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EFFECT OF PRUNING TIME AND NITROGEN APPLICATION ON YIELD OF BER (*ZIZIPHUS MAURITIANA* LAMK.)

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ABSTRACT

The present investigation was carried out at agricultural experimental station, Navsari Agricultural University, Tanchha, Bharuch, Gujarat during 2022-23 and 2023-24 for evaluating the effect of time of pruning and nitrogen application on yield parameters of ber cv. Gola. The experiment was laid out in factorial completely randomized design (FCRD) with three repetitions and 16 treatments comprising of four levels of time of pruning and four levels of nitrogen application. Results of the present investigation revealed that trees pruned during the 2nd fortnight of April (P₂) produced the highest fruit set (9.98%), number of fruits per tree (1674.73), fruit yield (36.31 kg tree⁻¹), fruit weight (25.57 g) and fruit volume (22.26 ml). Among nitrogen levels, the highest dose of 850 g N + 250 g P₂O₅ + 250 g K₂O per tree (N₄) resulted in the maximum fruit set (10.20%), number of fruits per tree (1678.23), fruit yield (37.60 kg tree⁻¹), fruit weight (25.29 g) and fruit volume (22.26 ml). Pruning in the second fortnight of April coupled with the application of 850 g N + 250 g P₂O₅ + 250 g K₂O per tree recorded the highest fruit set (10.90%), fruit yield (43.91 kg tree⁻¹), fruit weight (26.91 g) and fruit volume (24.75 ml), highlighting the synergistic effect of pruning (2nd fortnight of April) and application on nitrogen (850 g) in ber cv. Gola

Keywords : Ber, *Ziziphus mauritiana* Lamk., Gola, Pruning time and Nitrogen application.

Introduction

Ber (*Ziziphus mauritiana* Lamk.), commonly known as Indian jujube, is an important arid fruit crop of the Rhamnaceae family, native to the Indo-China region and widely cultivated in India, Pakistan, China, Afghanistan, Iran and Iraq. In India, it covers about 52,000 ha with a production of 5.26 lakh MT. Gujarat, Madhya Pradesh, Chhatisgarh, Maharashtra and Odisha are the leading states in ber production. Gujarat alone accounts for about 10,708 ha and contributes 1.05 lakh MT to the national production (Anon., 2024). Commercial cultivars of ber include Gola, Umran and Thai Apple ber. It is nutritionally rich and an excellent source of vitamins (A and C), minerals (potassium, iron, calcium) and antioxidants. The crop has significant medicinal, industrial as well as fodder

value. The crop thrives in diverse soils, tolerates salinity up to pH 9.2 and endures high temperatures (up to 50°C), making it ideal for dryland farming (Singh *et al.*, 1998). Its flowers are cross-pollinated, borne on current-season shoots, emphasizing the importance of annual pruning to induce new fruiting wood. Without pruning, trees become bushy and unproductive due to poor aeration, shading and weak branches. Pruning, the art and science of selective branch removal, improves canopy structure, light penetration, fruiting and quality. The ideal pruning time is region-specific and in Gujarat, it is best performed between mid-April to late May during dormancy. Proper pruning promotes new shoot growth, which bears about 98% of the total fruits (Kurian, 1985). Nutrient management, especially nitrogen

application, is equally vital for sustaining productivity. Nitrogen enhances vegetative growth, chlorophyll formation and photosynthetic efficiency, leading to improved fruit size, weight and yield (Singh and Ahlawat, 1996; Sharma *et al.*, 1991). Studies indicate that increasing nitrogen up to 500 g per plant enhances plant height, spread and yield in ber cultivars such as Gola and Umran (Lal and Dhaka, 2003), highlighting the role of proper pruning and nitrogen in optimizing growth, yield and fruit quality in ber. The present investigation was therefore undertaken to identify, the best time of pruning and ideal nitrogen application for ber cv. Gola under South Gujarat conditions.

