was recorded in treatment T_0-Control. While Minimum Days of sprouting of shoots (38.59) was recorded in treatment T_{14}-0.2% Boron + 0.1% Zinc Sulphate + 0.2% Copper followed by T_1-0.1% Boron (48.02). Maximum Days of sprouting of shoots (48.26) was recorded in treatment T_0-Control. Maximum Number of sprouted shoots per canesat successive stage 120 days (25.32) was recorded in treatments T_{14} (0.2% Boron + 0.1% Zinc Sulphate + 0.2% Copper), Followed by T_{12} (0.2% Boron + 0.1% Zinc Sulphate + 0.1% Copper) (24.68). The minimum Number of sprouted shoots per canes (10.60) was recorded with the treatment T_0 (Control) respectively. In incase of leaves per plant the maximum (28.19) was recorded in treatments T_{14} (0.2% Boron + 0.1% Zinc Sulphate + 0.2% Copper), Followed by T_{12} (0.2% Boron + 0.1% Zinc Sulphate + 0.1% Copper) (27.74). The minimum Number of leaves (19.69) was recorded with the treatment T_0 (Control). Maximum Length of shoots at successive stage (79.08) was recorded in treatment T_{14} (0.2% Boron + 0.1% Zinc Sulphate + 0.2% Copper), Followed by T_{12} (0.2% Boron + 0.1% Zinc Sulphate + 0.1% Copper) (78.16). The minimum Length of shoots at successive stage 120 days (66.58) was recorded with the treatment T_0 (Control) and number of fruiting at successive stage (25.11) was significantly increased in treatment T_{14} (0.2% Boron + 0.1% Zinc Sulphate + 0.2% Copper), Followed by T_{12} (0.2% Boron + 0.1% Zinc Sulphate + 0.1% Copper) (24.34). The minimum Number of fruiting (12.46) was recorded with the treatment T_0 (Control) respectively.

From the (Table 3 & fig 2) it is observed that, the mean number of canes per bush. A critical analysis of appendix ANOVA table shows that number of canes per bush was significantly affected by different micronutrient treatment over control. Number of fruit per bush (2512.34) was significantly increase in treatment T_{14} (0.2% Boron + 0.1% Zinc Sulphate + 0.2% Copper), Followed by T_{12} (0.2% Boron + 0.1% Zinc Sulphate + 0.1% Copper) (2460.46). The minimum Number of fruit per bush (1408.79) was recorded with the treatment T_0 (Control). Significantly increase in Fresh weight of 10 fruit (9.17) was recorded in treatment T_{14} (0.2% Boron + 0.1% Zinc Sulphate + 0.2% Copper), Followed by T_{12} (0.2% Boron + 0.1% Zinc Sulphate + 0.1% Copper) (8.41). The minimum Fresh weight of 10 fruit (5.41) was recorded with the treatment T_0 (Control) respectively. Significantly maximum Fruit yield days per bush (4.66 kg) was recorded in treatment T_{14} (0.2% Boron + 0.1% Zinc Sulphate + 0.2% Copper), Followed by T_{12} (0.2% Boron + 0.1% Zinc Sulphate + 0.1% Copper) (4.10 kg). The minimum Fruit yield days per bush (1.25 kg) was recorded with the treatment T_0 (Control) respectively. Significantly increase in Fruit yield per bush (q/ha) (68.86 q/ha) were recorded in treatment T_{14} (0.2% Boron + 0.1% Zinc Sulphate + 0.2% Copper), Followed by T_{12} (0.2% Boron + 0.1% Zinc Sulphate +

0.1% Copper) (65.49 q/ha) per plot. The minimum Fruit yield per bush (19.90 q/ha) was recorded with treatment T_0 (Control) respectively. Significantly increase in TSS (22.78) were recorded in treatment T_{14} (0.2% Boron + 0.1% Zinc Sulphate + 0.2% Copper), Followed by T_{12} (0.2% Boron + 0.1% Zinc Sulphate + 0.1% Copper) (22.23). The minimum TSS (17.08) was recorded with the treatment T_0 (Control) respectively. In case of Sugar percent (12.39) were recorded in treatment T_{14} (0.2% Boron + 0.1% Zinc Sulphate + 0.2% Copper), Followed by T_{12} (0.2% Boron + 0.1% Zinc Sulphate + 0.1% Copper) (12.34). The minimum Sugar percent (8.78) was recorded with the treatment T_0 (Control) respectively. Significantly decrease in Titrable acidity (3.40) were recorded in treatment T_0 (Control), Followed by T_1 (0.1% Boron) (3.31). The minimum Titrable acidity (2.64) was recorded with the treatment T_{12} (0.2% Boron + 0.1% Zinc Sulphate + 0.1% Copper) respectively.

