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YIELD PERFORMANCES AND CUP QUALITY OF SOME BTRI TEST CLONES OF TEA

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Abstract

A long term experiment was conducted to investigate the yield and quality performances of four vegetative propagated test clones of tea coded as A/8/01, A/17/22, A/22/27 and A/22/40 at Bangladesh Tea Research Institute (BTRI) farm during 1996-2010. A standard clone BT1 was considered as control. Cuttings of the test clones were collected from the selected bushes of Amo tea estates and were raised at BTRI nursery. Then saplings were put to long term yield and quality trial following Latin Square Design (LSD) with 3 replications. The green leaf was harvested at weekly interval during the plucking season starting from mid March to mid December throughout the experimental period. Yield data were recorded and analyzed statistically using MSTAT programme. Results of the experiment revealed that among the test clones A/22/40 gave the highest significant yield of 3509.1 kg ha^{-1} of made tea followed by BT1 (3203.69 kg ha^{-1}), A/8/01 (2912.24 kg ha^{-1}), A/17/22 (2817.76 kg ha^{-1}) and A/22/27 (2278.78 kg ha^{-1}) from the average of 9 years (2002-2010) at mature stage. At immature stage i.e. 1st year to 5th year after plantation yield difference was insignificant. The overall cup quality of the test clones was assessed by conventional organoleptic test. The cup quality of A/8/01, A/17/22, A/22/40 as well as the standard clone BT1 was found to be above average (AA) while the cup quality of A/22/27 was average (A). Considering the yield and quality potentials, the test clone A/22/40 has appeared quite promising to be released as a standard clone.

Keywords: Yield performances, Cup quality, Test clones, BTRI

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Introduction

Tea is one of the most important cash crops in Bangladesh and south Asia. It is also an important food commodity of international trade. The principal types of tea produced and consumed in the world are black and green tea with small amounts of other types. The world tea production is 4,162 million kg in 2010 (ITC, 2011). It is a major cash crop as well as a significant export item of Bangladesh accounting for about 0.81% of the GDP (BTB, 2002).

Our present yield hectare^{-1} is quite low compared to other tea growing countries of the world. Because a large portion of our tea growing area is covered with seedling plants which are over 60 years old and are of unimproved jats of lower productivity. Moreover, a significant area of this old plantation has low plant population density resulting in lower productivity and poor quality of tea. The increasing cost of production as well as adverse climatic conditions has led to marginal economic return to the tea industry. In these circumstances, the industry needs to replant and extend new tea areas with improved planting materials of higher yield and good quality. Due to the heterogenous nature of tea seedlings, the available seed except biclonal stocks, could not guarantee the production of improved planting material (Njuguna, 1990). Therefore, emphasis should be given on selection and planting of vegetatively propagated material i.e. high yielding quality clones for better yield and quality of tea (Dutta and Alam, 2001).

Clonal selection is the most popular practice in tea for evolving better varieties. Desirable potential plants are isolated from the seedling population that have derived from superior jats or breeding lines. Procedure of clonal selection is more or less same in all the tea growing countries (Tubbs, 1946; Vissar & Kehl, 1958; Wight, 1961; Barua, 1964).

With an objective of evolving planting materials with high yield and quality potential, BTRI has put its priorities of research on clonal selection and hybridization programme since its inception. The clonal selection programme was initiated in 1959 and hybridization programme in 1965 (Rashid and Alam, 1990). As an outcome of these works, the institute so far has released eighteen vegetative clones in the Bangladesh tea (BT) series (BT1 – BT18) to the industry.

Few more test clones are in various stages of trial. The present experiment was carried out to study the long term yield and quality performances of four vegetatively propagated test clones of tea selected from the Amo tea estate.

Materials and Methods

The experiment was carried out with four test clones and one standard clone of tea in the BTRI experimental farm, during the period from April, 1996 to December, 2010. Cuttings were collected from the selected bushes of Amo tea estate during 1994, which were raised at BTRI nursery. After the rooting trial in nursery, the selected test clones, namely A/8/01, A/17/22, A/22/27 and A/22/40 were put to long term yield and quality trial in 1996. The experiment was laid out in Latin Square Design (LSD) with three replications. Each plot was 5 m x 5 m in size with 105 cm (row-row) x 60 cm (plant-plant) spacing. There were 25 plants per plot. A standard clone BT1 was used as control for yield and quality comparison. The experiment was conducted in rain-fed condition. Yield data was collected during the cropping seasons throughout the experimental period.

The N-P-K mixture was applied at young and mature tea as per BTRI recommendations (Kibria and Rashid, 1994; Kibria and Uddin, 1998). Pruning was followed for young tea: Decentre – Prune – Skiff – Prune – Skiff (Shahiduzzaman *et al.*, 2002) and for mature tea: Light Prune (LP) – Deep skiff (DSK) – Medium skiff (MSK) – Light skiff (LSK) cycle as per BTRI recommendations (Rashid, 1986). The green leaf was harvested at weekly interval during the plucking season starting from mid March to mid December throughout the experimental period. Yield data were recorded and analyzed statistically using MSTAT programme in a microcomputer. The mean values were adjudged by DMRT. The yield was expressed as mean yield of green leaf g plant^{-1} and is presented separately for immature (1st - 5th year) and mature (6th- 14th year) stage. The made tea (kg ha^{-1}) was also calculated on the basis of 23% recovery from green leaf and 15875 plants ha^{-1} at 105 cm x 60 cm spacing. The quality performances of manufactured by CTC method in the BTRI mini tea factory. Quality of all the test clones and control were assessed weekly by conventional organoleptic test and scored numerically. General characteristics of four test clones and control BT1 is given in Table 1.

