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Effect of pruning intensity and different levels of zinc sulphate on physico-chemical attributes of phalsa fruits (*Grewia subinaequalis* D.C.)

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Abstract: The present investigation was conducted during the year 2014-15. The experiment was laid out in factorial randomized bock design with nine treatments and replicated in three times, considering two plants as a unit.The treatments significantly increased the vegetative growth and yield of phalsa. The maximum fruit length(1.53cm) & width(1.07cm), weight of 50 fruits(49.33g), pulp: stone ratio(1.23), total soluble solids (29.00^0 Brix), reducing sugar % (16.05), non reducing sugar % (4.63), total sugars % (21.08), minimum acidity (1.91%) and maximum ascorbic acid (38.50 mg/100 g pulp) were recorded with the spray of $ZnSO_4$ @ 0.4 per cent with 50cm pruning intensity.

Key Words: Foliar application of nutrients, Physico- chemical attributes of phalsa

Introduction

Phalsa (*Grewia subinaequalis* D.C.) belongs to family Tilliaceae. Fruit is known as berry. The family has about 41 genera and 400 species which are mostly distributed in the tropical and subtropical regions of the world. In India, it is commercially grown in Punjab, Haryana, Rajasthan, Uttar Pradesh and Madhya Pradesh. Besides these states, it is also cultivated to limited scale in Maharashtra, Gujarat, Andhra Pradesh, Bihar and West Bengal.It has high nutritional and medicinal value containing iron, vitamin 'A', 'C' and phosphorous. It contains about 50-60% juice, 10 -11% sugar, 2-2.5% acids, calories 329 per lb (724 per kg), moisture 81.13%, protein 1.58%, fat 1.82% and crude fiber 1.77%.The fruits are very delicious, tasty and used for table purposes.It has high market value, because it's wood are also used for fuel purposes and basket making which is income generating entrepreneurship to the rural farming community (Yadav and Godra, 1987; Hiwale and Raturi, 1993 and Katiyar *et al.,* 2010). Phalsa can be grown as an inter-crop with mango, aonla, bael and ber. It is a quick growing, very hardy shrub which thrives well in arid and semi-arid, salt affected wasteland conditions.It bears small berry like fruits of deep reddish brown colour. Its flowers come in February and the fruit repines in the second fortnight of April and continuous up to middle of June. Phalsa produces fruits in cluster in axil of leaves of the young shoots. It is one of the hardiest fruit crop and does not affected by any insect, pest and disease .

The objectives of study to find out the effect of pruning intensity and different levels of Zinc Sulphate on physico-chemical attributes of phalsa fruits.

Materials and Methods

The experiment was conducted at departmental, Main Experiment Station (Horticulture) of university during 2014-15 growth season. Twenty five year old plants of phalsa having uniform vigour were selected for present investigations. The experiment was conducted in Factorial Randomized Block Design (R.B.D.) with nine treatments which were replicated in three times, considering two plants as unit.T_1 : 0 cm+Water Spray , T_2 : 0 cm+ $ZnS0_4$ 0.2%, T_3 : 0 cm+ $ZnS0_4$ 0.4%, T_4 : 25 cm+ Water Spray, T_5 : 25 cm+ $ZnS0_4$ 0.2%, T_6: 25 cm + $ZnS0_4$ 0.4%, T_7 : 50 cm+ Water Spray, T_8 : 50 cm+ $ZnS0_4$ 0.2%, T_9 : 50 cm + $ZnS0_4$ 0.4%.

Pruning was done in first week of February and first spray of nutrient in second fortnight of March (Pre blooming Stage) and second spray just after fruit setting. The observations regarding fruit length(cm), fruit width(cm), weight of 50 fruits(g), pulp: stone ratio, total soluble solids (^{0} Brix), reducing sugar (%), non reducing suga (%), total sugars (%) (Lane and Eynon, 1943), acidity per cent and ascorbic acid (mg/100 g pulp) A.O.A.C. (1970) were recorded at the time of fruit picking. The data were analysed statistically and results were evaluated at five per cent significance (Panse and Sukhatme ,1985).

Results and Discussion

Data presented in table -1 reveal that most of the treatments proved to improve the physico-chemical characters of phalsa over control. The maximum fruit size varied significantly due to various nutrient spray and pruning levels. The maximum fruit length(1.53cm) and width (1.07cm), weight of 50 fruits (49.33g), pulp: stone ratio (1.23), total soluble solids (29.00 ff Brix), reducing sugars (16.05%),

Table -1: Effect of pruning intensity and different levels of Zinc Sulphate on physico-chemical attributes of phalsa fruits