Table 2: Effect of different micronutrient on pre harvest of Phalsa (*Grewia asiatica* L.*) c.v Sharbati*.

Treatments	Number of canes per bush	Days of sprouting of shoots	Number of sprouted shoots per canes	Number of leaves	length of shoots (cm)	Number of fruiting
T_0	7.79	48.26	10.6	19.69	66.58	12.46
T_1	12.69	48.02	13.66	20.87	70.94	18.59
T_2	12.26	45.92	14.71	22.09	67.91	17.53
T_3	13.46	46.59	14.81	23.88	75.12	19.06
T_4	13.32	45.36	15.65	24.54	74.25	20.92
T_5	12.58	44.19	17.78	23.01	72.21	19.48
T_6	14.02	45.04	19.81	25.64	75.73	21.59
T_7	13.79	47.39	19.1	25.29	75.48	20.62
T_8	14.12	43.92	20.2	26.25	76.16	22.12
T_9	12.29	43.83	19.11	22.26	72.73	19.29
T_{10}	12.46	43.06	18.93	23.6	73.32	19.9
T_{11}	14.42	41.51	21.02	26.5	76.38	23.02
T_{12}	15.06	41.26	24.68	27.74	78.16	24.34
T_{13}	14.56	40.07	23.76	27.4	77.09	23.46
T_{14}	15.46	38.59	25.32	28.19	79.08	25.11
Result	S	S	S	S	S	S
S. Ed.(±)	0.012	0.1	0.297	0.0049	2.005	2.005
C.D. at 5%	0.026	0.213	0.631	0.0105	2.01	2.01

Table 3: Effect of different micronutrient of on post-harvest of Phalsa (*Grewia asiatica* L.*) c.v Sharbati*

Treatments	Fresh weight of 10 fruit (gm)	Fruit yield days per bush(Kg)	Fruit yield (q/ha)	Total soluble solids (ºBrix)	Total Sugar percent (%)	Titrable acidity
T_0	5.41	1.25	19.9	17.08	8.78	3.4
T_1	5.51	1.78	28.36	18.11	9.01	3.31
T_2	5.27	1.52	23.75	19.02	8.92	2.91
T_3	5.78	1.86	29.81	19.02	8.92	3.07
T_4	6.14	2.89	48.43	18.59	9.77	3
T_5	5.63	1.75	27.82	19.99	11.03	2.99
T_6	6.55	3.43	55.11	18.68	9.29	2.87
T_7	6.64	3.07	51.76	19.01	10.37	2.99
T_8	7.48	3.24	52.64	17.82	9.55	3.02
T_9	5.67	2.16	35.12	19.61	11	3.26
T_{10}	6.73	2.58	42.79	20.08	10.82	2.86
T_{11}	7.94	3.38	57.07	20.77	11.29	2.92
T_{12}	8.41	4.1	65.49	22.23	12.34	2.64
T_{13}	8.17	3.73	62.46	20.95	11.71	2.63
T_{14}	9.17	4.66	68.86	22.78	12.39	2.67
Result	S	S	S	S	S	S
S. Ed. (±)	0.143	2.103	2.603	2.693	1.693	1.293
C.D. at 5%	0.304	2.217	2.717	2.807	1.807	1.407