Table 1. General characteristics of some selected test clones and BT1

Clone	Bush characters	Leaf type	Pruning recovery	Nursery rooting	Cup quality	Manufacturing Preference
T1-A/8/01	Assam, vigorous, ortho-plagiotropic, good girth, fairly compact	Large, light green with prominent pointed apex, semi erect	Good	Good	Above average	CTC
T2-A/17/22	Assam hybrid, medium bush, vigorous, Ortho-plagiotropic, grower with good spread, quite compact plucking table	Medium to large, semi dark green, green, semi-erect, pointed apex	Good	Good	Above average	CTC
T3-A/22/27	Medium bush, heavy girth, good grower with good spread, orthotropic, thick shoots	Medium to large, light green, erect, prominent leaf apex	Good	Good	Average	CTC
T4- A/22/40	Assam hybrid, medium bush, vigorous orthotropic grower with a very good spread forming dense plucking table	Medium to large, semi-dark green, glossy, semi-erect, serrated margin	Good	Good	Above average	CTC
T5-BT1 (Control)	Bush size medium, plagiotropic, thickly branched and compact, fairly dense and evenly distributed plucking points with short internodes	Leaves semi-dark green, medium sized, horizontal pose. Prominent long apex, leaf margin deeply serrated, leaf blade wavy	Good	Good	Above average	CTC

The tea clones were categorized into the following classification

Category of clones	Yield clone (kg ha^{-1})	Standard clone (kg ha^{-1})	Quality clone (kg ha^{-1})
Yield Performance	>4000	3000-4000	<3000
Cup Quality*	AA or A	AA	E

* Quality score:
E = Excellent (34 to >34 out of 50)
AA = above average (32 to <34 out of 50)
A = average (30-32 out of 50)
BA = Below Average (<30 out of 50)

Results and Discussion

The mean yield of green leaf (g plant^{-1}) at immature (1st - 5th year) and mature (6th- 14th year) stage is presented in Table 2 and Table 3, respectively. At the initial stage of growth, all test clones showed similar yield trend as control (BT1) (Table 2). Green leaf yield was converted as made tea (kg ha^{-1}) over the experimental period. The mean made tea production at immature and mature stage is presented in Table 4 and Table 5, respectively. During the experimental period, test clone A/22/40 maintained higher trend of yield over control whereas A/8/01, A/17/22, A/22/27 maintained lower trend of yield over control (Table 5).

Table-2. Mean yield of green leaf (g plant^{-1}) at immature stage (1st–5th year)

Year / Clone	1st Year Skiff 1997	2nd Year Prune 1998	3rd Year Skiff 1999	4th Year Prune 2000	5th Year Skiff 2001	Average
A/8/01	63.39a	156.50a	316.83a	395.33a	716.04b	329.62a
A/17/22	57.94a	169.00a	283.88a	432.73a	722.24b	333.16a
A/22/27	61.44a	154.02a	289.40a	430.09a	521.80c	291.35a
A/22/40	62.63a	184.38a	274.02a	442.65a	904.12a	373.56a
BT1	66.90a	185.79a	319.86a	465.94a	850.26a	377.75a
LSD at 0.05	NS	NS	NS	NS	70.80	87.04

Within column values followed by different letter (s) are significantly different by DMRT ($p \leq 0.05$)

Table-3. Mean yield of green leaf (g plant^{-1}) at mature stage (6th –14th year)

Year / Clone	6th Year LP 2002	7th Year DSK 2003	8th Year MSK 2004	9th Year LSK 2005	10th Year LP 2006	11th Year DSK 2007	12th Year MSK 2008	13th Year LSK 2009	14th Year LP 2010	Average
A/8/01	655.23b	716.87c	746.62c	941.34bc	686.70a	804.00a	805.00bc	935.45b	888.1b	797.70c
A/17/22	591.14c	703.37c	730.26c	880.52c	669.24a	786.75a	756.88c	926.37b	901.8b	771.82c
A/22/27	516.44c	568.66d	536.71d	653.63d	698.85a	691.59a	619.02c	696.34c	636.9c	624.24d
A/22/40	759.87a	881.62a	930.25a	1150.75a	757.80a	881.74a	972.62a	1192.14a	1123.8a	961.18a
BT1	657.46b	848.81ab	838.83b	1046.91ab	745.20a	795.66a	880.89b	1080.72ab	1003.3ab	877.53b
LSD at 0.05	81.26	68.68	94.28	137.5	NS	NS	110.5	157.96	127.6	57.71

Within column values followed by different letter (s) are significantly different by DMRT ($p \leq 0.05$)

