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Studies on chemical composition of fruits of important mango (*Mangifera indica* L.) varieties in Uttarakhand

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Abstract

The present study was conducted to evaluate the chemical quality attributes of 43 mango varieties in tarai region of Uttarakhand. The varieties revealed significant differences for various quality parameters. The pooled data of two years study revealed that the variety Chausa exhibited maximum total soluble solids (22.11 °Brix) and T.S.S/acid ratio (152.39). The variety also revealed highest sugar: acid ratio (123.56) and non-reducing sugar content (13.36 %). However, the maximum reducing (6.12 %) and total sugar content (18.05 %) were found in cultivars Duddha Peda and Amrapali, respectively. Variety Langra Gorakhpur recorded highest ascorbic acid content (91.31 mg/100g pulp), while, the maximum carotene content (8.11 mg/100g pulp) was obtained in Amrapali. The results revealed that the varieties like Chausa and Amrapali are most superior in terms of chemical attributes. These findings can be utilized by the breeders for crop improvement programmes in future.

Keywords: Mango, chemical attributes, varieties, Uttarakhand

1. Introduction

Mango is one of the most important tropical fruit of the world. Originated in South East Asia, mango enjoys the status of the “King of fruits”. India is the largest producer of mango in the world with an area of 2.22 m ha and an annual production of 18.83mt (Anonymous, 2014) [1]. The major mango producing states in India are Andhra Pradesh, Uttar Pradesh, Karnataka, Tamil Nadu, Maharashtra etc. The fruits of mango are renowned for their pleasant flavor, high nutritional value, attractive appearance and wide adaptability. There are many health benefits of mango fruit. Ripe mango can play an important role in balancing human diet by providing about 64-86 calories of energy per 100 g (Rathore *et al.*, 2007) [20]. The fruit pulp is also rich in carotenoids, vitamin B and essential mineral nutrients like potassium, calcium etc. Mango fruits provide about 32-200 mg vitamin C per 100 g pulp (Pleguezuelo *et al.*, 2012) [18] which aids in the prevention of degenerative processes such as cardiovascular diseases and cancer (Berardini *et al.*, 2005) [5]. Fruits can be utilized at all stages of development. Raw fruits are used for the preparation of curries, chutneys, preserves, mango powder and pickles (Singh and Saxena, 2008) [22], while ripe fruits are processed into different forms like mango leather, candy, juice etc.

The eating quality of mango is a function of its flavor which in turn is associated with its chemical characteristics like soluble solids, titratable acidity, sugar content etc. From the consumer point of view, fruits with low acidity and high soluble solid content are preferred. Although in the past, the chemical characteristics of various mango varieties have been adjudged across globe. But, there are many variations in the chemical traits of fruits depending upon the methods adopted for analysis, degree of ripeness at the time of harvest and most importantly the climatic discrepancies among the regions they were produced.

Although a hilly state, Uttarakhand also provides an immense scope for mango cultivation in lowlands as well as valley areas. ‘Dashehari’, ‘Langra’ and ‘Chausa’ are the most common and popular varieties of this region. Besides, the Horticulture Research Centre, Patharchatta, G.B.P.U.A.&T., Pantnagar also maintains a good collection of mango germplasm consisting of about 200 varieties. Presently, there is no detailed information regarding the chemical characters of various mango varieties in this region. The following study was therefore, undertaken to systematically evaluate the chemical attributes of some of the local and improved mango varieties.

This study may aid in the effective utilization of mango genetic resources in breeding programmes for crop improvement and may open new expectations for the market.

Material and Methods

The present study was conducted for two growing seasons during the year 2012 and 2013, at G.B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand. The site is situated in the foot hills of Himalayas about 243.84 m above the mean sea level, at 29° North latitude and 79.3° East longitude. Fruits of forty-three mango varieties were evaluated for different chemical attributes. The varieties were of different age ranging from 12 to 25 years old and were maintained under uniform cultural operations. The experiment was carried out in Randomized Block Design and treatments were replicated three times. Three trees of each variety served as a unit of treatment. Ten fruits per replication of each cultivar were taken for chemical analysis.

