

OBSERVATIONS ON THE TOLERANCE AND SUSCEPTIBILITY OF TEA CLONES TO SHOT-HOLE BORER INFESTATION—1969

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One of the cultural methods of shot-hole borer control is the selection of clones tolerant to the pest. This paper presents the results of further investigations on the tolerance of clones to shot-hole borer infestation and gives a comparative assessment of the information collected to date.

Of 12 clones tested in the Experiment *MVP3 planted in 1963, only clone ML 7 has good tolerance to shot-hole borer infestation; but it is a very poor yielder. Clone W3 has excellent quality (Kirtisinghe, de Silva & Samarasingham 1968), good drought resistance and shows moderate borer tolerance, and is also a promising clone in respect of yield.

The clones TRI 2023 and DG 39 still appear to be the best clones for propagation in the mid-country wet zone.

Calnaido & Kanapathipillai (1967) commenced work on clonal selection for tolerance to shot-hole borer infestation. They assessed the performance of 32 clones in the Experiment MVP1* in respect of borer tolerance or susceptibility, in relation to other known desirable characters of yield and drought resistance. This was followed by similar information in respect of 16 additional clones in the Experiment MVP2* (Thirugnanasuntharan & Calnaido 1968).

This paper presents additional information on the 12 clones of the Experiment MVP3* planted in 1963, as regards their borer tolerance or susceptibility and their ability to withstand drought conditions, and collates the information of a series of continuous observations on 60 clones, and their performance in their first pruning cycle in the Mid-Country.

MATERIALS AND METHODS

The clonal testing experiment MVP3 at the TRI Mid-Country Station, Hantane, Kandy, consists of 12 clones arranged in four randomized blocks (block 13-16) and was laid down in 1963. Each block has 12 plots to which the 12 clones were allotted at random, one to each plot. Two of the four blocks are shaded with *Gliricidia maculata* and the other two are unshaded. The nature of the shade and the system of planting of clones in the plots are the same as for experiments MVP1 and MVP2.

*For further details of experiments MVP1, MVP2 and MVP3 refer Part 2 of the Annual Reports of the Tea Research Institute, 1965 to 1968.

The estimates of borer damage in the clones were determined by the 'branch-breakage method', from four observations made in the 24th, 28th, 32nd and 36th months after prune, in October 1967, February 1968, June 1968 and October 1968 respectively. Further, estimates of the total number of galleries (open and healed) in the prunings (mean per 25 branches per plot) were made at the end of the pruning cycle in October 1968. The mean weights of all prunings per ten bushes per plot and mean weights of samples of 25 branches per plot were also recorded and these values were used to make corrections for the variations of the number of branches per bush in different clones.

The effect of shade on the performance of clones as regards shot-hole borer damage were assessed on the basis of observations made in the first pruning cycle of the 60 clones of Experiments MVP1, MVP2 and MVP3.

RESULTS

Tolerance and susceptibility of clones to borer attack

Estimations of shot-hole borer damage as measured both by the branch-breakage method and by counts of galleries in prunings are shown in Table 1. Table 2 shows the relative borer infestation of the 60 clones as measured by counting the number of galleries.

TABLE 1—*Shot-hole borer attack on 12 clones of MVP3 (planted in 1963), as measured by (1) branch breakage and (2) the content of the total galleries in pruned branches*

Clone	Branch breakage per bush mean of 4 observations	Clone	Total number of galleries per 25 pruned branches per plot
DG 7	0.45	ML 7	44.25
E 7/27	0.52	W 3	54.50
DG 3	0.52	DG 3	60.75
ML 7	0.53	E 7/27	64.50
TRI 2045	0.60	TRI 2021	73.00
W 3	0.63	TGK 2	76.50
TRI 2024	0.64	W 2/145	77.25
W 2/145	0.70	TRI 2046	83.25
TRI 2021	0.77	DG	90.25
TRI 2046	0.86	DG 7	91.25
DG	0.92	TRI 2045	96.75
TGK 2	0.95	TRI 2024	106.50
LSD at $P = 0.05$	0.19		34.97
$P = 0.01$	0.25		47.14
$P = 0.001$	0.34		62.56

TABLE 2—*Shot-hole borer attack on 60 clones of the experiments MVP1, MVP2 and MVP3, as measured by the total number of galleries in pruned branches*