Table-4. Estimated made tea yield (kg ha^{-1}) at immature stage (1st – 5th year)

Year / Clone	1st Year Skiff 1997	2nd Year Prune 1998	3rd Year Skiff 1999	4th Year Prune 2000	5th Year Skiff 2001
A/8/01	231.45	571.35	1156.68	1443.27	2614.12
A/17/22	211.55	616.98	1036.39	1579.81	2636.75
A/22/27	224.3	562.29	1056.54	1570.17	1904.98
A/22/40	228.65	673.13	1000.39	1616.02	3300.76
BT1	244.23	678.28	1167.74	1701.75	3104.13

Table-5. Estimated made tea (kg ha^{-1}) at mature stage (6th –14th year)

Year / Clone	6th Year LP 2002	7th Year DSK 2003	8th Year MSK 2004	9th Year LSK 2005	10th Year LP 2006	11th Year DSK 2007	12th Year MSK 2008	13th Year LSK 2009	14th Year LP 2010	Average
A/8/01	2392.11	2617.15	2725.76	3436.64	2507.00	2935.24	2938.89	3415.14	3242.3	2912.24
A/17/22	2158.50	2567.86	2666.00	3214.60	2443.26	2882.27	2767.22	3381.99	3292.29	2817.76
A/22/27	1885.40	2076.06	1959.42	2386.27	2551.36	2524.85	2259.92	2542.18	2324.10	2278.97
A/22/40	2774.13	3218.62	3396.16	4201.16	2766.57	3219.05	3550.84	4262.49	4102.00	3509.10
BT1	2400.25	3098.84	3062.40	3822.06	2720.57	2904.79	3215.95	3945.49	3661.8	3203.69

At immature stage (1st - 5th year), the highest average made tea yield (1379.08 kg ha^{-1}) was obtained from the standard clone BT1 which was statistically identical with A/22/40 (1364 kg ha^{-1}) (Fig. 1).

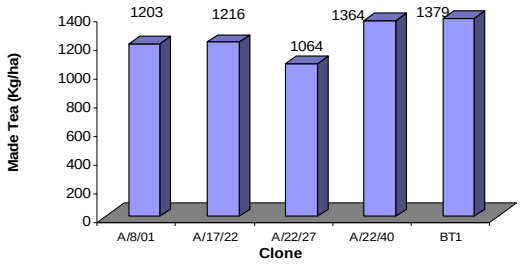

Fig. 1 Estimated yield at immature stage (1st to 5th year).

At standard productivity level i.e. after maturity, in the year of 6th, 7th, 8th, 9th, 12th, 13th & 14th made tea yield variations were significant except in the year of 10th & 11th. This was occurred due to drought in 2006 and 2007.

On the average of 9 year production, the test clone A/22/40 gave significantly (LSD at 0.05) higher yield (3509.1 kg ha^{-1}) followed by A/8/01 (2912.24 kg ha^{-1}), A/17/22 (2817.76 kg ha^{-1}), A/22/27 (2278.97 kg ha^{-1}) over control BT1 (3203.69 kg ha^{-1}) (Fig. 2).

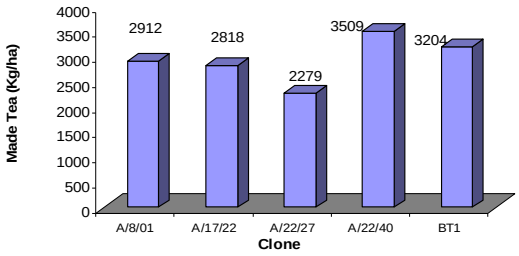

Fig. 2 Estimated yield at mature stage (6th to 14th year).

Quality performance: The overall quality performances of the test clones and control are shown in Table 6. The cup characteristics of all the test clones including the control BT1 were categorized as "Above average" except A/22/27. They have bright infusion, strong liquour colour with useful strength and briskness (Table 6).

Table 6. Cup quality of test clones (Average score of 10 years)

Test Clone	Infusion (10)	Liquour colour (10)	Briskness (10)	Strength (10)	Creaming down (10)	Total	Overall Quality
A/8/01	7.23b	7.49ab	7.37b	7.14b	3.00b	32.22bc	AA
A/17/22	7.31b	7.61ab	7.33bc	7.40a	3.04b	32.67b	AA
A/22/27	7.28b	7.46b	7.17c	7.14b	2.66c	31.74c	A
A/22/40	7.38b	7.56ab	7.41ab	7.40a	3.08b	32.95ab	AA
BT1	7.54a	7.66a	7.58a	7.41a	3.39a	33.54a	AA
LSD at 0.05	0.1616	0.1786	0.1745	0.2086	0.2409	0.7276	-

Within column values followed by different letter (s) are significantly different by DMRT ($p \leq 0.05$)
A = Average, AA = Above Average

Considering the quality standard and yield performances throughout study period, the test clone A/22/40 has appeared superior to the control BT1 and to be released as a standard clone. The other test clone A/8/8 has also found prospective in quality characters and yield, and can be used as a standard clone or valuable breeding stock.

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