The total soluble solids (°Brix) and titratable acidity (%) were determined using Erma hand refractometer and titration method as described by Ranganna (1986) [19], respectively. Total soluble solids/acid ratio was worked out by dividing the total soluble solids with titratable acidity while the total, reducing and non-reducing sugar per cent was estimated as per the method prescribed by A.O.A.C (1984) [2]. The sugar acid ratio was calculated by dividing the total sugar of fruit pulp with its acid content and the ascorbic acid content (mg per 100 g of pulp) in fruits was estimated by reduction of 2, 6-dichlorophenol indophenol (dye) by ascorbic acid according to the method given by Ranganna (1986) [19]. The total carotenoids (mg per 100 g pulp) were also determined as per the method suggested by Srivastava (1993) [24]. The data was analysed by using analysis of variance (ANOVA) as per procedure given by Cochran and Cox (1959) [7].

Results

The different mango varieties varied significantly in terms of total soluble solids, titratable acidity and total soluble solids/acid ratio (Table 1). During 2012, the maximum total soluble solids content (21.51 °Brix) was recorded in variety Chausa which was significantly superior over other varieties while the minimum total soluble solids content (13.11 °Brix) was recorded in variety Bijoragarh. Again, in the year 2013, the variety Chausa and Bijoragarh recorded maximum (22.71 °Brix) and minimum (14.26 °Brix) total soluble solids content, respectively. In both the years, the remaining varieties were found to be significantly superior over Bijoragarh. The pooled data of both years also confirmed a significant variation, with maximum (22.11 °Brix) and minimum (13.69 °Brix) total soluble solids content in Chausa and Bijoragarh, respectively. In terms of titratable acidity, during the first year of study, the variety Husn-a-ra and Chausa recorded maximum (0.404 %) and minimum (0.142 %) value, respectively. However, the variety Husn-a-ra was found *at par* with the variety Kesar (Basti) (0.395 %). In the second year, maximum titratable acidity (0.412 %) was found in the variety Kesar (Basti) while the minimum titratable acidity (0.148 %) was recorded in the variety Chausa which was *at par* with Amrapali (0.157 %). All the other varieties were found to be significantly lower than Kesar (Basti). The TSS/acid ratio is a key contributor for characteristic flavor in fruits. Results pertaining to the total soluble solids/acid ratio differed significantly among the mango varieties. The variety Chausa revealed maximum total soluble solids/acid ratio in both the years while in the first year the minimum total soluble solids/acid ratio (39.454) was

recorded in Langra Gorakhpur which was *at par* with Husn-a-ra (40.349) and Kesar (Basti) (40.996). During the second year the variety Kesar (Basti) recorded minimum total soluble solids/acid ratio (37.731). The pooled analysis also indicated a similar trend with the maximum TSS/acid ratio in Chausa (152.39) and minimum in Kesar (39.364) which was *at par* with Langra Gorakhpur.

During the course of study, a significant difference was revealed among the cultivars in terms of total sugars, reducing sugars and non-reducing sugars percent. In the first trial, the variety Amrapalli registered maximum total sugar content (17.93%) followed by Langra (17.76 %), Chausa (17.69 %), Mallika (17.53 %) and Safeda Lucknow (17.02 %) while the minimum total sugar per cent (7.34 %) was found in the variety Banarasi Betali. In terms of reducing sugars, the variety Duddha Peda was found to be most superior (6.14%) preceded by Neelum (5.75 %), while the variety Bara Malda was revealed as most inferior with a reducing sugar of 1.46 per cent. The non-reducing sugars ranged from 13.31 % to 3.97 %, with the maximum and minimum amount in Mallika and Banarasi Betali, respectively. The variety Mallika was also found *at par* with Amrapali (13.30 %) and Chausa (13.22 %). The second course of study also revealed significant differences for total, reducing and non-reducing sugars. However, in terms of total sugars the variety Langra was adjudged as most superior (18.32 %) but it was found statistically *at par* with Amrapali (18.17 %) and Chausa (18.17 %), while, the minimum total sugar per cent was found in the variety Haathijhool (7.93 %). The results for reducing sugar were found to be analogous to the previous year with the varieties Duddha Peda and Bara Malda recording maximum (6.14 %) and minimum (1.46 %) per cent, respectively. But, Duddha Peda was observed statistically similar with Husn-a-ra (2.06 %). The non-reducing sugars ranged from 13.51 % to 3.71 % with Chausa exhibiting the maximum content. Further, the variety was found *at par* with Amrapali (13.41 %) and Langra (13.41 %), while, the minimum non reducing sugar per cent (3.71 %) was noted in Haathijhool. The results on basis of pooled data also verified that the total sugars (percent), reducing sugars (percent) and non-reducing sugars (percent) varied significantly among the mango cultivars. The maximum and minimum total sugar was revealed in Amrapali and Banarasi Betali, respectively. But, Amrapalli was also found to be *at par* with Langra. For reducing sugars, the variety Duddha Peda was found to be significantly most superior while the non-reducing sugar content was noted maximum in variety Chausa.

