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Effect of cycocel, potassium sulphate and benlate on morphology and fruit quality in ber (*Ziziphus mauritiana*) cv. BANARASI KARAKA

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Abstract : A field experiment was undertaken to find out the effect of potassium sulphate, cycocel and benlate on various morphological parameters and on post harvest life of ber, cultivar Banarasi Karaka was selected for the experiment. Foliar application of various treatments that is potassium sulphate (0, 1 % and 2%), cycocel (0,1000 and 1500 ppm) and benlate (0 and 500 ppm) to runoff stage. Frist application was given in month of September during blooming period followed by second application of pea stage of fruits. Experiment was laid out in Randomized Block Design with three replications. Uniform cultural practices were followed during course of investigation. Higher concentration of potassium sulphate (2%) was found effective to increase the fruit length, diameter and weight followed by lower concentration of potassium sulphate (1%). In general application of potassium sulphate was found beneficial than control. Foliar application of cycocel and benlate did not exert any significant effect on various morphological parameters .During storage of fruits a combination of (cycocel 1500ppm, potassium sulphate 2 per centand benlate 500 ppm) significantly increased TSS and ascorbic acid content at different period of storage and maintained maximum level at 12 days of storage. Whereas acidity increased with pre-harvest application of C_0 k_2 B_1(0 ppm, 2%, 500 ppm).

Key words : Cycocel, Potassium sulphate, Benlate, Ber

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Ber or Indian jujube (*Ziziphus mauritiana* Lamk.) is native to India. Leading ber growing states in India are Haryana, Punjab, Uttar Pradesh, Rajasthan, Madhya Pradesh, Gujarat, Bihar, Maharashtra, Andhra Pradesh, and Tamila Nadu. It is well documented in ancient literature in India and grown widely at commercial scale. Ber fruits are rich in Vitamin C, Vitamin A and Vitamin B complex. A lot of work on nutritional and hormonal aspect has been done on several fruit crops .Whereas information on these aspects in ber is scanty. Hence, present experiment was undertaken to find out the influence of cycocel, potassium sulphate and benlate on morphological parameters and fruit quality parameters during storage in ber.

RESEARCH METHODS

A field experiment was carried out to see the response of potassium sulphate, cycocel and benlate on morphology and fruit quality in ber (*Ziziphus mauritiana*) cv. BANARASI KARAKA. Treatments consisted of various concentrations of potassium sulphate (0, 1 and 2%), cycocel (0, 1000, and 1500 ppm) and benlate (0 and 500 pmm). Experiment was carried out in Randomized Block Design with three replications. Distilled water was used to prepare the solution. Different concentration of chemicals were sprayed to the ber plants at flowering and pea size stage. Control plants were treated with distilled water. All chemicals and distilled water were applied to the plant upto runoff stage. Morphological parameters were taken at maturity stage. Whereas post harvest parameters of different days of storage were observed in the laboratory after harvesting of the fruits. Total soluble solid was determined by Erama hand Refrectometer at 20^0C. (Anonymous, 1970). Estimation of acidity was done by methods described by Rangana (1977). The titrimatric methods for estimation of ascorbic

acid was followed as given by Rangana (1977).

RESEARCH FINDINGS AND DISCUSSION

Significant effect of various concentrations of potassium sulphate was observed on fruit length in ber, whereas different concentrations of cycocel and benlate failed to exert any conspicuous effects on the length of fruits (Table 1). Application of 2 per cent potassium sulphate significantly increased length of fruits than control. During I and II years of observations, whereas it was statistically at par with lower concentration of potassium sulphate (1%). Singh and Tripathi (1978) also observed an increase in fruit size in mango cultivar Banarasi Langra by spraying of potassium fertilizer. All the concentrations of cycocel and benlate did not any pronounced response on diameter of fruits, whereas spraying of potassium sulphate strikingly increased fruits diameter. Higher concentration of potassium sulphate (2%) resulted in to maximum diameter of fruit followed by potassium sulphate (1%) and control (distilled water) during both the years of observations. In a experimental findings Rajput *et al*. (1978) found various physico-chemical characters of guava fruits by foliar application of muriate of potash. Similar to fruit length, diameter and fruit weight was significantly increased by spraying of potassium sulphate. Whereas all other chemicals (cycocel and benlate) failed to give any significant effect. Spraying of potassium sulphate at 2 per cent significantly increased fruit weight than application at potassium sulphate at lower concentration (1%) and control during both the years of the observations. In a comprehensive study Patil (1977) found that higher concentration of K resulted into maximum ber weight and by which berry weight of grape increased significantly.

