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Evaluation of taro (*Colocasia esculenta* L.) cultivars for growth, yield and quality attributes

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ABSTRACT

A study on varietal evaluation in taro for growth, yield and quality attributes was carried out in a replicated experiment and morphological and chemical analysis was done. Significant differences were recorded for all the characteristics studied. 'Panchmukhi' recorded highest plant height (179.33cm), petiole length (153.11cm), petiole breadth (13.87mm) and leaf size (3095.67cm^2), LAI (1.14), corm length (152.41mm) and breadth (107.77mm), average corm weight (1500.00g) and corm yield (20.00t/ha). 'C-3' recorded maximum (15.00) petiole number and cormel length (85.93mm). Cormel yield (15.29t/ha), total yield (25.92t/ha) and number of cormels per plant (30.33) was found to be maximum in cv. White Gouriya. 'ML-2' recorded maximum (7.33) number of side shoots. Highest average cormel weight (72.85g) was maximum in cv. Arcol-7, and 'Arcol-5' recorded maximum (67.43mm) cormel breadth; the least blight incidence percentage (8.00) was recorded in 'Nayabungalow'. As for biochemical constituents, 'Nainital' recorded the highest (5.85%) total sugars, 'Kandha-5' exhibited the highest (34.67%) starch content and 'Nadia Local' with showed highest levels of oxalic acid (1.05mg/100g). Highest dry matter content (27.50%) was recorded in cvs. KCA-1 and Panchmukhi, while the highest moisture percentage (82.83) was recorded in 'IG Coll-5'.

Key words: Colocasia, taro cultivars, growth, yield, quality

INTRODUCTION

Colocasia (*Colocasia esculenta* L. Schott.), commonly known as *arvi* or taro, is a member of the family Araceae and sub-family *Colocasioidae*. It is a wetland herbaceous, monocotyledonous plant and is an important tuber crop. It is believed to have originated in the Indo-Malayan region, but ethno-botanical evidence favours India as its place of origin (Plucknett, 1979). It is cultivated throughout the tropics and sub-tropics. It is also called 'potato of the tropics'. It is believed that the origin of domesticated taro can be traced to the wild type *C. esculenta* var. *aquatilis*, either in North East India or South East Asia (Matthews, 1991). Colocasia is popular for its high nutritive value, delicious taste and good flavour. It contains a considerable amount of carbohydrates, protein, vitamins and minerals (like Ca, Fe and P). Tubers are rich in starch; leaves contain Provitamin A and Vitamin C. (Chopra *et al*, 1956). Quality of the corms and cormels depends on their acridity and presence of fibre. Good quality colocasia corms are without any raphides, are fibreless, and soft like butter upon cooking. In North-eastern region, it is an important source of food during the lean period, and constitutes feed for livestock. All the plant parts, i.e., leaves, petiole, corms and cormels of taro are eaten in some or the other part of the region. In its raw form, however, the plant is unpalatable from the presence of calcium oxalate crystals in the corm, cormel and leaf. This is the main cause for its acridity, and can be removed by cooking or steeping in cold water overnight.

The North-Eastern region of India is known for a diversity of flora and fauna. Wide variability can be seen among colocasia cultivars grown in the region (Sarma, 2001). This variation among the cultivated types of taro in the region, available in the form of one or the other vegetable, offers a great scope for commercial exploitation. Also, it has an immense potential and a good future as raw material for convenience foods (flour), animal feed, and commodity chemicals like starch, vitamins, proteins etc. Although colocasia has multiple uses with a great diversity present in the cultivars, it has not been exploited in both new and old world aroids in a range of environments, thus indicating a vast and largely untapped potential for research in this crop.

Malnutrition and food shortage among the poor rural population is conspicuous. Cultivation of crops like colocasia will not only increase food production, but also provide balanced nutrition to the deprived sections of the region. Therefore, popularizing taro cultivation and identifying suitable cultivars for nutritional value is important.