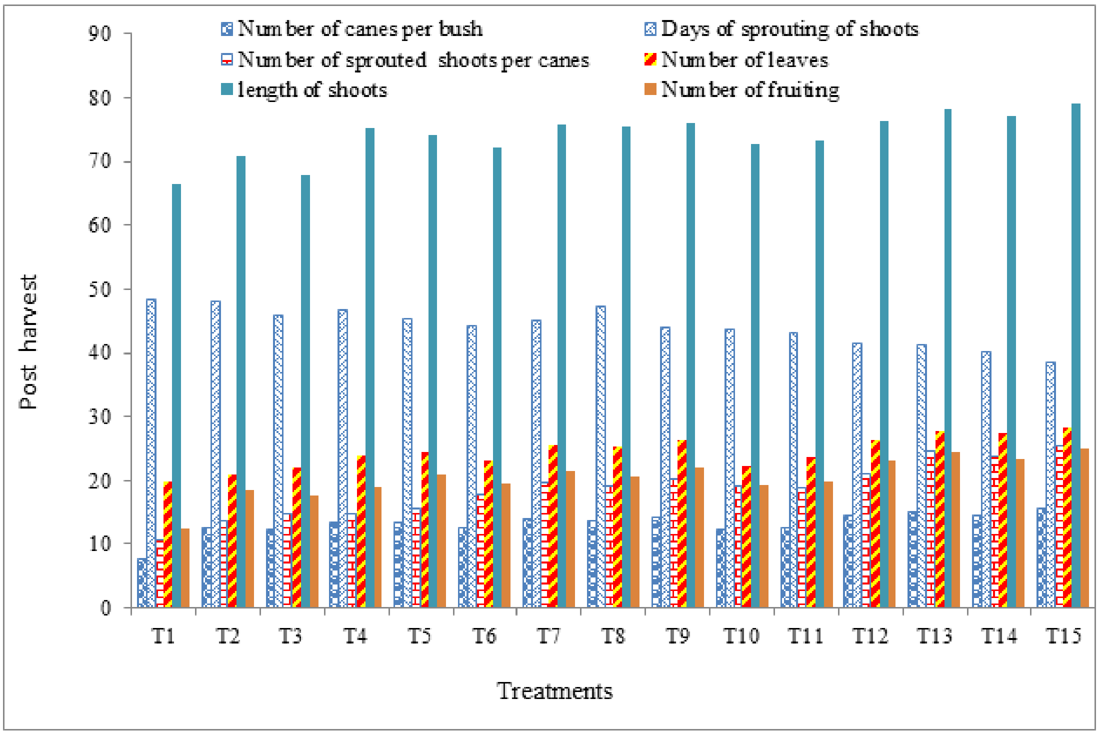

Fig 1: Effect of different micronutrient on pre harvest of Phalsa (*Grewia asiatica* L.) c.v Sharbati

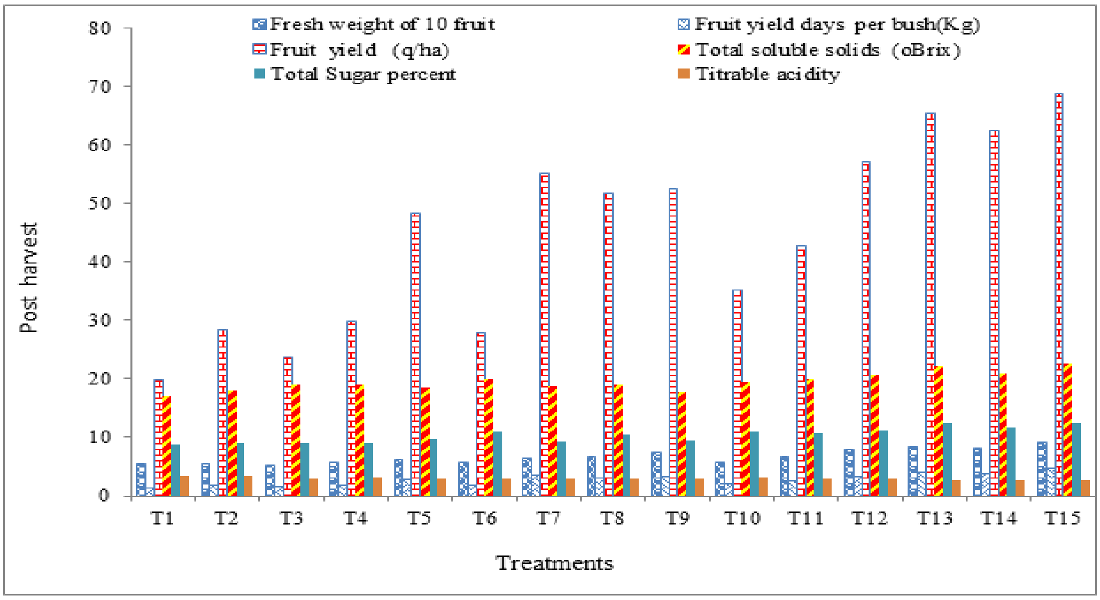

Fig 2: Effect of different micronutrient of on post-harvest of Phalsa (*Grewia asiatica* L.) c.v Sharbati

Conclusion

On the basis of present investigation it is concluded that the application of T_{14} (0.2% Boron + 0.1% Zinc Sulphate + 0.2% Copper) was best in term of growth. Maximum yield and cost benefit ratio (1: 8.25) was recorded in the treatment T_{14} (0.2% Boron + 0.1% Zinc Sulphate + 0.2% Copper), Followed by T_{12} (0.2% Boron + 0.1% Zinc Sulphate + 0.1% Copper) by(1: 8.18) treatment) and the minimum cost benefit ratio was recorded in treatment T_0 (Control).

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