Effect of foliar application of chemicals on shelf life of ber (*Ziziphus mauritiana* L.)" cv. Apple ber

Abstract:

A fieldexperiment entitled "**Effect of foliar application of chemicals on shelf life of ber (*Ziziphus mauritiana* L.)" cv. Apple ber** was conducted out at Experimental orchard, Post-harvest Technology Laboratory of Department of Horticulture and laboratory of Department of Soil Science, CCS Haryana Agricultural University, Hisar during the year 2022-23. The experiment was laid out in a Randomized Block Design with thirteen treatments and three replications *viz.*, T_1: K_2SO_4 (1.0%), T_2: K_2SO_4 (1.5%), T_3: K_2SO_4 (2.0%), T_4: K_2SO_4 (2.5%), T_5: $Ca(NO_3)_2$ (0.5%), T_6: $Ca(NO_3)_2$ (1.0%), T_7: $Ca(NO_3)_2$ (1.5%), T_8: $Ca(NO_3)_2$ (2.0%), T_9: $C_2H_6ClO_3P$@ 150 ppm , T_{10}: $C_2H_6ClO_3P$@ 300 ppm), T_{11}: $C_2H_6ClO_3P$@ 450 ppm T_{12}: $C_2H_6ClO_3P$@ 600 ppm T_{13}: Control (water spray). Among the shelf life parameters minimum spoilage % and minimum loss in PLW % was observed in case of calcium nitrate @ 2.0 % which further improve the shelf life of ber fruits.

Key words: Foliar application, potassium sulphate, calcium nitrate, ethephone, PLW %, spoilage %, shelf life.

Introduction:

Ber or Indian jujube (*Zizyphusmauritiana* Lamk.) belongs to family Rhamnaceae is considered as an ideal fruit tree for arid and semi arid regions of the country. It is originated from Central Asia and there are numerous species and varieties of it. The ber fruit crop is distributed worldwide including the Africa, Indian Subcontinent, China, South East Asia, Australia, Mediterranean region and American center but its cultivation is confined to dried parts of the globe and main cultivation occurs in India. In India, it occupies 53.74 thousand hectare area with production of 596.14 MT and the major ber growing states are Rajasthan, Haryana, Punjab, Gujarat, Madhya Pradesh, Bihar, Maharashtra, Andhra Pradesh and Tamil Nadu. In Haryana, it occupies 4.43 thousand hectare area with the production of 46.95 MT (Anonymous, 2022) and major ber growing district are Hisar, Mewat, Palwal, Rewari, Mahendregarh, Gurugram, Sirsa, Fatehabad, Panipat, Sonipat, Bhiwani, Jhajjar, Rohtak and Jind. Apple Ber is a variety of ber from Thailand and developed from Thailand green apple and Thai local ber. The fruits of this variety resembles green apple in its appearance and taste like ber, hence known as Apple Ber. It is also called as Apple plum or Jujube berry (Saritha *et al*. 2021). The ripe fruit are rich in nutritive value having 13-24% total soluble solids, and up to 160 mg/100g vitamin C and contain fairly good amount of mineral like calcium, phosphorus and iron and also higher in ascorbic acid

content than the orange (Saritha *et al.* 2021). The inflorescence of ber fruit is axillary cymose. The fruits are borne in the axils of the leaves on the young shoots of the current season. Fully mature unripe fruits are used for preparation of murabba, candy, pickle and chutney. It is grown for its fresh fruits and is commonly known as the poor man's apple due to its great nutritional properties such as protein (0.8g), carotene (70 IU), vitamin C (50-100 mg), and therapeutic value (Rai and Gupta, 1994). In this experiment, the emphasis was made to study the effect of foliar application of chemicals on yield and quality of ber**.** Therefore the aim of present experiment is to study the effect of potassium sulphate, calcium nitrate and ethephon on shelf life of ber.