The perusal of data in Table 3 indicated a significant difference for sugar:acid ratio among the varieties. It was observed that Chausa recorded highest sugar:acid ratio (124.41) in the initial year of study, while the lowest (29.51) was noted in Hathijhool, which was *at par* with Husn-a-ra and Tamancha. In the second year of study, the maximum sugar:acid ratio (122.71) was again recorded in variety Chausa. But the minimum value (26.27) was revealed in Tamancha. Findings related to pooled data also revealed maximum sugar:acid ratio in variety Chausa which was significantly highest followed by Amrapali and Langra, while, significantly lower sugar:acid ratio was found in variety Tamancha. The data in Table 3 indicated significant differences for ascorbic acid content which varied from 91.31 mg/100 g to 12.11 mg/100 g among the varieties, as revealed by the pooled data. The variety Langra Gorakhpur exhibited highest ascorbic acid content throughout the course of study whereas the lowest was found in Mithua Malda. It is evident

from the data in Table 3 that the varieties differed significantly in terms of total carotenoids content. The variety Amrapalli was found to be statistically most superior (8.15 mg/100 g) while Amin was considered as most inferior (1.22

mg/100 g) for total carotenoids content. The following year of study also revealed the same trend with the total carotenoids ranging from 8.08 mg/100 g to 1.25 mg/100 g.

Table 1: Studies on T.S.S, titratable acidity and T.S.S: acid ratio of mango varieties