Little work has been done on qualitative evaluation of physico-chemical properties of taro in this part with the above points in view, the present investigation was planned to evaluate and study comparative performance of the cultivar and screen out superior ones for yield and quality, as also to identify suitable cultivars for providing a balanced diet. Some colocasia cultivars were collected from various parts of the north-eastern region, while some promising varieties were collected from outside the region, and evaluated under Meghalaya conditions.

MATERIAL AND METHODS

Forty cultivars of colocasia from the north-eastern region, and some promising varieties from outside the region, were collected and planted in March 2009 and March 2010 at the Experimental Farm, Division of Horticulture, ICAR (RC) for NEH Region, Umiam, Meghalaya, to evaluate for various physical parameters, corm and cormel characteristics, yield attributes and its chemical properties, under rainfed conditions.

Morphological parameters were recorded at 120 days after planting, while corm and cormel characteristics and physico-chemical properties were recorded/ analyzed at harvest, i.e., 240 days after planting. The experimental design was RBD, with three replications, in a plot sized 2mx2m. Sprouted corms/ cormels were planted 5-7cm deep, at a spacing of 45cm between and within rows, in pits. Uniform package of practices was applied throughout the experiment.

Morphological parameters included plant height (cm), leaf size (cm^2), number of side shoots, petiole length (cm) and breadth (mm), number of petioles, leaf blight incidence (percentage), leaf area index (LAI), corm length and breadth (mm), average corm weight (g), corm yield (t/ha), cormel length and breadth (mm), average cormel weight (g), cormel yield (t/ha), total yield (t/ha) and number of cormels per plant.

Moisture and dry-matter content in a sample was determined by oven-drying 10g of the sample at 60°C, till a constant weight was obtained (Rangana, 1997).

Total sugars were estimated by titration, using Fehling's solution and methylene blue indicator (Rangana, 1997).

Amount of starch present in the samples was determined as per Rangana (1997). After the sugars present in a sample leached out, the starch was hydrolyzed using acid, and estimated as invert-sugar.

% Starch = % Reducing sugar x 0.9

Oxalic acid content (dry weight basis) was determined as per CTCRI manual (1979).

Observations on growth, yield and chemical constituents were recorded and subjected to statistical analysis as per Panse and Sukhatme (1978).

RESULTS AND DISCUSSION

Morphological traits showed a wide variation among cultivars (Table 1). Highest plant height (179.33cm) was recorded in var. Panchmukhi, followed by 'BCC1A' (161.44cm); while, the lowest (96.33cm) was observed in 'Ascol-1'. Data on petiole length showed a significant variation among cultivars. 'Panchmukhi' recorded significantly higher petiole length (153.11cm), followed by BCC1A (137.56cm); lowest (77.89cm) petiole length was observed in 'Ascol-1', which was statistically at par with 'C-149' (78.22cm).

In petiole breadth, significant difference was seen among cultivars. Maximum petiole breadth (13.87mm) was recorded in 'Panchmukhi', followed by 'ML-9' and 'BCC1A' (13.27mm and 13.15mm, respectively). 'Ascol-1' recorded the lowest (7.60mm) petiole breadth, followed by cv. Gouriya (8.68mm). Maximum vegetative growth, viz., plant height (cm), petiole length (cm) and petiole breadth (mm) seen in 'Panchmukhi' may be due to a greater leaf size and leaf area index (LAI), leading to higher photosynthesis. This may have resulted in accumulation of more amounts of assimilates, thus increasing plant height (Mili, 2001).

Data on leaf size revealed significant differences among cultivars. 'Panchmukhi' recorded maximum ($3095.67cm^2$) leaf size, followed by BCC1A ($2349.22cm^2$) and Nayabungalow ($2345.67cm^2$), which were statistically at par. The lowest leaf size ($549.11cm^2$) was observed in 'Ascol-1'. Greater leaf size ($3095.67cm^2$) in 'Panchmukhi' may be due to its genetic make-up, geared to produce larger leaves (Bora and Das, 1998).