Material and Method:

The present study entitled "**Effect of foliar application of chemicals on shelf life of ber (***Ziziphus mauritiana* **L.)" cv. Apple ber** was conducted at Experimental orchard, Post-harvest Technology Laboratory of Department of Horticulture and laboratory of Department of Soil Science, CCS Haryana Agricultural University, Hisar during the year 2022-23. The ber variety used was apple ber and the age of plant was 5 years. The experiment was laid out in a Randomized Block Design with thirteen treatments and three replications *viz*., T_1: K_2SO_4 (1.0%), T_2: K_2SO_4 (1.5%), T_3: K_2SO_4 (2.0%), T_4: K_2SO_4 (2.5%), T_5: $Ca(NO_3)_2$ (0.5%), T_6: $Ca(NO_3)_2$ (1.0%), T_7: $Ca(NO_3)_2$ (1.5%), T_8: $Ca(NO_3)_2$ (2.0%), T_9: $C_2H_6ClO_3P$@ 150 ppm , T_{10}: $C_2H_6ClO_3P$@ 300 ppm, T_{11}: $C_2H_6ClO_3P$@ 450 ppm T_{12}: $C_2H_6ClO_3P$@ 600 ppm T_{13}: Control (water spray).The each treatments were applied two times *i.e.* first spray in the 3rd week of december and second spray at 10 days after first spray in the first week of january until total saturation of foliage of experimental plants. The control trees were sprayed with water. However, response of plants to these may vary depending upon the soil and agro-climatic conditions.

The observations were recorded on tagged shoots from all directions of experimental plants of each replication. The observations were recorded on tagged shoots from all directions of experimental plants of each replication. The shelf life of the fruits was determined by recording the number of days the fruits remained in good condition in each replication during storage. When spoilage of the fruits exceeded 10 per cent, it was considered end of storage life. The fruits (2 kg/treatment) were packed in corrugated fibre board boxes and stored at room temperature under ambient condition. The observations were recorded at two days interval up to 8 days. The physiological losses in weight (PLW) of fruits were calculated on their initial weight basis. After each interval weight of the fruits were recorded and per cent of physiological loss in weight (PLW) was calculated by recorded both final weight and initial weight of fruits. The number of fruits spoiled in each replication was counted at 2 days interval and spoilage per

cent was calculated as given below storage out of total fruits stored was computed and expressed in percentage. The spoilage % was determined based on the following visual observations.

1. Fungal infections and rotting

2. Over-ripening and skin browning

Spoilage% = Number of spoiled fruits/ number of fruits x 100

Result and Discussion:

Shelf life:

Physiological loss in weight (PLW %)

Physiological loss in weight increased with increase in storage period irrespective of treatments. On 2nd day of storage among different chemical sprays, minimum weight loss (10.03 %) was recorded under calcium nitrate @ 2.0 per cent which was significantly lower than other treatments whereas, maximum weight loss (14.76 %) was recorded under ethephon @ 600 ppm.

On 4th day of storage minimum weight loss (16.74 %) was recorded under calcium nitrate @ 2.0 per cent which was significantly lower than other treatments whereas, maximum weight loss (18.78 %) was recorded under ethephon @ 600 ppm.

On 6th day of storage among different chemical spray, minimum weight loss (18.19 %) was recorded in case of calcium nitrate @ 2.0 per cent which was significantly lower than other treatments whereas, maximum weight loss (23.87 %) was recorded under ethephon @ 600 ppm.

On 8th day of storage among different chemical spray, minimum weight loss (19.97 %) was recorded under calcium nitrate @ 2.0 per cent which was significantly lower than rest of the treatments whereas, maximum weight loss (33.65 %) was recorded under ethephon @ 600 ppm.

The minimum decay loss was observed under $Ca(NO_3)_2$@ 2.0 %. This might be due to higher firmness of fruit which might have delayed the pathogen and other microorganism infection for longer period (Rajput *et al.* 2015). The reduction in spoilage might have been possible checking the growth of various microflora. The results were in line with findings of Ramesh and Kumar (2007) in banana, Goswami *et al.* (2012) in guava and Kumar *et al.* (2013) in ber.

