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Torsa - A High Yielding, Early Maturing Motihari Tobacco (*N. rustica* L.) Variety for Terai Region of West Bengal

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Abstract

An early maturing, high yielding Motihari tobacco (*N. rustica*) variety Torsa was developed through mass selection method of breeding from a local variety Tangua Manda and released by Central Tobacco Research Institute Research Station, Dinhata, West Bengal in 2008. It possesses moderately large sized leaves and attains height of 45—47 cm under topped condition. After topping, 8—9 leaves can be retained. Cured leaf exhibits desired reddish brown color, thick texture with higher gums and oil, pungent taste, sweet aroma and satisfactory chewing strength. In the station replicated trials, the variety registered 19.6 and 20.2% increase in cured (2190 kg/ha) and first grade leaf (1,435 kg/ha) yield over check *Bitri,* respectively. In on-farm trials, it recorded an average increase of 26 and 35% for cured (2, 407 kg/ha) and first grade leaf yield (1, 638 kg/ha) over the control variety *Bitri*. Leaf thickness and nicotne content in cured leaf of Torsa were 37.5 and 24.8% higher than check. Chewing taste evaluation score in Torsa registered 15.5% superiority over the check. The net benefit per rupee of investment recorded in this vriety was Rs 1.97 compared to Rs 1.46 in check *Bitri*.

Key words : Torsa, Motihari tabacco, High yielding, Early maturing

Motihari tobacco (*N. rustica* L.) is extensively grown as a cash crop in terai region of West Bengal mainly in northern districts of Cooch Behar and Jalpaiguri. It occupies an area of 14, 000 ha of which 25—30% is under early maturing cultivars commonly known as *Bitri* type. Apart from the early maturing variety *Bitri* released during 1979-80 by this Research Station, there are a few local land varieties still in vogue in different pockets of Cooch Behar and Jalpaiguri districts of West Bengal. Prominent among these land races are Tangua Manda, Manda, RT-Bulk and Bombai, though mature early, are low yielders. Populations of these cultivars were found to be heterogeneous due to admixtures of variants which affected yield and quality over the years. These populations were improved by mass selection (1) for short duration and improvement in yield. The present investigation aims at evaluating yield and quality performance of these lines in replicated trial at the research station, and to assess performance of superior selections in bulk plot assessment and on farm trial in farmers fields.

Methods

The test material comprised three land varieties of early maturing *Motihari* tobacco viz. Manda , Tangua Manda and Bombai improved by mass selection by compositing the progeny of the selected pure lines followed by selection and repetition of the cycle consecutively for four years leading to improvement in local land varieties (2). The lines were further evaluated for their yield and quality performance in a randomized block design with 40 plants in a plot replicated four times along with *Bitri* as check variety for two years in 2004-05 and 2007-08 following standard procedures. Spacing in between rows and plants was 60 and 45 cm, respectively. Manurial and cultural practices were followed based on recommended package of practices for *Motihari* tobacco (3). Best performing line Tangua Manda was further evaluated along with earlier tested superior cultivar RT-Bulk (4) and check *Bitri* in bulk plot trials with 500 plants each at the Research Station farm. On-farm trials were conducted for yield and quality performance at three locations during 2005-06 and 2006-07. Individual year and pooled data for two year replicated, bulk plot and locational trials along with the physical (size, body, aroma, oiliness, incrustation and color) and chemical characteristics (nicotine, reducing sugar, chloride, total N, P and K) of cured leaf were recorded. Incidence of diseases under natural and articial condi-

Table 1. Mean cured leaf yield of early maturing *Motihari* tobacco cultivars in 2004-05 and 2007-08 and on pooled basis. Figures in parentheses indicate percent increase or decrease over check.

Variety	Total cured leaf yield (kg/ha) 2004-05	2007-08	pooled	First grade leaf yield (kg/ha) 2004-05	2007-08	Pooled
Manda	2035	1859	1947 (6.3)	1286	1274	1280 (7.3)
Tangua Manda	2181	2200	2190 (19.6)	1376	1495	1435 (20.2)
Bombai	1744	1790	1767 (-3.6)	920	1041	980 (-21.7)
Bitri (Check)	1762	1900	1831	1175	1211	1193
SE ±	71.82	48.25	–	82.23	67.89	–
CD 5%	221	149	–	253	209	–
CV%	7.90	5.57	–	15.46	12.10	–
Pooled	S. Em	C.D 5%	C.V.%	S.Em	C.D 5%	C. V. %
Line (L)	47.36	137	6.83	57.81	167	13.79
Season (S)	33.49	ns		40.87	ns	
L × S	66.78	ns		81.74	ns	

tions (brown spot *Altermaria altermata* and hollow stalk *Erwinia carotovora* sb. sp. *carotovora*) was recorded. Chewability of cured leaf was subjected to taste evaluation for four chewing parameters (pungency, saliva secretion, maturity and taste) by expert chewers. Cost economic and net profit were worked.