Significant differences were recorded in number of side shoots among cultivars. Highest number of side shoots

Table 1. Comparative performance of some colocasia cultivars with regard to morphological traits (2009-2010)

Cultivar	Plant height (cm)	Leaf size (cm^2)	No. of side shoots	Petiole length (cm)	Petiole breadth (mm)	Number of petioles	Blight incidence (%)	LAI
ML-1	154.83	1548.83	5.67	119.50	10.37	11.83	12.00	1.02
ML-2	127.50	1132.33	7.33	97.17	10.42	13.50	10.67	0.84
ML-9	130.17	1067.00	5.33	101.83	13.27	12.50	13.33	0.91
Arcol-2	130.33	1271.83	5.67	103.00	12.69	11.50	20.00	0.96
Arcol-5	126.17	1140.67	3.67	99.83	9.98	11.33	13.33	0.92
Arcol-6	122.17	958.50	4.17	93.17	10.81	11.33	20.00	0.90
Arcol-8	131.33	1248.33	5.67	105.67	9.86	11.00	12.00	0.93
Muktakeshi	111.67	883.33	5.50	89.33	11.95	11.17	12.00	0.83
Meghalaya Local	135.00	998.17	1.67	108.33	12.15	5.17	20.00	0.95
Kandha Local	121.00	840.50	4.50	94.83	12.07	10.83	10.67	0.84
BCC-1	117.33	902.67	6.50	93.83	11.98	12.33	12.00	0.87
KCA-1	112.00	909.33	3.17	90.33	12.87	7.83	16.00	0.74
C-3	148.50	1546.17	6.83	112.00	10.84	15.00	17.33	0.93
Arcol-1	119.44	654.22	5.11	102.44	9.90	10.44	12.00	0.75
Arcol-7	137.78	643.00	5.33	119.11	10.69	7.67	16.00	0.97
Kandha	140.56	1267.45	3.11	117.11	10.75	7.44	12.00	0.96
Kandha-5	147.56	1705.00	4.22	125.11	11.49	9.56	12.00	1.04
B.K. Coll-1	116.33	1046.55	4.22	96.33	9.07	9.55	16.00	0.76
B.K. Coll-2	111.11	752.45	2.55	88.11	9.42	4.67	12.00	0.73
Meghalaya Coll-1	138.11	1910.55	3.89	114.22	11.64	7.56	12.00	1.00
Meghalaya Coll-2	136.78	1640.67	3.33	114.11	10.86	8.11	16.00	0.98
C-137	151.89	1482.89	5.11	128.89	12.51	10.11	28.00	1.09
C-149	100.67	1002.67	4.44	78.22	9.68	8.00	12.00	0.62
Nayabungalow	155.00	2345.67	4.89	132.55	12.20	9.22	8.00	1.02
Panchmukhi	179.33	3095.67	1.89	153.11	13.87	7.00	12.00	1.14
Sunajuli	120.67	1133.45	3.56	98.78	9.64	7.22	16.00	0.72
Nainital	128.89	668.78	2.78	107.33	9.69	9.56	16.00	0.91
Suryamukhi	133.67	1102.22	3.44	113.89	9.07	9.00	16.00	0.90
Gouriya	110.55	1376.22	3.89	87.78	8.68	8.00	12.00	0.84
White Gouriya	151.33	1691.00	4.33	128.89	9.56	8.44	12.00	1.02
Nadia local	139.22	1185.22	3.78	117.44	11.35	10.22	12.00	0.99
Kadina local	140.66	1330.44	5.00	117.55	10.41	11.00	16.00	1.00
Telia	129.34	657.78	2.67	106.11	9.53	8.00	16.00	0.63
BCC1A	161.44	2349.22	5.33	137.56	13.15	9.67	24.00	1.08
BCC 11	138.56	1567.22	2.89	114.89	10.95	9.56	12.00	0.91
Ascol-1	96.33	549.11	3.55	77.89	7.60	6.56	12.00	0.71
Ascol-2	139.22	1413.56	3.56	113.89	10.05	7.00	16.00	0.96
IG Coll-5	148.22	2012.22	2.89	126.22	11.72	6.55	16.00	1.04
SJ-1	122.89	946.00	4.55	91.67	10.08	8.11	12.00	0.88
TMV-293	123.78	980.33	4.00	102.00	9.70	8.56	16.00	0.78
SEm +	3.62	106.33	0.40	3.72	0.98	0.90	2.40	0.08
CD (*P=0.05*)	11.71	344.35	1.30	12.04	3.19	2.90	7.79	0.26

(7.33) was recorded in 'ML-2', followed by 'C-3' (6.83) and 'BCC-1' (6.50), which were statistically at par. The lowest number (1.67) was recorded in 'Meghalaya Local'.