Material and Methods

A field trial was conducted during 2022-23 and 2023-24 to study the "Effect of pruning time and nitrogen application on ber" at the Agricultural Research Station, Navsari Agricultural University, Tanchha. The experiment was carried out on 30 years old trees of ber cv. Gola. All selected trees were uniform in growth, planted at a distance of 10m × 10m and subjected to standard agricultural practices. The experiment was evaluated in Completely Randomized Design based on factorial concept and comprised of two factors with four levels each. The first factor comprised of time of pruning; P₁ = 1st fortnight of April, P₂ = 2nd fortnight of April, P₃ = 1st fortnight of May and P₄ = 2nd fortnight of May. Hard pruning was done by cutting back the previous season growth to a length of 20-30 cm from the base of primary or secondary shoots. The second factor consisted of different Nitrogen (N) application doses while keeping other nutrients constant *viz.*, N₁ = 550g N + 250g P₂O₅ + 250g K₂O per tree, N₂ = 650g N + 250g P₂O₅ + 250g K₂O per tree, N₃ = 750g N + 250g P₂O₅ + 250g K₂O per tree and N₄ = 850g N + 250g P₂O₅ + 250g K₂O per tree. Nitrogen (urea) was applied in two splits, half in July and the remaining half in September. Full dose of Phosphorus (single super phosphate) and Potassium (muriate of potash) were applied in July. Five uniform branches on each tree were selected and tagged for calculating the fruit set (%). The number of fruits per tree were recorded separately for each tree and the average value computed. Fruits harvested from each successive picking were weighed and the total weight of fruits per tree was expressed in kilograms. The weight of five randomly selected fruits from each treated tree was averaged to estimate the fruit weight (g). Similarly, fruit volume (ml) was calculated using five randomly selected fruits from each tree utilizing the water displacement method. The data collected was subjected to statistical analysis as per the method suggested by Panse and Sukhatme (1985).

Results

Time of pruning and soil incorporation of nutrients in ber cv. Gola had a significant influence on all traits included in the study (Table 1 & 2).

Fruit set (%)

The highest fruit set (9.86%, 10.09% and 9.98%) in ber cv. Gola was recorded with pruning in the second fortnight of April (P₂) during 2022–23, 2023–24 and in pooled data, respectively (Table 1). With regard to nutrient application, treatment N₄ (850 g N + 250 g P₂O₅ + 250 g K₂O per tree) gave the maximum fruit set during 2022-23 (10.10%), 2023-24 (10.31%) and pooled data (10.20%). The interaction effect (P × N) was found significant, with treatment P₂N₄ (pruning in the second fortnight of April + application of 850 g N + 250 g P₂O₅ + 250 g K₂O per tree) achieving the highest fruit set (10.90%) in pooled data. It was statistically at par with P₂N₃ and P₁N₄ treatment combinations (Table 3).

Number of fruits per tree

Pruning ber cv. Gola in the 2nd fortnight of April (P₂) recorded the highest fruit number (1632.94, 1716.53 and 1674.73) during 2022-23, 2023-24 and pooled data respectively, followed closely by treatment P₃ (pruning in 1st fortnight of April). Further, the maximum number of fruits (1647.46, 1708.99, and 1678.23) was recorded with treatment N₄ (850 g N + 250 g P₂O₅ + 250 g K₂O), which was at par with N₂ and N₃ treatments (Table 1). The interaction effect (P × N) for number of fruits per tree was found to be non-significant.

Fruit weight (g)

Pruning in the 2nd fortnight of April (P₂) resulted in the highest fruit weight (24.93, 26.22 and 25.57 g) during 2022-23, 2023-24 and in pooled data, respectively. In 2022-23, treatment P₁ was statistically at par with P₂. Nitrogen levels had a marked influence on fruit weight in 2022-23 and in pooled data. The maximum fruit weight was recorded with N₄ (850 g N + 250 g P₂O₅ + 250 g K₂O) in 2022-23 (25.36 g) and pooled data (25.29 g), followed closely by N₃ (Table 2). The interaction effect (P × N) was found significant during 2023-24. Treatment combination P₂N₄ yielded the highest fruit weight (26.30, 27.52 and 26.91 g) across respective years and pooled data (Table 3).

Fruit volume (ml)

The maximum fruit volume (21.47, 23.05 and 22.26 ml) during 2022-23, 2023-24 and in pooled data was reported by pruning in the 2nd fortnight of April (P₂). Treatment P₁ was statistically at par with P₂ in

Table 2: Effect of pruning time and nitrogen application on fruit weight and fruit volume in ber cv. Gola

Treatments	Fruit volume (ml)			Fruit yield (kg/tree)		
	2022-23	2023-24	Pooled	2022-23	2023-24	Pooled
Pruning Time (P)						
P ₁ = 1 st Fortnight of April	19.83	21.42	20.63	27.20	35.20	31.20
P ₂ = 2 nd Fortnight of April	21.47	23.05	22.26	30.91	41.71	36.31
P ₃ = 1 st Fortnight of May	18.72	19.64	19.18	28.53	38.10	33.31
P ₄ = 2 nd Fortnight of May	16.95	17.83	17.39	20.77	24.27	22.52
SEm (±)	0.62	0.71	0.53	0.52	0.79	0.47
CD at 5%	1.82	2.03	1.47	1.49	2.27	1.33
Nitrogen Application (N)						
N ₁ = 550g N + 250g P ₂ O ₅ + 250g K ₂ O per tree	17.46	18.38	17.92	18.80	21.34	20.07
N ₂ = 650g N + 250g P ₂ O ₅ + 250g K ₂ O per tree	19.37	20.73	20.05	26.04	33.12	29.58
N ₃ = 750g N + 250g P ₂ O ₅ + 250g K ₂ O per tree	21.28	22.54	21.91	30.80	41.37	36.09
N ₄ = 850g N + 250g P ₂ O ₅ + 250g K ₂ O per tree	22.01	23.23	22.62	31.76	43.44	37.60
SEm (±)	0.54	0.63	0.41	0.52	0.79	0.47
CD at 5%	1.57	1.91	1.32	1.49	2.27	1.33
Interaction (P X N)						
SEm (±)	0.87	1.05	0.76	1.03	1.58	0.94
CD at 5%	2.68	3.04	2.18	NS	NS	2.66
CV %	7.82	8.09	7.53	6.66	7.84	7.48
Interaction (P X N X Y)						
	P x Y	N x Y	P x N x Y	P x Y	N x Y	P x N x Y
S.Em.±	0.5462	0.5462	1.0924	0.6658	0.6658	1.3317
CD at 5%	NS	NS	NS	NS	NS	NS