Results and Discussion

Replicated trials

Year wise and pooled analysis of data from replicated trials of two years (2004-05 and 2007-08) for yield characters are presented in Table 1. Line Tangua Manda showed significantly higher total cured leaf over the check *Bitri* in individual years and in pooled. First grade leaf yield recorded significant superiority over check *Bitri* in 2007-08 and pooled. Statistical analysis of pooled data indicated an increase of 19.6 and 20.2 % in total cured and first grade leaf yield, respectively over check *Bitri.* There was no significant variation in both the yield parameters due to season and their interaction with the lines indicating that yield performance of lines was not influenced by environmental conditions and could be judged on their *per se* performance.

Table 2. Average morphological characters of lines over years, 2005-06 and 2006-07.

Variety	Plant heigh (cm)	Leaf length (cm)	Left breadth (cm)	Leaf area (sq. cm)	No. of leaf/ plant	Maturity score (1—5)
Tangua manda	48.0	32.7	26.9	586.4	8.6	4.58
RT-Bulk	54.6	33.7	29.2	656.0	8.5	3.92
Bitri (c)	48.7	27.1	24.9	449.9	8.2	4.00

Bulk Plot Trials

Performance of Tangua Manda, the best performing line in replicated trials and another superior line RT-Bulk along with check variety Bitri in non-replicated bulk trials during 2005-06 and 2006-07 for growth and yield parameters are presented in Tables 2 and 3 respectively. Line Tangua Manda showed numerical superiority over check Bitri for different growth parameters e. g. leaf length and breadth, area, number and maturity score of leaf. Plant height on an average exceeding 50 cm as recorded by line RT-Bulk is not desirable in *Motihari* tobacco as it give rise to more inter-nodal space and lower maturity score (Table 2). Consequently, it would lead to decline in quality leaf

Table 3. Mean cured leaf yield of early maturing Motihari tobacco cultivars in bulk plot trials in 2005-06 and 2006-07. Figures in parentheses indicate percent increase or decrease over check.

Variety	Total cured leaf yield (kg/ha) 2005 -06	2006 -07	Pooled	First grade leaf yield (kg/ha) 2005 -06	2006 -07	Pooled
Tangua Manda	2367	2975	2671 (41)	1393	2050	1722 (43)
RT-Bulk	2183	2670	2427 (28)	1333	1291	1312 (9)
Bitri (Check)	1559	2233	1896	1148	1266	1207

Table 4. Average cured leaf yield, physical and chemical quality and disease incidence of early maturing cultivars over locations and Years 2005-06 and 2006-07. Figures in parentheses indicate percent increase or decrease over check.

Parameters	Torsa (Tangua Manda)	RT-Bulk	Bitri (Check)
Yield			
Total cured leaf (kg/ha)	2407 (26)	2189 (15)	1910
First grade leaf (kg/ha)	1638 (35)	1233 (2)	1210
Physical Quality			
Size × 10	9	6	8
Body × 10	10	6	7
Aroma × 10	9	7	8
Oiliness × 10	9	6	8
Incrustation × 10	7	5	6
Colour × 25	22	17	20
Total ×75	66	47	57
Thickness (mm)	0.66 (37.5)	0.44 (-8.3)	0.48
Chemical Quality			
Nicotine (%)	5.74 (24.8)	5.48 (19.1)	4.60
Reducing sugar (%)	0.34	0.28	0.19
Chloride (%)	1.34	1.21	1.26
Total N (%)	3.14	3.71	3.88
Total P (%)	0.31	0.39	0.35
Total K (%)	1.89	2.47	2.12
Disease Incidence (Natural)			
CMV (%)	1	3	1
Brown spot (%)	10	20	20
Hollow stalk (%)	0.8	10	12

yield which is not desirable as higher productivity of first grade leaf fetches higher monetary returns. In bulk plot trials Tangua Manda recorded 41 and 43% higher total cured and first grade leaf yield, respectively over check *Bitri* as against 28 and 9% in line RT-Bulk (Table 3).

On-Farm Locational Trials

Data from three farmer's fields at different locations for two years on yield, physical and chemical quality parameters and incidence of diseases under natural conditions are presented in Table 4. Data on disease incidence under artificial inoculation are presented in Table 5. In on-farm trials conducted at different locations for two years, line Tangua Manda recorded 26 and 35% increase in total cured and first grade leaf yield, respectively over check *Bitri* as against 15 and 2% recorded in RT-Bulk.

Table 5. Disease reaction of early maturing cultivar and check under artificial inoculation (2007-08). * Per cent disease index calculated for brown spot based standard scale. ** Linear length of soft rot of pith tissues measured after 6th days of inoculation.