Significant differences in the number of petioles were recorded among cultivars. Highest petiole number (15.00) was recorded in 'C-3; followed by 'ML-2' (13.50); whereas, the lowest number of petioles (4.67) was seen in 'B.K. Coll-2'.

Significant differences were found in terms of disease incidence (percentage) among cultivars. 'C-137' was found to exhibit the highest disease percentage (28.00), followed by 'BCC1A' (24.00); while, the lowest (8.00) was observed in Nayabungalow, followed by 'ML-2' and 'Kandha Local' (10.67).

Data also indicated a significant difference in LAI among cultivars. Highest LAI (1.14) was recorded in 'Panchmukhi', followed by 'C-137' and 'BCC1A' (1.09 and 1.08, respectively). The lowest LAI (0.62) was recorded in 'C-149', which was statistically at par with 'Telia' (0.63). Higher LAI in 'Panchmukhi' indicates that canopy development in taro is subject more to internal plant-control, and suggests that the capacity of a variety at attaining a certain LAI depends on its ability to express its potential leaf area (Pardales, 1986).

Data on corm length revealed significant difference among cultivars. Highest corm length (152.41mm) was seen in 'Panchmukhi', followed by 'Arcol-7' (107.91mm); while, the lowest (43.37mm) was observed in 'BCC1'.

Data furnished in Table 2 reveal that corm breadth varied significantly among cultivars. 'Panchmukhi' recorded the highest (107.77mm) corm breadth, followed by 'White Gauriya' and 'Kandha-5' (83.53mm and 83.36mm, respectively); whereas, the lowest (31.73mm) was recorded in 'BCC1'.

As for average corm weight, significant differences were seen among cultivars. Highest average corm weight (1500.00g) was observed in cv. Panchmukhi, followed by 'Arcol-7' (983.33g), while, the lowest (33.33g) was found

Table 2. Corm and Cormel characteristics, total yield and number of cormels per plant (2009-2010)