Pruning intensity	Fruit length (cm)	Fruit width (cm)	Wt. of 50 fruits (g)	Pulp-stone ratio	T.S.S. (^{0} Brix)	Reducing sugar (%)	Non-reducing sugar (%)	Total sugars (%)	Acidity (%) 100g pulp)	Ascorbic acid (mg/
P_1	1.09	0.96	44.44	1.11	19.66	13.62	4.20	17.48	2.50	32.87
P_2	1.13	0.99	46.11	1.14	24.44	14.21	4.36	18.66	2.228	34.37
P_3	1.17	1.04	47.77	1.18	27.00	15.35	4.70	20.11	2.17	36.33
SEm	0.005	0.010	0.50	0.006	0.62	0.18	0.11	0.21	0.054	0.17
CD	0.015	0.030	1.50	0.018	1.88	0.46	N.S.	0.64	0.16	0.53
Nutrients										
C_0	1.10	0.97	44.88	1.11	22.33	13.59	3.88	17.48	2.60	32.93
C_1	1.13	0.99	46.33	1.14	23.33	14.42	4.50	18.98	2.27	34.82
C_2	1.16	1.02	47.11	1.18	25.44	15.17	4.70	19.79	2.08	35.83
SEm	0.005	0.010	0.50	0.006	0.62	0.18	0.11	0.21	0.054	0.17
CD	0.015	0.030	1.50	0.018	1.88	0.56	0.34	0.64	0.16	0.53
Interaction										
P_1C_0	1.07	0.94	43.66	1.08	18.66	12.71	3.51	16.22	2.71	31.66
P_1C_1	1.10	0.97	45.33	1.12	23.00	13.41	3.98	17.42	2.58	33.63
P_1C_2	1.14	1.02	45.66	1.14	25.33	14.65	4.25	18.81	2.50	33.50
P_2C_0	1.10	0.96	44.66	1.12	19.33	13.86	4.90	17.95	2.52	32.96
P_2C_1	1.13	1.00	46.00	1.14	24.00	14.05	4.45	18.50	2.19	34.50
P_2C_2	1.18	1.03	48.33	1.18	26.66	15.35	4.76	20.50	1.10	37.00
P_3C_0	1.12	1.00	45.00	1.14	21.00	14.29	4.20	18.29	2.27	34.00
P_3C_1	1.20	1.01	47.00	1.16	26.33	15.19	4.67	20.07	2.07	35.00
P_3C_2	1.53	1.07	49.33	1.23	29.00	16.05	4.63	21.08	1.91	38.50
SEm	0.0016	0.0033	0.16	0.002	0.20	0.062	0.036	0.07	0.018	0.059
CD	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	0.92

P1: 0 cm pruning above ground level; P2: 25 cm pruning above ground level; P3: 50 cm pruning above ground level; C_0 : Water Spray; C1: $ZnS0_4$:0.2 %; C2 : $ZnS0_4$ - 0.4%

non reducing sugars (4.63%), total sugars (21.08%), minimum acidity (1.91%) and maximum ascorbic acid (38.50 mg/100 g pulp) were recorded with the spray of $ZnSO_4$@0.45% with 50cm pruning intensity.

The weight of fifty fruits was significantly influenced by micro-nutrients spray and pruning levels. However, the highest weight of fifty fruits was observed with foliar spray of $ZnSO_4$@ 0.4 per cent with pruning at 50cm above ground level. The present findings is in close agreement with the result of Mishra *et al* (2003) in Kinnow mandarin and Mahendra *et al.* (2007) in phalsa. Pulp-stone ratio varied significantly with pruning levels and micro-nutrients spray. The highest pulp-stone ratio was measured with foliar spray of $ZnSO_4$ @ 0.4 per cent at 50 cm above ground level. The interaction between pruning levels and micro-nutrients spray on pulp- stone ratio was found non-significant. Physical character of fruits such as width and weight of 50 fruits were increased due to application of micro nutrients.

Effect of pruning intensity and micro-nutrients on chemical character of fruits: The chemical attributes of fruits particularly total soluble solids in fruits have been enhanced significantly by the use of micro-nutrients spray especially $ZnSO_4$ @ 0.4 per cent, recorded the maximum level of TSS in fruits. Pruning levels had also significant effect on TSS content in fruits and the maximum TSS was recorded with foliar spray of $ZnSO_4$ @ 0.4 per cent pruning at 50 cm above ground level. The interaction between pruning levels and micro-nutrients spray on TSS was found non-significant. The increase in TSS content of fruit may be explained by fact that zinc is helpful in photosynthesis which ultimately lead to the accumulation of carbohydrates which helps in increasing TSS content of fruits. Zinc play an important role in activating certain enzymes involved in production of sugars and metabolites. The present result is enclosed conformity with the findings of Sindhu *et al.* (1994) in grape; and Sharma *et al.* (2002) in kagzi lime.

The reducing, non-reducing and total sugars contents in fruit juice of phalsa have been increased significantly by use of micro-nutrients spray and pruning levels, while interaction effect between micro-nutrients spray and pruning levels was found non-significant. However, the highest level of reducing, non- reducing and total sugars were analyzed with foliar spray of $ZnSO_4$ @ 0.4 per cent with pruning at 50 cm above ground level. The significant increase in sugar contents might be due to accumulation of carbohydrates in fruits as a result of increased supply/ absorption of N, K and Zn also role played by appropriate pruning intensity. Similar findings are also reported by Yadav and Godra (1987); Hiwale and Raturi (1993) and Katiyar *et al.* (2010) in ber.

Acidity percentage in fruit juice was reduced significantly by micro-nutrients spray, also significant effect was observed with pruning levels. The less acidity per cent was noted with the effect of $ZnSO_4$ @ 0.4 per cent along with pruning at 50 cm above ground level. The reason for decrease in acidity due to application of zinc

might be due to increase translocation of carbohydrates and increase metabolism due to conversion of acids to sugar. The finding is in agreement to Mahendra *et al.* (2007) and Yadav *et al.* (2007) in phalsa. It is evident from the table that ascorbic acid content (mg/100g pulp) in fruit juice has been significantly increased with micro-nutrients spray and pruning levels. However, the highest ascorbic acid was analyzed with the use of $ZnSO_4$ @ 0.4 per cent along with pruning at 50 cm above ground level. The increase in ascorbic acid content may be attributed to quality improving properties of zinc. Another reason might be due to increase in synthesis of catalytic activity of several enzymes and co-enzymes which are instrumental in ascorbic acid synthesis. The result is in agreement with the findings of Singh *et al.* (2002) in kagzi lime and Singh *et al.* (2009) in phalsa.

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