Table: 1. Effectof foliar application of potassium sulphate, calcium nitrate and ethephon on shelf life (PLW %) in ber

PLW (%) Days after storage					
Treatment No.	**Chemicals**	**2nd**	**4th**	**6th**	**8th**
T_1	**K_2SO_4@ 1.0 %**	13.76	17.62	18.21	25.04

T_2	**K_2SO_4@ 1.5 %**	13.89	17.76	18.34	24.46
T_3	**K_2SO_4@ 2.0 %**	13.97	17.99	18.78	19.99
T_4	**K_2SO_4 @ 2.5 %**	14.02	18.02	18.99	20.53
T_5	**$Ca(NO_3)_2$@ 0.5 %**	13.23	17.53	19.18	28.34
T_6	**Ca(NO3)2@ 1.0 %**	12.85	17.22	19.02	25.58
T_7	**$Ca(NO_3)_2$@1.5 %**	11.08	16.98	18.25	20.01
T_8	**$Ca(NO_3)_2$@ 2.0 %**	10.03	16.74	18.19	19.97
T_9	**$C_2H_6ClO_3P$@ 150 ppm**	14.46	18.51	22.54	28.63
T_{10}	**$C_2H_6ClO_3P$@ 300 ppm**	14.35	18.57	22.64	28.65
T_{11}	**$C_2H_6ClO_3P$@ 450 ppm**	14.55	18.61	22.75	28.78
T_{12}	**$C_2H_6ClO_3P$@ 600 ppm**	14.76	18.78	23.87	33.65
T_{13}	**Control- Water spray**	13.98	17.89	22.87	28.99
	CD at 5%	0.59	0.99	0.85	1.11

Spoilage (%):

The data pertaining to spoilage per cent of fruits as influenced by the pre-harvest application of potassium sulphate, calcium nitrate and ethephon at different concentrations on ber cultivar. In all the treatments the spoilage per cent was not observed upto 4th day of storage. On 4th day of storage among different chemical sprays, minimum spoilage % was observed under calcium nitrate @ 2.0 % (23.99 %) and maximum spoilage % was observed under ethephon @ 600 ppm (28.97 %).

On 6th day of storage among different chemical sprays, minimum spoilage (26.56 %) was recorded under calcium nitrate @ 2.0 per cent and maximum was observed in case of ethephon spray @ 600 ppm (37.87). Similar trend was observed on 8th day of storage, minimum spoilage percentage was observed under calcium nitrate @ 2.0 per cent (57.78 %) while maximum was observed under ethephon @ 600 ppm (70.09 %).

Fruits high in calcium may have potential for better transportation and remains in good condition for longer duration because calcium decreases respiration rate, maintains fruit firmness, delays senescence and thus extends the storage life and reduces the incidence of physiological disorders during storage (Ferguson, 1984).

Table: 2. Effect of foliar application of potassium sulphate, calcium nitrate and ethephon on shelf life (Spoilage (%) of ber

Spoilage (%)

Treatment No.	Chemicals	2th day	4th day	6th day	8th day
T_1	**K_2SO_4@ 1.0 %**	0	25.02	30.08	62.23
T_2	**K_2SO_4@ 1.5 %**	0	24.98	31.42	61.35
T_3	**K_2SO_4@ 2.0 %**	0	24.79	31.45	61.11
T_4	**K_2SO_4 @ 2.5 %**	0	24.99	30.09	60.29
T_5	**$Ca(NO_3)_2$@ 0.5 %**	0	25.43	31.26	60.01
T_6	**Ca(NO3)2@ 1.0 %**	0	25.32	31.17	59.89
T_7	**$Ca(NO_3)_2$@1.5 %**	0	25.21	29.98	59.24
T_8	**$Ca(NO_3)_2$@ 2.0 %**	0	23.99	26.56	57.78
T_9	**$C_2H_6ClO_3P$@ 150 ppm**	0	27.78	34.46	67.78
T_{10}	**$C_2H_6ClO_3P$@ 300 ppm**	0	27.84	35.69	68.51
T_{11}	**$C_2H_6ClO_3P$@ 450 ppm**	0	28.46	36.78	68.98
T_{12}	**$C_2H_6ClO_3P$@ 600 ppm**	0	28.97	37.87	70.09
T_{13}	**Control- Water spray**	0	25.85	37.75	66.72
	CD at 5%	0	0.999	0.824	2.514

Conclusion:

The results of the present study exhibited that pre-harvest application of chemicals had a significant impact on shelf life parameters like physiological loss in weight (PLW) and spoilage percentage. PLW was in the acceptable range upto eight days of storage, where the minimum PLW and minimum spoilage % was recorded under $Ca(NO_3)_2$ @ 2.0 %. The rapid loss of moisture through transpiration and respiration could be the reason of physiological loss in weight with increases in storage time. The biochemical reactions of the fruits changed continuously after harvest, which causes fruit softening and spoilage and ultimately degrades the quality of fruits.

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