Variety	T.S.S (°Brix)			Titratable acidity (%)			T.S.S : acid ratio		
	2012	2013	Pooled	2012	2013	Pooled	2012	2013	Pooled
1	2	3	4	5	6	7	8	9	10
Amin	18.12	17.51	17.82	0.282	0.245	0.264	64.360	71.456	67.908
Amrapali	18.44	18.85	18.65	0.155	0.157	0.156	119.480	120.190	119.830
Bara Malda	15.12	15.01	15.07	0.213	0.203	0.208	70.920	74.011	72.466
Banarasi Betali	17.17	18.87	18.02	0.217	0.248	0.233	79.306	76.003	77.655
Baramasi	16.40	16.13	16.26	0.277	0.263	0.270	59.209	61.474	60.341
Bathui	17.50	17.06	17.28	0.299	0.282	0.291	58.499	60.566	59.532
Bijoragarh	13.11	14.26	13.69	0.204	0.193	0.199	64.286	73.974	69.130
Bombay Green	19.00	17.67	18.34	0.243	0.210	0.226	78.345	84.370	81.357
Bride of Russia	19.91	20.48	20.20	0.167	0.166	0.166	119.280	123.760	121.520
Chausa	21.51	22.71	22.11	0.142	0.148	0.145	151.280	153.510	152.390
Dashehari	19.20	20.27	19.74	0.191	0.184	0.188	100.730	110.070	105.400
Dashehari-51	18.56	19.46	19.01	0.212	0.207	0.209	87.718	94.234	90.976
Duddha Peda	19.25	19.68	19.46	0.262	0.288	0.275	73.492	68.370	70.931
Gulabkhas	18.95	17.60	18.28	0.305	0.267	0.286	62.091	65.902	63.996
Gulabkhas Green	18.21	18.03	18.12	0.313	0.291	0.302	58.197	61.900	60.048
Gurwani	17.79	18.44	18.12	0.218	0.231	0.225	81.743	79.746	80.744
Haathijhool	16.05	15.63	15.84	0.310	0.226	0.268	51.799	65.702	58.750
Husn-a-ra	16.30	17.05	16.67	0.404	0.384	0.394	40.349	44.358	42.353
Kaitki Bihar	20.02	19.31	19.67	0.354	0.353	0.353	56.586	54.754	55.670
Kesar (Basti)	16.19	15.54	15.87	0.395	0.412	0.404	40.996	37.731	39.364
Khas-ul-Khas	19.37	18.74	19.05	0.377	0.361	0.369	51.336	51.858	51.597
K.O.-07	17.51	16.84	17.18	0.259	0.245	0.252	67.615	68.692	68.154
Langra	19.05	19.48	19.26	0.194	0.183	0.189	98.069	106.520	102.290
Langra Gorakhpur	15.08	15.27	15.18	0.382	0.345	0.364	39.454	44.277	41.865
Langra Rampur	16.52	15.82	16.17	0.306	0.293	0.300	54.010	53.960	53.985
Mallika	19.09	18.02	18.56	0.329	0.306	0.317	58.104	58.944	58.524
Mithua Malda	17.45	16.82	17.14	0.217	0.223	0.220	80.397	75.598	77.997
Mulgoa Deshi	19.86	20.25	20.06	0.306	0.292	0.299	64.920	69.369	67.144
Neelum	17.12	17.87	17.49	0.254	0.244	0.249	67.414	73.202	70.308
Neelum × Chausa	18.44	18.75	18.60	0.263	0.237	0.250	70.057	79.160	74.609