Significant variation due to various treatments on T.SS. content at ber fruits was observed after harvesting at different storage period (Table 2). Maximum T.SS after harvesting of the fruits (0, days to 12 days storage) was recorded with C_2 K_1 B_1 (1500 ppm, 2%, 500 ppm) treatment combinations. A decreasing trend on TSS content was observed at 8 and 12 days storage period, maximum T.SS was observed with C_2 K_2 B_1 treatment combination followed by C_2 K_2 B_0 treatment combination during both the years of experimentation. Mean T.S.S. value was also high in these treatment combination during both years. Present findings is lent credence with the observation made by Patil (1977) who notice TSS. percentage of grape was increased by spraying of potassium solution.

Data pertaining to the acidity was significantly influenced by the treatments from 0 days to 12days of storage period (Table 3). Maximum mean acidity was recorded with C_0 K_2 B_1 (0 ppm, 2% and 500 ppm) during the both years of observations. Whereas minimum acidity was found in the fruits of control plants. After harvesting of fruits there was a decreasing trends of acidity noted by increasing storage period on 12 days of storage, maximum acidity was maintained by (0 ppm, 2% and 500 ppm) C_0 K_2 B_1 treatment combinations during both the years of observations. However, minimum acidity was

Table 1 : Effect of cycocel, potassium sulphate and benlate on fruit length (cm), diameter(cm) and weight (g) of ber fruit cv. BANARASI KARAKA

Treatments	Fruit length (cm)		Diameter of fruit(cm)		Weight of fruit (g)	
	I Year	II Year	I Year	II Year	I Year	II Year
Cycocel $_{0ppm}$	4.63	4.72	3.19	3.32	22.97	23.68
Cycocel$_{1000ppm}$	4.84	4.91	3.34	3.46	24.86	25.79
Cycocel$_{1500ppm}$	4.89	4.96	3.38	3.50	25.11	26.05
S.E.(m) ±	0.13	0.13	0.09	0.09	0.75	0.73
C.D. (P=0.05)	NS	NS	NS	NS	NS	NS
Potassium $_{0\%}$	4.29	4.05	3.05	3.13	19.97	20.38
Potassium $_{1\%}$	5.03	5.14	3.34	3.50	24.88	25.88
Potassium $_{2\%}$	5.13	5.17	3.53	3.64	28.10	29.26
S.E.(m) ±	0.13	0.13	0.09	0.09	0.75	0.73
C.D. (P=0.05)	0.37	0.36	0.25	0.26	2.14	2.08
Benlate $_{0ppm}$	4.74	4.76	3.30	3.40	24.36	25.34
Benlate $_{500ppm}$	4.73	4.91	3.31	3.45	24.26	25.01
S.E.(m) ±	0.11	0.10	0.07	0.07	0.61	1.26
C.D. (P=0.05)	NS	NS	NS	NS	NS	NS

NS = Non-significant

Table 2 : Effect of combinations of different levels of cycocel, potassium sulphate, benlate and storage periods on T. S. S. content of ber fruits (*Ziziphus mauritiana* Lamk) cv. BANARASI KARAKA