Table 3 : Interaction effect of pruning time and nitrogen application on fruit set, fruit weight, fruit volume and fruit yield in ber cv Gola

Treatment combinations	Fruit set (%)			Fruit weight (g)			Fruit volume (ml)			Fruit yield (kg/tree)		
	2022-23	2023-24	Pooled	2022-23	2023-24	Pooled	2022-23	2023-24	Pooled	2022-23	2023-24	Pooled
P ₁ N ₁	7.47	7.67	7.57	21.63	22.31	21.97	18.12	18.87	18.50	17.45	18.72	18.09
P ₁ N ₂	7.91	8.12	8.02	22.23	23.01	22.62	19.38	20.61	19.99	27.67	35.17	31.42
P ₁ N ₃	8.84	9.11	8.97	23.58	24.53	24.06	20.64	22.07	21.36	31.48	42.94	37.21
P ₁ N ₄	10.27	10.45	10.36	25.40	26.78	26.09	21.17	22.59	21.88	32.18	43.96	38.07
P ₂ N ₁	9.03	9.20	9.12	23.81	24.99	24.40	19.21	19.98	19.60	22.26	27.93	25.10
P ₂ N ₂	9.62	9.75	9.69	24.39	25.76	25.08	21.04	22.19	21.62	29.93	39.96	34.95
P ₂ N ₃	10.00	10.42	10.21	25.21	26.59	25.90	22.68	23.92	23.30	34.98	47.59	41.29
P ₂ N ₄	10.80	11.00	10.90	26.30	27.52	26.91	23.13	24.09	23.61	36.46	51.36	43.91
P ₃ N ₁	6.44	6.64	6.54	20.20	26.18	23.19	16.96	17.92	17.44	20.80	24.50	22.65
P ₃ N ₂	7.08	7.26	7.17	21.09	24.12	22.61	18.31	19.13	18.72	28.18	37.16	32.67
P ₃ N ₃	8.58	8.97	8.77	23.20	21.71	22.46	19.61	20.28	19.95	32.54	44.78	38.66
P ₃ N ₄	9.68	9.97	9.83	24.88	20.80	22.84	20.00	20.99	20.50	32.60	45.93	39.27
P ₄ N ₁	5.60	5.82	5.71	19.00	19.52	19.26	15.75	16.62	16.19	14.68	14.21	14.45
P ₄ N ₂	6.26	6.48	6.37	19.93	20.49	20.21	17.00	17.88	17.44	18.38	20.20	19.29
P ₄ N ₃	8.17	8.44	8.31	22.67	23.55	23.11	18.20	19.03	18.62	24.22	30.18	27.20
P ₄ N ₄	9.64	9.81	9.72	24.86	25.78	25.32	18.61	19.74	19.18	25.81	32.50	29.16
SEm (±)	0.44	0.46	0.32	1.33	1.21	0.90	0.87	1.05	0.76	1.03	1.58a	0.94
CD at 5%	NS	NS	0.90	NS	3.50	NS	2.68	3.04	2.18	NS	NS	2.66

Conclusion

Based on two years of experimentation, it can be concluded that time of pruning and nitrogen application have a profound impact on the yield of ber cv. Gola. Pruning when done in the 2nd fortnight of April resulted in the maximum values of fruit set, fruit yield and physical parameters of fruit quality. Similarly, nutrient application of 850 g N + 250 g

P₂O₅ + 250 g K₂O per tree gave the highest fruit set, number of fruits per plant, fruit weight and fruit yield over lower nitrogen levels. Pruning in the 2nd fortnight of April coupled with the application of 850 g N + 250 g P₂O₅ + 250 g K₂O per tree was found to be the best treatment combination for maximizing production in ber cv. Gola under South Gujarat conditions.

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