Pulgoa Darbhanga	17.73	16.64	17.18	0.274	0.284	0.279	64.824	58.667	61.746
Rahman Pasand	17.30	16.68	16.99	0.271	0.271	0.271	63.930	61.583	62.757
Rataul	20.59	18.74	19.66	0.303	0.288	0.296	68.030	64.984	66.507
Rumani	20.14	20.15	20.15	0.199	0.186	0.192	101.410	108.420	104.910
Safeda Lucknow	17.08	17.34	17.21	0.283	0.267	0.275	60.357	64.881	62.619
Sensation	18.66	19.44	19.05	0.228	0.237	0.233	81.852	81.944	81.898
Suvarnrekha	17.12	17.51	17.32	0.197	0.185	0.191	87.091	94.616	90.853
Tamancha	16.84	16.13	16.48	0.345	0.365	0.355	48.777	44.187	46.482
Thanking Amadi	17.34	17.36	17.35	0.320	0.301	0.310	54.262	57.738	56.000
Totapari Red Small	15.09	15.57	15.33	0.242	0.237	0.239	62.483	65.798	64.140
Vanraj	18.23	18.29	18.26	0.225	0.210	0.218	81.152	87.064	84.108
Zafrani Gola	17.19	18.29	17.74	0.254	0.288	0.271	67.615	63.543	65.579
Zardalu	20.25	19.46	19.86	0.259	0.240	0.249	78.333	81.168	79.750

Discussion

The eating quality of a fruit is a function of its sweetness and sourness which is further adjudged through different chemical attributes including total soluble solids content, titratable acidity and TSS/TA ratio. The aforementioned results revealed a significant trend in total soluble solids content. In line with the results of present study, (Dalal *et al.* 2005) [8] also reported highest total soluble solids content (26.08 percent) in 'Chausa'. Similarly, (Passam 1982) [17], (Chatterjee *et al.* 2005) [6] and (Das *et al.* 2007) [9] also confirmed significant variation in the total soluble solids content among the different mango varieties. These variations could be attributed to the genetic constitution of the varieties and their interaction with the environmental conditions. In

terms of titratable acidity, comparable results were obtained by (Badiyala and Awasthi 1990) [4] and (Gohil *et al.* 2006) [11], who found similar variations for titratable acidity among various varieties. The TSS/acid ratio is a key contributor for characteristic flavor in fruits. Results pertaining to the total soluble solids/ acid ratio differed significantly among the mango varieties. Similar findings were also reported by (Mitra *et al.* 2001a) [16] and (Chatterjee *et al.* 2005) [6].