Treatments	T.S.S.									
	I year					II Year				
	Storage period (days)					Storage period (days)				
	0	4	8	12	Mean	0	4	8	12	Mean
$C_0K_0B_0$	14.59	14.69	12.24	10.81	13.08	14.63	14.85	12.44	10.96	13.22
$C_0K_0B_1$	14.69	14.89	12.34	11.22	13.29	14.73	15.00	12.50	11.39	13.41
$C_0K_1B_0$	16.42	17.51	15.71	12.75	15.60	16.48	17.71	15.94	12.94	15.77
$C_0K_1B_1$	16.89	17.96	16.32	13.46	16.16	16.89	18.15	16.58	13.64	16.32
$C_0K_2B_0$	16.81	17.89	16.52	13.67	16.22	17.04	18.11	16.73	13.83	16.43
$C_0K_2B_1$	16.46	17.56	15.56	12.55	15.53	15.55	16.74	15.76	12.57	15.15
$C_1K_0B_0$	17.76	18.87	16.38	13.39	16.60	17.89	19.09	16.58	13.15	16.68
$C_1K_0B_1$	17.77	18.85	15.91	13.01	16.38	17.94	19.07	16.09	13.24	16.58
$C_1K_1B_0$	17.83	18.79	16.42	14.08	16.78	17.92	19.00	16.60	14.34	16.97
$C_1K_1B_1$	17.58	18.69	16.22	13.26	16.44	17.72	18.90	16.42	13.02	16.51
$C_1K_2B_0$	17.69	18.83	16.01	13.06	16.40	17.97	19.04	16.19	13.60	16.70
$C_1K_2B_1$	17.54	18.62	16.93	14.28	16.84	17.76	18.75	17.14	14.65	17.07
$C_2K_0B_0$	17.86	19.02	16.17	13.19	16.56	18.15	19.24	16.35	13.73	16.87
$C_2K_0B_1$	17.95	19.04	16.07	13.14	16.55	18.12	19.26	16.25	13.37	16.75
$C_2K_1B_0$	17.46	18.56	17.14	14.48	16.91	18.10	19.19	16.77	14.48	17.14
$C_2K_1B_1$	18.01	18.98	16.59	14.22	16.95	17.72	18.79	17.32	14.87	17.18
$C_2K_2B_0$	17.72	18.80	17.10	14.42	17.01	17.93	18.93	17.31	14.79	17.24
$C_2K_2B_1$	17.64	18.75	17.31	14.63	17.08	17.89	18.98	17.50	15.02	17.35
Mean	17.15	18.13	15.94	13.31		17.25	18.27	16.14	13.53	
C.D. (P=0.05)	Treatment	=			0.46					0.46
	Days	=			0.18					0.19
	Treatment x Days =				0.91					0.92

Table 3 : Effect of combinations of different levels of cycocel, potassium sulphate, benlate and storage periods on acidity of ber fruits (*Ziziphus mauritiana* Lamk) cv. BANARASI KARAKA

Treatments	T.S.S.									
	I year					II Year				
	Storage period (days)					Storage period (days)				
	0	4	8	12	Mean	0	4	8	12	Mean
$C_0K_0B_0$	0.326	0.204	0.143	0.112	0.196	0.336	0.216	0.148	0.117	0.204
$C_0K_0B_1$	0.332	0.208	0.145	0.118	0.201	0.340	0.225	0.152	0.185	0.226
$C_0K_1B_0$	0.388	0.286	0.245	0.218	0.284	0.404	0.301	0.259	0.228	0.298
$C_0K_1B_1$	0.394	0.290	0.230	0.221	0.284	0.410	0.303	0.263	0.235	0.303
$C_0K_2B_0$	0.402	0.304	0.253	0.224	0.296	0.412	0.309	0.258	0.231	0.302
$C_0K_2B_1$	0.400	0.300	0.257	0.231	0.297	0.410	0.410	0.266	0.239	0.331
$C_1K_0B_0$	0.296	0.200	0.167	0.141	0.201	0.301	0.190	0.175	0.138	0.201
$C_1K_0B_1$	0.300	0.202	0.169	0.145	0.204	0.307	0.194	0.179	0.150	0.208
$C_1K_1B_0$	0.337	0.235	0.188	0.159	0.230	0.331	0.249	0.194	0.163	0.234
$C_1K_1B_1$	0.343	0.240	0.194	0.163	0.235	0.336	0.252	0.200	0.173	0.240
$C_1K_2B_0$	0.357	0.250	0.204	0.176	0.247	0.373	0.255	0.218	0.185	0.258
$C_1K_2B_1$	0.369	0.265	0.214	0.188	0.259	0.381	0.276	0.228	0.198	0.271
$C_2K_0B_0$	0.299	0.202	0.169	0.142	0.203	0.304	0.191	0.177	0.139	0.203
$C_2K_0B_1$	0.303	0.204	0.171	0.146	0.206	0.310	0.196	0.181	0.152	0.210
$C_2K_1B_0$	0.340	0.237	0.190	0.161	0.232	0.334	0.252	0.196	0.164	0.236
$C_2K_1B_1$	0.346	0.242	0.196	0.165	0.237	0.339	0.255	0.202	0.175	0.243
$C_2K_2B_0$	0.361	0.252	0.206	0.178	0.249	0.377	0.258	0.221	0.187	0.261
$C_2K_2B_1$	0.373	0.268	0.216	0.190	0.262	0.385	0.279	0.230	0.200	0.273
Mean	0.348	0.244	0.198	0.171		0.355	0.256	0.208	0.181	
C.D. (P=0.05)	Treatment	=			0.007					0.007
	Days	=			0.002					0.003
	Treatment x Days =				0.005					0.010