Cultivar	Corm				Cormel				Total yield (t/ha)	No. of cormels per plant
	Length (mm)	Breadth (mm)	Average wt. (g)	Yield (t/ha)	Length (mm)	Breadth (mm)	Average wt.(g)	Yield (t/ha)		
ML-1	101.73	46.40	237.50	15.25	85.08	30.39	53.17	6.88	22.13	15.67
ML-2	85.22	43.95	236.67	12.00	60.08	29.83	33.78	6.67	18.67	17.22
ML-9	84.92	61.76	229.17	9.08	64.35	37.19	36.39	10.05	19.13	20.78
Arcol-2	71.01	50.23	243.33	5.00	61.88	34.70	43.17	2.75	7.75	11.00
Arcol-5	74.40	66.26	232.50	5.63	77.39	67.43	45.23	9.75	15.38	19.33
Arcol-6	100.66	66.55	626.67	17.00	62.67	40.55	65.31	5.25	22.25	7.33
Arcol-8	64.36	40.11	90.00	8.75	59.50	26.88	17.35	3.00	11.75	7.67
Muktakeshi	64.85	62.24	136.50	3.88	60.48	35.73	30.21	9.88	13.76	23.83
Meghalaya Local	80.53	43.48	481.67	4.25	68.33	18.94	12.04	2.75	7.00	9.67
Kandha Local	68.35	70.86	153.11	4.08	68.66	37.25	34.00	10.58	14.66	17.56
BCC-1	43.37	31.73	36.11	5.83	30.79	21.00	15.89	6.67	12.50	8.67
KCA-1	71.93	73.63	326.67	5.00	71.25	28.36	14.58	6.25	11.25	23.33
C-3	69.61	45.47	773.33	17.33	85.93	33.58	43.11	3.50	20.83	5.00
Arcol-1	92.81	72.94	308.33	5.00	50.32	34.84	32.04	0.75	5.75	4.67
Arcol-7	107.91	45.98	983.33	17.00	63.91	31.53	72.85	2.50	19.50	5.33
Kandha	90.63	65.96	310.83	9.25	65.10	35.04	39.77	10.75	20.00	22.83
Kandha-5	78.90	83.36	763.33	8.75	59.71	34.74	27.85	3.75	12.50	13.00
B.K. Coll-1	68.04	45.46	122.67	1.50	54.05	35.64	29.08	2.50	4.00	11.00
B.K. Coll-2	60.64	48.61	179.33	1.75	68.91	30.14	30.83	3.00	4.75	19.33
Meghalaya Coll-1	102.07	62.76	399.17	12.38	66.22	28.17	25.75	5.13	17.51	20.00
Meghalaya Coll-2	66.10	61.51	259.00	5.38	61.70	27.08	32.67	10.38	15.76	23.33
C-137	78.12	61.36	233.33	10.00	58.63	32.49	45.97	5.00	15.00	13.33
C-149	62.50	47.07	160.00	3.00	61.51	27.66	29.95	8.00	11.00	17.00
Nayabungalow	73.41	65.40	933.33	17.00	83.79	25.34	17.50	8.50	25.50	16.67
Panchmukhi	152.41	107.77	1500.00	20.00	61.99	35.36	17.33	1.75	21.75	9.33
Sunajuli	72.74	60.41	173.33	8.75	62.77	33.04	35.50	15.00	23.75	24.33
Nainital	63.24	64.36	265.67	6.75	69.48	34.14	29.92	9.25	16.00	21.00
Suryamukhi	75.03	62.72	212.17	4.13	53.63	29.30	26.40	10.00	14.13	22.17
Gouriya	58.05	43.09	33.33	0.25	59.40	29.06	21.00	3.25	3.50	17.67
White Gouriya	93.53	83.53	344.17	10.63	59.48	31.72	31.30	15.29	25.92	30.33
Nadia Local	78.94	58.18	226.67	4.88	62.88	36.93	42.55	3.63	8.51	17.33
Kadina Local	62.22	57.47	225.00	7.50	72.64	34.18	56.53	14.00	21.50	22.33
Telia	74.51	60.36	224.33	4.25	65.97	39.62	34.20	13.50	17.75	23.33
BCC1A	78.00	35.20	66.67	0.50	53.80	23.78	14.00	1.00	1.50	3.67
BCC 11	90.85	48.22	275.33	2.20	46.98	29.32	20.22	5.00	7.00	26.00
Ascol-1	54.09	33.00	41.67	0.25	52.80	18.40	13.34	1.25	1.50	9.33
Ascol-2	72.64	55.95	211.00	5.63	68.62	32.07	24.63	8.88	14.51	14.50
IG Coll-5	94.67	52.67	362.00	5.75	46.31	29.74	21.67	6.25	12.00	12.00
SJ-1	74.41	48.41	241.93	5.25	63.62	29.13	39.07	13.25	18.50	25.03
TMV	66.60	54.13	171.67	3.63	55.32	31.43	37.07	6.88	10.51	15.83
SEm +	9.65	5.41	119.40	1.35	6.34	3.24	4.49	1.08	1.92	3.36
CD (*P=0.05*)	31.25	17.52	386.69	4.36	20.53	10.51	14.55	3.51	6.21	10.96

Table 3. Comparative performance of some Colocasia cultivars with regards to chemical parameters (2009-2010)