During the course of study, a significant variation was revealed among the cultivars in terms of total sugars, reducing sugars and non-reducing sugars percent. This could be due to the varying activity of hydrolytic enzymes during the ripening process of different varieties, which in turn have influenced the hydrolysis of complex sugars into simpler ones

(Elsheshetawy *et al.*, 2016) ^[10]. In correspondence to these findings, (Syamal and Mishra 1989) ^[21] reported that mango cultivars exhibit variation for parameters like sugar content and Langra excelled this attribute. (Chatterjee *et al.* 2005) ^[6] also reported in their study that 'Amrapali' possess highest

non-reducing sugar (13.99 percent) and total sugar content (19.86 percent). Similarly, (Kumar *et al.* 2001a) ^[14] and (Jilani *et al.* 2010) ^[13] also studied the variation in sugars percentage in different mango varieties.

Table 2: Studies on total sugar, reducing sugar and non-reducing sugar content of mango varieties

Variety	Total Sugars (%)			Reducing sugars (%)			Non-reducing sugars (%)		
	2012	2013	Pooled	2012	2013	Pooled	2012	2013	Pooled
1	2	3	4	5	6	7	8	9	10
Amin	10.83	9.20	10.02	3.13	2.97	3.05	7.32	5.94	6.63
Amrapali	17.93	18.17	18.05	3.95	4.04	3.99	13.30	13.41	13.36
Bara Malda	8.52	9.31	8.92	1.46	2.01	1.74	6.71	6.94	6.83
Banarasi Betali	7.34	9.21	8.27	3.16	2.74	2.95	3.97	6.15	5.06
Baramasi	13.14	11.67	12.41	3.16	2.69	2.92	9.49	8.53	9.01
Bathui	14.13	14.51	14.32	3.97	3.82	3.90	9.65	10.17	9.91
Bijoragarh	12.95	13.15	13.05	4.44	4.64	4.54	8.11	8.08	8.09
Bombay Green	12.30	13.46	12.88	3.56	3.45	3.51	8.30	9.53	8.92
Bride of Russia	11.96	10.61	11.29	2.55	2.67	2.61	8.93	7.54	8.24
Chausa	17.69	18.17	17.93	3.77	3.94	3.86	13.22	13.51	13.36
Dashehari	16.04	16.32	16.18	3.63	3.54	3.59	11.80	12.16	11.98
Dashehari-51	16.22	16.27	16.25	3.44	3.40	3.42	12.14	12.23	12.19
Duddha Pedda	16.49	16.68	16.59	6.14	6.10	6.12	9.84	10.05	9.95
Gulabkhas	12.98	11.44	12.21	3.64	3.25	3.45	8.87	7.81	8.34
Gulabkhas Green	15.37	14.42	14.90	4.04	4.19	4.12	10.75	9.74	10.25
Gurwani	13.23	13.91	13.57	4.76	4.69	4.73	8.06	8.76	8.41
Haathijhool	9.15	7.93	8.54	4.18	4.02	4.10	4.71	3.71	4.21
Husn-a-ra	12.92	13.53	13.23	2.19	2.06	2.13	10.20	10.90	10.55
Kaitki Bihar	15.34	15.08	15.21	4.80	5.14	4.97	10.01	9.45	9.73
Kesar (Basti)	14.04	12.97	13.51	3.45	3.27	3.36	10.06	9.23	9.64
Khas-ul-Khas	14.76	13.51	14.14	4.05	3.75	3.90	10.19	9.29	9.74
K.O.-07	16.22	15.80	16.01	3.21	3.33	3.27	12.38	11.86	12.12
Langra	17.76	18.32	18.04	4.15	4.20	4.18	12.93	13.41	13.17
Langra Gorakhpur	14.74	15.36	15.05	3.18	3.03	3.11	10.98	11.70	11.34
Langra Rampur	13.95	13.52	13.73	3.67	3.76	3.71	9.77	9.27	9.52
Mallika	17.53	17.36	17.44	3.53	3.46	3.49	13.31	13.20	13.26
Mithua Malda	12.43	12.40	12.41	3.55	3.60	3.58	8.44	8.37	8.41
Mulgoa Deshi	11.22	11.92	11.57	2.95	2.78	2.87	7.88	8.70	8.29
Neelum	16.13	16.33	16.23	5.75	5.95	5.85	9.87	9.86	9.87
Neelum × Chausa	13.54	12.97	13.25	3.48	3.51	3.49	9.57	8.99	9.28
Pulgoa Darbhanga	16.43	16.50	16.46	3.51	3.48	3.50	12.27	12.37	12.32
Rahman Pasand	10.51	10.16	10.34	2.93	2.52	2.72	7.22	7.26	7.24
Rataul	15.82	14.81	15.32	3.68	3.75	3.72	11.55	10.51	11.03
Rumani	16.42	16.52	16.47	3.42	3.46	3.44	12.37	12.43	12.40
Safeda Lucknow	17.02	17.04	17.03	4.36	4.33	4.34	12.04	12.09	12.06
Sensation	14.84	15.62	15.23	3.41	3.17	3.29	10.87	11.83	11.35
Suvarnrekha	13.10	14.54	13.82	3.93	3.83	3.88	8.72	10.18	9.45
Tamancha	10.31	9.59	9.95	4.80	4.56	4.68	5.26	4.79	5.02
Thanking Amadi	14.20	14.11	14.16	4.14	4.16	4.15	9.56	9.46	9.51
Totapari Red Small	12.49	13.05	12.77	3.24	3.43	3.34	8.80	9.14	8.97
Vanraj	15.27	15.86	15.57	4.21	4.15	4.18	10.51	11.12	10.82
Zafrani Gola	15.50	14.47	14.98	3.75	3.88	3.82	11.17	10.05	10.61
Zardalu	13.54	13.02	13.28	4.03	4.11	4.07	9.04	8.47	8.76