Table 4 : Effect of combinations of different levels of cycocel, potassium sulphate, benlate and storage periods on ascorbic acid of ber fruits (*Ziziphus mauritiana* Lamk) cv. BANARASI KARAKA

Treatments	T.S.S.									
	I year					II Year				
	Storage period (days)					Storage period (days)				
	0	4	8	12	Mean	0	4	8	12	Mean
$C_0K_0B_0$	79.97	61.81	49.47	39.07	57.58	80.81	62.64	50.12	39.57	58.29
$C_0K_0B_1$	80.09	62.22	49.98	39.27	57.89	80.92	63.16	50.90	39.80	58.69
$C_0K_1B_0$	89.96	76.91	66.30	56.10	72.32	90.97	77.91	67.16	56.96	73.25
$C_0K_1B_1$	90.27	77.52	66.91	56.61	72.83	91.30	78.42	67.69	57.31	73.68
$C_0K_2B_0$	93.66	81.19	69.97	59.36	76.05	94.68	82.21	70.37	60.15	76.85
$C_0K_2B_1$	93.84	80.78	69.56	58.14	75.58	94.88	81.62	69.83	59.12	76.36
$C_1K_0B_0$	92.31	82.42	66.50	57.22	74.61	93.28	83.27	67.59	57.93	75.51
$C_1K_0B_1$	92.51	82.62	66.81	57.43	74.84	93.50	83.47	67.82	58.07	75.72
$C_1K_1B_0$	96.10	81.80	67.32	55.20	75.11	96.92	82.73	68.39	55.93	75.99
$C_1K_1B_1$	96.72	82.03	67.83	55.29	75.47	97.46	82.98	68.72	56.05	76.30
$C_1K_2B_0$	99.96	85.58	68.44	54.47	77.11	69.01	86.52	69.24	55.12	69.97
$C_1K_2B_1$	100.39	84.76	68.75	54.57	77.12	98.43	83.81	69.41	56.61	77.07
$C_2K_0B_0$	93.23	83.24	67.17	57.79	75.36	94.21	84.10	68.26	58.51	76.27
$C_2K_0B_1$	93.44	83.45	67.48	58.00	75.59	94.44	84.31	68.49	58.65	76.47
$C_2K_1B_0$	97.07	82.62	67.99	55.75	75.86	97.89	83.56	69.08	56.49	76.75
$C_2K_1B_1$	97.68	82.85	68.51	55.85	76.22	69.70	87.39	69.93	55.67	70.67
$C_2K_2B_0$	100.96	86.43	69.13	55.01	77.88	100.94	85.94	69.50	55.19	77.89
$C_2K_2B_1$	101.39	85.61	69.44	55.12	77.89	101.95	86.80	70.20	55.74	78.67
Mean	93.86	80.21	65.98	54.46		91.18	81.16	66.82	55.16	
C.D. (P=0.05)	Treatment =				2.12					2.11
	Days =				0.86					0.86
	Treatment x Days =				4.25					4.22

recorded with control at different period of observations. Present findings is also experimentally substantiated with the observation of Koo *et al.* (1974).

Different treatments also influenced ascorbic acid content at 0 days to 12 days of storage period (Table 4) C_2 K_2 B_1 (1500 ppm, 2% and 500 ppm) exhibited maximum vitamin C content at 0 days of storage . Whereas, on same day of observation C_1 K_1 B_1 (1000ppm,1% and500ppm) (control) resulted in minimum ascorbic acid content. In general their a decreasing trend was observed as the period of the storage was enhanced. Mean value of vitamin C content was also noted with C_2 K_2 B_1 (1500 ppm, 2% and 500 ppm) treatments combinations.Koo *et al.* (1974) found that application potassium increase vitamin C content in lemon. Several earlier workers also advocated beneficial effect of benlate on fruit quality (Kalinov *et al*., 1982; Cornack and Brown, 1969).

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