Cultivar	Total sugars (%)	Starch (%)	Oxalic acid (%)	Dry matter (%) in cormel	Moisture (%) in cormel
ML-1	2.26	18.50	0.69	23.50	76.50
ML-2	4.10	27.96	0.41	25.50	74.50
ML-9	3.95	14.70	0.83	22.33	77.67
Arcol-2	5.12	20.56	0.50	20.67	79.33
Arcol-5	1.91	16.20	0.72	24.50	75.50
Arcol-6	2.85	22.45	0.47	25.50	74.50
Arcol-8	2.58	19.19	0.57	21.67	78.33
Muktakeshi	5.12	18.09	0.53	25.50	74.50
Meghalaya Local	2.69	22.68	0.81	21.50	78.50
Kandha Local	3.04	21.89	0.72	24.83	75.17
BCC-1	2.76	20.03	0.81	21.83	78.17
KCA-1	1.79	13.64	0.66	27.50	78.17
C-3	2.77	16.40	0.57	25.67	74.33
Arcol-1	2.19	26.89	0.86	21.67	78.33
Arcol-7	3.30	20.36	0.68	18.67	81.33
Kandha	2.50	17.63	0.63	22.17	77.83
Kandha-5	4.31	34.67	0.83	20.17	79.83
B.K. Coll-1	2.77	19.47	0.80	20.67	79.33
B.K. Coll-2	2.97	14.22	0.44	17.83	82.17
Meghalaya Coll-1	1.96	17.81	0.84	21.00	79.00
Meghalaya Coll-2	2.98	16.51	0.75	18.50	81.50
C-137	2.00	27.92	0.56	22.67	77.33
C-149	4.28	21.21	0.75	19.33	80.67
Nayabungalow	3.64	30.04	0.80	23.50	77.50
Panchmukhi	3.85	21.17	0.71	27.50	72.50
Sunajuli	2.15	27.25	0.63	22.83	77.17
Nainital	5.85	20.94	0.77	25.50	74.50
Suryamukhi	4.20	18.77	0.62	23.67	76.33
Gouriya	1.93	17.57	0.93	19.33	80.67
White Gouriya	1.92	31.03	0.72	24.33	75.67
Nadia Local	2.78	24.56	1.05	21.17	78.83
Kadina Local	1.61	20.44	0.75	20.00	80.00
Telia	2.44	21.00	0.77	18.83	81.17
BCC 1A	1.60	21.04	0.74	19.00	81.00
BCC 11	3.55	14.21	0.92	19.17	80.83
Ascol-1	2.77	13.81	0.92	18.50	81.50
Ascol-2	3.02	13.03	1.04	19.67	80.33
IG Coll-5	2.57	24.01	0.95	17.17	82.83
SJ-1	2.19	29.61	0.36	20.83	79.19
TMV-293	3.66	14.64	0.74	22.50	77.50
SEm +	0.51	2.90	0.12	2.00	2.00
CD (P=0.05)	1.65	9.38	0.39	6.48	6.48

in cv. Gauriya, followed by 'BCC1' (36.11g). Highest average corm weight was recorded in 'Panchmukhi' which could be due to a greater quantity of dry matter having been translocated to the corm, combined with a higher rate of yield-attributing characters, viz., plant height, LAI, etc. throughout growth. Similar results were reported by Onwueme (1978) and Parthasarthy *et al* (1989) in taro.

There was a significant variation in corm yield among cultivars. 'Panchmukhi' recorded significantly higher corm yield (20.00 t/ha), followed by 'C-3; (17.33 t/ha). The lowest yield (0.25 t/ha) was recorded in 'Ascol-1' and 'Gauriya', which was statistically at par with that in 'BCC-1A' (0.50 t/ ha). High corm-yield in 'Panchmukhi' may be attributed to a better utilization of photosynthates (due to maximum plant height and leaf number), resulting in better sized tubers; it could also be due to higher corm-weight. Similar result was obtained by Sarmah (1997).

There was a significant variation in cormel length among cultivars. 'C-3' recorded maximum (85.93mm) cormel length, which was statistically at par with 'ML-1' (85.08mm). The lowest (30.79mm) was recorded in 'BCC1'.

Significant variation was seen in cormel breadth among cultivars. 'Arcol-5' recorded maximum (67.43mm) cormel breadth, followed by 'Arcol-6' (40.55mm); while, 'Ascol-1' recorded the lowest (18.40mm) cormel breadth, which was statistically at par with Meghalaya Local (18.94mm).

Data presented on average cormel weight, evidently shows a significant difference among cultivars. Maximum average cormel weight (72.85g) was recordrd in 'Arcol-7', followed by Arcol-6 (65.31g). The lowest average weight (12.04g) was recorded in 'Meghalaya Local'.