The sugar acid ratio is considered as an important measure of fruit quality. In our study, significant variations were found for sugar acid ratio which might be attributed to the genetic constitution of varieties and further its interaction with the environment. The present results for ascorbic acid content were also confirmed by (Chatterjee *et al.* 2005) ^[6] who also noted highest vitamin C in 'Langra'. Likewise, (Jilani *et al.* 2010) ^[13] and (Liu *et al.* 2013) ^[15] also found variation in mango varieties for ascorbic acid content. Ascorbic acid and

carotenoids are crucial indicators of the nutritional quality of fruits. It is evident from the data that the varieties differed remarkably in terms of total carotenoids content. These results were in agreement with (Singh 2002) ^[23] who also revealed highest total carotenoid content (8.17 mg/100 g) in 'Amrapali', amongst the twenty-one mango cultivars studied. Similar findings have also been reported earlier by (Hoda *et al.* 2003) ^[12] and (Abirami *et al.* 2004) ^[3].

Table 3: Studies on sugar: acid ratio, ascorbic acid and total carotenoid content of mango varieties

Variety	Sugar : acid Ratio			Ascorbic acid (mg/100g pulp)			Total carotenoids (mg/100g pulp)		
	2012	2013	Pooled	2012	2013	Pooled	2012	2013	Pooled
1	2	3	4	5	6	7	8	9	10
Amin	38.45	37.60	38.02	32.37	32.49	32.43	1.22	1.25	1.23
Amrapali	116.29	115.74	116.00	35.18	41.16	38.17	8.15	8.08	8.11
Bara Malda	39.88	45.92	42.95	39.22	35.27	37.24	5.34	5.31	5.33
Banarasi Betali	33.91	37.06	35.48	38.66	40.97	39.82	3.23	3.28	3.26
Baramasi	47.47	44.47	45.97	17.84	15.95	16.89	2.77	2.68	2.73
Bathui	47.24	51.57	49.41	15.27	12.21	13.74	4.60	4.57	4.58
Bijoragarh	63.59	68.20	65.90	54.64	56.72	55.68	5.69	5.73	5.71
Bombay Green	50.71	64.34	57.53	46.32	45.38	45.85	4.19	4.27	4.23
Bride of Russia	71.61	64.07	67.84	50.27	49.08	49.67	5.23	5.16	5.20
Chausa	124.41	122.71	123.56	66.16	68.34	67.25	3.84	4.00	3.92
Dashehari	84.18	88.73	86.45	44.04	48.47	46.26	4.43	4.55	4.49
Dashehari-51	76.64	78.78	77.71	45.85	47.32	46.59	4.51	4.51	4.51
Duddha Peda	63.02	57.97	60.49	20.20	23.66	21.93	4.35	4.40	4.38
Gulabkhas	42.52	42.93	42.73	17.61	12.73	15.17	3.72	3.80	3.76
Gulabkhas Green	49.11	49.59	49.35	41.60	43.23	42.42	3.83	3.86	3.85
Gurwani	60.84	60.16	60.50	23.83	25.05	24.44	2.97	3.11	3.04
Haathijhool	29.51	35.11	32.31	42.23	40.15	41.19	3.28	3.23	3.26
Husn-a-ra	32.01	35.22	33.61	46.29	51.67	48.98	2.59	2.65	2.62
Kaitki Bihar	43.35	42.77	43.06	16.25	19.06	17.66	4.77	4.73	4.75
Kesar (Basti)	35.54	31.52	33.53	21.58	20.04	20.81	1.26	1.32	1.29
Khas-ul-Khas	39.17	37.42	38.30	29.72	28.17	28.94	5.74	5.75	5.75
K.O.-07	62.72	64.50	63.61	30.29	32.72	31.51	2.38	2.40	2.39
Langra	91.44	100.19	95.81	81.54	88.31	84.93	5.00	5.07	5.03
Langra Gorakhpur	38.57	44.49	41.53	88.14	94.49	91.31	1.67	1.68	1.68
Langra Rampur	45.59	46.11	45.85	80.42	87.55	83.99	3.16	3.21	3.18
Mallika	53.39	56.79	55.09	21.13	19.27	20.20	7.96	7.99	7.97
Mithua Malda	57.28	55.79	56.53	13.04	11.19	12.11	6.93	6.02	6.48
Mulgoa Deshi	36.73	40.91	38.82	19.38	20.24	19.81	4.06	4.09	4.08
Neelum	63.59	66.92	65.26	41.30	41.63	41.47	4.16	4.18	4.17
Neelum × Chausa	51.47	54.71	53.09	35.12	34.67	34.90	5.59	5.64	5.61
Pulgoa Darbhanga	60.06	58.19	59.12	47.75	41.41	44.58	3.39	3.41	3.40
Rahman Pasand	38.91	37.53	38.22	30.85	28.56	29.71	3.60	3.51	3.56
Rataul	52.33	51.38	51.85	27.23	25.08	26.16	6.02	5.99	6.00
Rumani	82.79	88.99	85.89	31.48	29.41	30.45	3.72	3.78	3.75
Safeda Lucknow	60.17	63.80	61.98	22.70	16.34	19.52	5.25	5.30	5.28
Sensation	65.14	65.85	65.50	32.73	35.43	34.08	6.14	6.13	6.14
Suvarnrekha	66.64	78.59	72.62	32.85	36.71	34.78	5.36	5.39	5.37
Tamancha	29.93	26.27	28.10	40.19	38.15	39.17	2.16	2.19	2.18
Thanking Amadi	44.45	46.95	45.70	20.44	21.65	21.04	2.04	2.07	2.06
Totapari Red Small	51.73	55.16	53.44	47.55	48.10	47.83	4.19	4.20	4.20
Vanraj	68.00	75.49	71.74	36.31	38.90	37.61	5.70	5.71	5.71
Zafrani Gola	61.05	50.26	55.65	21.22	24.30	22.76	3.78	3.91	3.85
Zardalu	52.39	54.32	53.36	45.22	38.15	41.68	4.35	4.31	4.33

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