

Performance of nine ber cultivars (*Zizyphus mauritiana* Lamk) on top working in semi-arid region of West Bengal

S.N. Ghosh and B. Mathew

Department of Fruits and Orchard Management, Faculty of Horticulture, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur - 741 252, Nadia, West Bengal, India.

Abstract

Performance of nine ber cultivars viz., Banarasi Karaka, Chhuhara, Dandan, Gola, Ilayachi, Jogia, Kaithali, Katha Phal and Umran on top working was investigated. From the top working success point of view, Banarasi Karaka, Dandan, Kaithali, Jogia, Katha Phal and Umran performed better. Fruit yield at seven months after budding was highest in Jogia followed by Umran, Chhuhara and Dandan. Fruit weight and size were maximum in Jogia and Umran and minimum in Ilayachi. Total soluble solids, total sugar and vitamin C content were highest in Ilayachi with medium acidity and resulted better T.S.S./acid ratio. The cultivar Dandan, which yielded medium, produced fruits of better weight and size with good T.S.S. and acid ratio resulting in excellent taste.

Key words: Ber, *Zizyphus mauritiana* Lamk, cultivars, performance, top working

Introduction

Ber, the most drought hardy fruit tree, can give better income on marginal lands where other fruit plants and agricultural crops fail to grow. Besides nutritive value, many other aspects make the ber cultivation a good venture. It is a well-adapted fruit plant of arid and semi-arid areas. The commercial cultivation of ber in India is mainly in Punjab, Haryana, Rajasthan, Gujarat, Madhya Pradesh, Maharashtra and Andhra Pradesh (Pareek and Vashishtha, 1983). The agro-climatic situation of Western part of West Bengal, which is considered as semi-arid region, an area of 1.5 million ha, is suitable for growing ber. The choice of suitable cultivar is of paramount importance for a successful cultivation. There are several superior varieties recommended for different parts of the country (Pathak and Pathak, 1993). The cultivars which give good performance in one locality may not behave in a similar way under different agro-climatic conditions. Any scientific investigation on varietal performance of ber has not so far been made in West Bengal in general and semi-arid region in particular. With a view to find out suitable variety, nine promising ber cultivars were collected and evaluated at the Regional Research Station of Bidhan Chandra Krishi Viswavidyalaya, Jhargram. Considering the juvenile phase, the cultivars were top worked in a nearby private orchard to assess their performance in semi-arid region of West Bengal for initial recommendation as there is no information in this regard as stated earlier.

Materials and methods

Study on performance of nine ber cultivars viz., Banarasi Karaka, Chhuhara, Dandan, Gola, Ilayachi, Jogia, Kaithali, Katha Phal and Umran on top working was made in a private orchard situated 5 km from the Regional Research Station of Bidhan Chandra Krishi Viswavidyalaya, Jhargram. The scion of the cultivars were collected from the Central Arid Zone Research Institute and were planted at the Regional Research Station, Jhargram during 1999.

The scion buds taken from the R.R.S., Jhargram were top-worked on 5 years old trees of local ber plants (*Zizyphus rotundifolia*) planted at 5 x 5m distance, which were beheaded on 3rd May, 2001. After beheading the plants were fertilized with 40 kg FYM, 150 g N, 50 g P₂O₅ and 100 g K₂O per plant followed by light irrigation to encourage shoot growth. Five shoots per plant in proper place were allowed to grow and others were removed time to time. The plants were again fertilized with 150 g N, 50 g P₂O₅ and 100 g K₂O during September, 2001. The top working was made on 5 shoots of each beheaded plant by patch budding on 9.6.2001, taking 4 beheaded plants as a unit of replication for each cultivar in a randomized block design. The plants were sprayed with insecticides and fungicides as and when it required. The plants were irrigated three times during October, November and December at monthly interval.

The observations on budding success and scion growth were made 2 months after budding. After taking observation 2 shoots per plant in suitable position were retained to form the main frame work and others were removed. The number of fruits per plant were counted on 9.1.2002. Ten mature fruits from each plant collected randomly, were brought to the laboratory of the Regional Research Station, Jhargram in polythene bags and were analysed for physico-chemical characteristics. The T.S.S. was determined by hand refractometer. Titratable acidity, total sugar and vitamin C were estimated by standard methods (A.O.A.C., 1990).

Results and discussion

Budding success: The perusal of the data given in Table 1 reveal that the success in budding significantly varied among the cultivars on top working. Hundred per cent success was obtained in the cultivars Banarasi Karaka and Kaithali followed by 80 per cent in Dandan, Jogia, Katha Phal and Umran. The findings was in close conformity with the result of Verma *et al.* (2000) in ber where they noted maximum budding success in Banarasi Karaka (86%) on one year old rootstock. Lowest budding success was