Data on cormel yield show significant differences among cultivars. Highest cormel yield (15.29 t/ha) was recorded in 'White Gouriya', which was statistically at par with 'Sunajuli' (15.00 t/ha). The lowest yield (0.75 t/ha) was recorded in 'Arcol-1'.

Significant variation was observed in total yield. Highest (25.92 t/ha) total yield was observed in 'White Gouriya', followed by 'Nayabungalow' (25.50 t/ha). The lowest yield (1.50 t/ha) was recorded in 'Ascol-1' and 'BCC-1A'. The high total yield obtained in 'White Gouriya' may have resulted from rainfed and flooding conditions. Similar finding was observed by De la Pena and Plucknett (1967).

Data on the number of cormels per plant showed significant difference among cultivars. Highest number of side-tubers (30.33) was observed in 'White Gouriya', followed by 'BCC-2' (26.00); the lowest number (3.67) was found in 'BCC-1A', followed by 'Arcol-1' (4.67). Higher number of cormels per plant in 'White Gouriya' may be due to accumulated storage foods, which have a direct bearing on crop yield (Bhuiyan and Quadir, 1989).

Data on moisture percentage in tubers shows a significant variation among cultivars. At harvest, cv. cultivar IG Coll-5 recorded the highest (82.83) moisture percentage, followed by 'B.K Coll-11' (82.17%). Lowest moisture percentage (72.50) was recorded in cvs. ML-9 and KCA-1. 'IG Coll-5' recorded highest moisture percentage which could be due to a combination of factors. Moisture content is not a fixed property, and is dependent upon several factors such as cultivar, yield, proportionate amount of chemical constituents, and, environmental factors such as temperature, relative humidity, etc. (Sarmah, 1997).

As for dry matter content in tuber, there was significant variation among cultivars. 'Panchmukhi' and 'KCA-1' recorded maximum dry-matter content (27.50%), followed by 'C-3' (25.67%). 'IG Coll-5' recorded the lowest dry-matter content (17.17%), followed by 'BK Coll-11' (17.83%). There were significant differences in starch content too, among different cultivars. Highest starch percentage (34.67) was recorded in 'Kandha-5', followed by 'White Gauriya' (31.03%); while the lowest (13.05%) was found in 'Ascol-2'. 'Panchmukhi' accumulated the highest amount of dry-matter, whereas 'IG Coll-5' recorded the lowest. 'Kandha-5' had the highest starch content, while cv. Ascol-2 recorded the lowest. Wills *et al* (1983) also reported varietal variation in starch and dry-matter content in taro.

Cv. Nainital recorded highest total sugars (5.85%), followed by 'Muktakeshi' and 'Arcol-2' (5.12%). The lowest value (1.60%) was recorded in cv. BCC-1A, which was statistically at par with 'Kadina Local' (1.61%).

Significant differences were found in oxalic acid content among cultivars. 'Nadia Local' recorded highest amounts of calcium oxalate (1.05%), followed by 'Ascol-2' (1.04%); whereas, the lowest (0.36%) was recorded in cv. SJ-1. Oxalic acid percentage was maximum in cv. Nadia Local, whereas 'SJ-1' recorded minimal oxalic acid content. Oxalate content is of interest because of its alleged adverse effect on nutrient bio-availability (Libert and Franceschi, 1987). Huang Chien-Chun *et al* (2007) also reported variation in calcium oxalate concentration among taro cultivars. Further, oxalates do not pose a hazard, since, these are leached out during cooking (taro is not consumed raw/uncooked). A cultivar may contain higher amounts of calcium oxalate, which causes physical irritation, as may be due to the presence of some other, complex chemical compound/s (Tang and Sakai, 1983).

The wide variations observed in chemical composition of different colocasia cultivars may be due primarily to varietal differences, which ultimately determine nutritional value of a particular crop, since, all the cultivars were grown under similar climate and soil type, under uniform cultivation practices (Barooah, 1982). Similar observations were made by Wills *et al* (1983) for taro cultivars grown in the highlands of Papua New Guinea.

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