Variety	Brown spot (PDI)*	Hollow stalk**
Tangua Manda (Torsa)	10.71	1.15
Bitri	17.98	2.55

Appraisal of scores for different physical quality parameters of cured leaves indicated superiority of line Tangua Manda (66) than RT-Bulk (47) and check *Bitri (*57). Leaf thickness of Tangua Manda was 66 mm compared to 47 and 57 mm in RT-Bulk and check *Bitri,* respectively. Analysis of cured leaf for chemical parameters indicated 24.8 and 19.13 % higher nicotine in line Tangua Manda and RT-Bulk respectively over check *Bitri* while other characters were almost similar. Average incidence of disease under natural conditions in line Tangua Manda was lowest for brown spot (*Alteraria altermata*) and hollow stalk (*Erwinia carotovora* sub.sp. carotovora) a serious endemic fungal and bacterial disease of *Motihari* tobacco in terai region of West Bengal respectively, compared to RT-Bulk and check, *Bitri.* Incidence of mosaic in line Tangua Manda was lower than RT-bulk and at par to check *Bitri*. Under artifical inoculation, line Tangua Manda showed lower disease reaction to brown spot and hollow stalk compared to *Bitri* (Table 5).

Yield Improvement

Variety Tangua Manda has recorded higher yield

Table 6. Average chewability score report of chewers * for different parameters of varieties (2006-07). * No. of chewers five.

Variety	Chewability parameter (Score) Pungency (X 10)	Saliva secretion (X 10)	Maturity (X 10)	Taste (X 10)	Total (X 10)
Tangua Manda (Torsa)	9.0	7.2	8.6	8.0	32.8
RT-Bulk	6.0	5.0	5.6	4.8	21.4
Bitri (Check)	8.2	6.0	7.2	7.0	28.4

Table 7. Cost economics and net return (2005-06, 2006-07 and 2007-08).

Economics/variety	Tangua Manda	RT-Bulk	Bitri (Check)
Cost of cultivation (Rs/ha)	30151	30151	30151
Average yield (kg/ha)	2365	2114	1891
Gross return (Rs/ha)	59672	43097	44183
Net profit (Rs/ha)	29520	12945	14031
Net profit per rupee of investment	1.98	1.43	1.46

of cured and first grade leaf yield than the check variety *Bitri.* In station yield trial, it recorded 19.6 and 20.3% in bulk plot trial 40.9 and 42.7 and in on-farm trials 26 and 35.4% higher cured and first grade leaf yield, respectively over check *Bitri*. Yield gain in var Tangua Manda validates the success of mass selection method of breeding. Similarly, improvement for tillering through mass selection in barley and wheat to the extent of 6.3 and 10.3% respectively has respectively has earlier been reported (5).

Chewability Test

The score for chewability teste carried out for four important parameters (pungency, saliva secretion, maturity and taste) by five expert chewers is presented in Table 6. The sum total of all the four parameters was higher in line Tangua Manda (32.8) followed by check *Bitri* (28.4) and line RT-Bulk (21.4).

Economics

The economic estimate in terms of monetary returns for line Tangua Manda and check *Bitri* is presented in Table 7. The net benefit per rupee of investment was Rs 1.98 for Tangua Manda as against Rs 1.46 for check variety *Bitri.* The net profit in Line Tangua Manda was Rs 29,520/ha which was Rs 15,489 and Rs 16,574 higher than Check *Bitri* and line RT-Bulk, respectively. The reason attributed for higher net return in line Tangua Manda was due to higher cured and first grade leaf yield in comparison to line RT-Bulk and the check.

Release of Variety

Keeping in view the promising nature of the line Tangua Manda in terms of its higher yield,superiority of quality leaf and for physical and chemical characters, the Institute Research Committee of Central Tabacco Research Institute, Rajahmundry identified the line and recommended for its release.

Line Tangua Manda was formally released as "Torsa" by Tobacco variety Release Committee of West Bengal during September, 2008 for *terai* region of West Bengal.

Package of Practices

Variety Torsa requires 125 kg N/ha, 50kg P_2O_5 /ha and 75 kg K_2O/ha along with 10 tonnes FYM/ha. Nitrogen in the form of urea is applied in two splits, one at the time of planting and the second at 45 days after planting. Optimum spacing in between plants and rows are 45 and 60 cm, respectively. In this variety, 9 to 10 leaves can be retained after topping. On need basis, 1—2 irrigation is required for obtaining good yield and quality. The life cycle of the new variety is 87—90 days. The new variety fits well in the existing cropping system like Jute Aman paddy (rainfed)– Tobacco or Boro Paddy (irrigated) –Aman paddy –Tobacco.

The results of the present investigation reveals that the new *Motihari* tobacco variety Torsa with better plant type, higher productivity for cured and first grade leaf with desired thickness and its potential for generating higher monetary returns is expected to replace the existing low yielding *Bitri* variety. The var Torsa holds better promise in future to bring forth economic upliftment of tobacco farming community of West Bengal as majority of the farmers in *Terai* region belong to small and mariginal category.

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