Table 1. Performance of nine ber cultivars on top working

Name of the cultivar	2 months after budding						Number of fruits/plant as on 9.1.2002	Fruit yield/plant (kg)
	Date of budding	Budding success (%)	Scion height (cm)	Scion girth (cm)	Number of leaves	Number of branches		
Banarasi Karaka	9.6.2001	100	62	4.4	83	6	670	19.6
Chhuhara	9.6.2001	70	60	3.3	48	4	1425	31.5
Dandan	9.6.2001	80	78	5.5	85	6	1125	31.0
Gola	9.6.2001	60	104	5.4	116	6	450	16.2
Ilayachi	9.6.2001	50	30	2	20	4	800	14.2
Jogia	9.6.2001	80	90	6	98	6	1600	62.1
Kaithali	9.6.2001	100	70	3.5	75	6	350	11.0
Katha Phal	9.6.2001	80	55	3	45	5	280	5.20
Umran	9.6.2001	80	155	10	90	6	950	37.2
C.D. ($p=0.05$)		5.1	6.2	0.4	7.3	NS	30.8	1.80

Table 2. Physico-chemical characteristics of fruits in top worked ber cultivars

Cultivar	Physical characteristics							Chemical characteristics				
	Fruit weight (g)	Fruit length (cm)	Fruit diameter (cm)	Seed weight (g)	Pulp (%)	Specific gravity	Pulp consistency	TSS ($^{\circ}$ Brix)	Total sugar (%)	Adicity (%)	Vitamin C (mg/100g pulp)	TSS/ acidity ratio
Banarasi Karaka	29.3	5.4	3.4	1.5	94.9	1.12	Moderate crispy	13.0	9.5	0.37	158.3	35.1
Chhuhara	22.1	4.8	3.0	1.1	95.0	1.02	Moderate crispy	12.1	9.5	0.32	138.3	37.8
Dandan	27.6	5.1	3.0	1.1	96.0	1.07	Moderate crispy	13.0	9.1	0.26	155.0	50.0
Gola	36	4.2	4.0	1.4	96.1	1.06	Melting	15.8	11.8	0.48	201.7	32.9
Ilayachi	17.8	3.2	3.2	0.6	96.6	1.03	Crispy	21.8	13.3	0.40	235.3	54.5
Jogia	38.8	4.9	3.8	1.9	95.1	1.10	Crispy	14.9	10.6	0.38	183.3	39.2
Kaithali	31.3	4.6	3.1	1.1	96.5	1.07	Moderate crispy	12.4	8.0	0.32	220.4	38.8
Katha Phal	18.7	3.9	3.0	1.1	94.1	1.06	Melting	14.8	11.1	0.26	183.5	56.9
Umran	39.2	4.8	3.8	1.8	95.4	1.04	Crispy	14.8	9.0	0.38	201.2	38.9
C.D. ($p=0.05$)	0.49	0.3	0.3	0.3	NS	NS		0.9	0.8	0.05	12.7	

recorded from Ilayachi (50%). Differential budding success among the cultivars might have been due to incompatible graft combination between stock and scion cultivars as described by Verma *et al.* (2000) in ber.

Scion growth: Two months after budding, it was noted that scion height and basal girth were highest in Umran (155.0 and 10.0 cm, respectively) and lowest in Ilayachi. Leaf production was maximum in Gola (116) followed by Jogia (98), Umran (90) and Dandan (85) and minimum in Ilayachi (20). Number of branches varied between 4 and 6 among the cultivars (Table 1).

Fruit production: The data presented in Table 1 indicated that the fruit production (by number and weight) was highest in Jogia which produced 62.1 kg fruits/plant in 7 months after budding followed by Umran (37.2 kg/plant). Highest yield in Jogia was due to maximum number of heavier fruits. Pareek and Vashishtha (1983) reported that the yield per tree in 'Jogia' ranges between 60 and 80 kg from 5 year old tree under irrigated condition. Bisla *et al.* (1980) found that Umran and Katha Bombay were high yielders among the late cultivars. The cultivars Chhuhara and Dandan also gave better yield (31.5 and 31.0 kg/plant, respectively) due to production of good numbers of fruits. The cultivars Katha Phal and Kaithali produced lesser number of fruits per plant and thereby resulted lower yield.

Physical characteristics of fruits: The physical characteristics of fruits of different cultivars have been presented in Table 2. The fruit weight, which is considered to be one of the important

criteria for getting premium price, was highest in Umran (39.2 g) closely followed by Jogia (38.8 g). The same cultivars produced fruits weighing only 7.9 and 12.5 g, respectively in reclaimed ravines in Agra (Kumar and Bhusan, 2001). Another interesting observation was that all the cultivars studied produced heavier fruits as compared to the same variety mentioned by Vashishtha (2001). It may be due to agro-climatic variation, raising the plants through top-working and providing irrigation during fruit growth and development. Considering length and diameter, the cultivars Banarasi Karaka, Dandan, Jogia and Umran produced better size fruits while Ilayachi produced fruits of minimum weight and size. Vashishtha (2001) also reported that the cultivar Ilayachi produced small size fruit weighing only 8.5 g.

The seed weight varied between 0.6 g (Ilayachi) and 1.9 g (Jogia) in different cultivars. The pulp content, which is the most important quality character, as it determines the edible portion, ranged between 94.1 and 96.6 per cent among the cultivars. The specific gravity varied between 1.02 and 1.12 among the cultivars. The pulp consistency in different cultivars was crispy or moderately crispy except in Gola and Katha Phal where the pulp was melting.

Chemical characteristics of fruits: The chemical characteristics of fruits of different ber cultivars have been presented in Table 2. Ilayachi produced highest total soluble solids (21.8 $^{\circ}$ Brix) and total sugar (13.3%) followed by Gola (15.8 $^{\circ}$ Brix TSS and 11.8% total sugar).

Table 3. Maturity time and special features of fruits of top worked ber cultivars

Cultivars	Ripening time	Shape of fruit	Skin colour at maturity	Seed shape
Banarasi Karaka	1 st week of February	Oblong, styler end,	Light yellow obliquely pointed	Spindle shaped, ends pointed
Chhuhara	4 th week of January	Oval, styler end tapering	Yellowish green	Elongated, blunt beak
Dandan	1 st week of February	Oblong, styler end nipple like	Yellowish green	Spindle shaped, both ends pointed with slight curve
Gola	4 th week of January	Round, styler end flat	Bright yellow	Oval, small blunt beak
Ilayachi	2 nd week of March	Oblate, styler end flat	Yellowish green	Oval, small blunt beak (seed very small size)
Jogia	4 th week of January	Oblong, styler end bluntly tapering	Yellowish green	Oblong
Kaithali	4 th week February	Oblong, styler end tapering	Light yellow (shining)	Elongated, slight bulge towards styler end with sharp needle like beak
Katha Phal	2 nd week of March	Obovate, styler end round	Yellowish green with	Same as 'Kaithali' but of red blush bigger size
Umran	3 rd week of February		Semi-cylindrical, styler	Greenish yellow Oval with end round
small beak				

Higher TSS content in Ilayachi (20 °Brix) is also reported by Vashishtha (2001). Similar values of TSS and total sugar for Gola have already been reported by Bal and Jawanda (1981-1982). In other cultivars, the TSS ranged between 12.1 (Chhuhara) and 14.9 °Brix (Jogia) while total sugar varied between 8.0 (Kaithali) and 11.1% (Katha Phal). Acidity was found to be the highest in Gola (0.48%) and lowest in Katha Phal and Dandan (0.26%). Similar value of acidity in Dandan was reported by Bal and Uppal (1992).

All the ber cultivars contained good amounts of ascorbic acid ranging between 138.3 and 235.3 mg per 100 g of pulp. It was the highest in Ilayachi (235.3 mg/100g) followed by Kaithali, Gola and Umran and lowest in Chhuhara (138.3 mg/100g). Highest vitamin C content in Ilayachi was also reported by Bisla *et al.* (1980). The TSS/acid ratio, which determine the taste pleasantry, was highest in Katha Phal followed by Ilayachi and Dandan and lowest in Gola.

Fruit ripening time: It is evident from the Table 3 that the fruits of different cultivars matured between 4th week of January and 2nd week of March. On the basis of ripening time, Banarasi Karaka, Chhuhara, Dandan, Gola and Jogia are grouped as early; Kaithali and Umran are medium while Ilayachi and Katha Phal are considered as late types under Jhargram condition.

Fruit characteristics: The shape of the fruit and seed and skin colour of mature fruit, which are considered as varietal characteristics, have been detailed in Table 3. The above characteristics were compared with the reports mentioned by Bal and Uppal (1992) and Vashishtha (2001) and found that they were similar to them.

Acknowledgement

Authors are grateful to MPS Greenery Developers Limited, Jhargram, Midnapore (West) for providing their orchard and other facilities to carry out the investigation.

References

- A.O.A.C., 1990. *Official Methods of Analysis*. Association of Official Analytical Chemists, Washington, D. C. 15th Edn.
- Bal, J.S. and D.K. Uppal, 1992. Ber varieties. Associated Publishing Company, New Delhi, pp. 89.
- Bal, J.S. and J.S. Jawanda, 1981-82. Studies on physico-chemical characteristics of ber cultivars grown at Ludhiana. *Hort. J.*, 1(1&2):42-47.
- Bisla, S.S., K.S. Chausan and N.R. Godara, 1980. Evaluation of late ripening germplasm of ber (*Zizyphus mauritiana* Lamk) under semi-arid regions. *Haryana J. Hort. Sci.*, 15:175-78.
- Kumar, Dinesh and L.S. Bhusan, 2001. A note on performance of ber cultivars in reclaimed ravines. *Orissa J. Hort.*, 29(1):104-05.
- Pareek, O.P. and B.B. Vashishtha, 1983. Delicious ber varieties of Rajasthan. *Indian Hort.*, 28(2):13-16.
- Pathak, R.K. and R.A. Pathak, 1993. Improvement of minor fruits. In : *Advances in Horticulture* Vol. 1, Eds K. L. Chadha and O. P. Pareek. Malhotra Publishing House, New Delhi - 110 064.
- Vashishtha, B.B. 2001. *Ber varieties : A monograph*. Agrobios (India), Jodhpur -342002, pp. 97.
- Verma, M.K., V.P. Sharma and S.K. Saxena, 2000. Compatibility of ber varieties on different rootstock. *Indian J. Hort.*, 57(1):13-17.