Clone	Experiment (MVP)	Total number of galleries per 25 pruned branches per plot in prunings	Clone	Experiment (MVP)	Total number of galleries per 25 pruned branches per plot in pruning
QT 1/5	1	13.75	TRI 2026	1	88.75
TRI 2023	1	19.50	DG	3	90.25
NL 4/2	1	20.00	KP 204	2	90.75
DN	1	34.50	DG 7	3	91.25
BG (MT)18	1	36.00	TRI 2020	2	91.50
MT/BG	1	39.00	GMT 9	1	91.75
ML 7	3	44.25	PO 26	1	92.00
T 5/35	1	44.50	CY 9	1	95.00
OT 5/8	2	45.50	K 136	1	95.00
MPA 1	2	50.00	KEN 16/3	1	96.75
MG	2	51.25	TRI 2045	3	96.75
W3	3	54.50	TRI 2022	2	104.50
UH 9/3	1	55.25	TRI 2024	3	106.50
PA 22	1	56.50	TRI 2043	2	109.00
DG 39	1	56.50	N 3	2	115.25
K 150	1	58.25	TK 48	1	119.00
DG 3	3	60.75	TRI 2024	1	121.75
NK 4B29	2	63.75	CV 5 B1	1	122.50
E 7/27	3	64.50	CR 4	1	127.50
CH 13	2	65.75	TRI 2039	2	128.00
CV 4 B1	1	68.50	TRI 2024	2	128.25
EN 31	1	68.75	DT 1	1	134.75
D	2	69.25	MG 3 B1	2	136.25
TRI 2021	3	73.00	TRI 2151	1	136.50
TGK 2	3	76.50	TRI 2027	1	138.25
W 2/145	3	77.25	T 5/3	1	147.50
SEED	1	78.75	NL 3/1	1	174.00
TRI 2046	3	83.25	TRI 2025	1	200.50
TRI 777	1	85.25	TRI 2016	2	204.50
KEN 15/7	1	88.75	H 6 A1	2	—
LSD at $P = 0.05$		56.68			
$P = 0.01$		75.00			
$P = 0.001$		96.47			

Rate of healing of borer galleries

A simple regression on the number of healed galleries and the total galleries in clones of MVP3 was very highly significant ($b = + 0.6733 \pm 0.1409$ at $P = 0.05$; $r = + 0.9576$ at $P = 0.001$). This indicates that the rate of healing was more or less same in all clones and that no clone showed any special ability to gallery healing. This is in accordance with previous observations on the clones of Experiments MVP1 and MVP2.

Shot-hole borer infestation and healing of galleries in shaded and unshaded tea

When all the observations on the 60 clones of the three experiments were considered together at the end of their first pruning cycle, there were no significant differences between the shaded and unshaded tea in respect of borer infestation. Shaded clones, however, showed significantly better healing of the borer galleries in the stems (Table 3).

TABLE 3—The effect of shade and no shade on (a) shot-hole borer infestations and (b) the ability of galleries to heal in clones

	Treatment	MVP1 (32 clones)	MVP2 (16 clones)	MVP3 (12 clones)	Mean of the 3 experiments (60 clones)
(a) No. of galleries (per 25 branches)	shade	97	84*	91	92
	no shade	78**	110	63***	83
(b) % healed galleries	shade	87%***	85%	79%	85%*
	no shade	81%	87%	78%	82%

*** = significant at $P < 0.001$

** = significant at $P < 0.01$

* = significant at $P < 0.05$

Clonal characteristics

The existing list of clones at the Mid-Country Station, where the clones are arranged in order of merit for yield (lb made tea per acre per year), along with the other characters of quality, drought resistance and shot-hole borer tolerance, is revised, so as to include the clones of experiment MVP3, and is presented in Table 4. The yield ratings are based on means of the first three-year pruning cycles, viz MVP1 — 1963 to 1966, MVP2 — 1964 to 1967 and MVP3 — 1965 to 1968. The quality of clones is rated according to the scheme given by Kirtisinghe *et al.* (1968); Kirtisinghe (1969). A measure of the drought resistance was arrived at by mean scores given on several visual observations, which were made following drought conditions. Shot-hole borer tolerance is assessed from the estimates of the mean total number of galleries per bush.

DISCUSSION

The three experiments, MVP1, MVP2 and MVP3 have completed their first three-year pruning cycles in 1963 to 1966, 1964 to 1967 and 1965 to 1968 respectively, and there has been some overlapping of time. The standard clone TRI 2024 had consistently more shot-hole borer attack than the average of all the other clones of the same experiment, but the levels of infestation between the experiments were not significantly different, as is tabulated below :

	Total number of galleries per bush (calculated)	
	TRI 2024	Mean per bush of all clones
MVP1 (32 clones)	40	25
MVP2 (16 clones)	38	27
MVP3 (12 clones)	50	32
Mean (60 clones)	43	26

TABLE 4—Characteristics of clones grown at the TRI Mid-Country Station 1969

Clone (in order of merit of yield)	Experiment No. MVP	Drought resistance	Shot-hole Borer tolerance	Quality Group after Kirtisinghe <i>et al.</i> 1968
TRI 2023	1	*	****	3
TRI 2026 (> 2500 lb)	1	—	*	5
TRI 2025	1	***	—	4
DG 39	1	**	***	3
TRI 2151	1	*	*	3
KEN 16/3 (> 2000 lb)	1	*	**	3
TRI 2027	1	**	—	3
T 5/35	1	*	***	—
MT/BG	1	**	***	4
BG/(MT)/18	1	*	***	4
NL 3/1	1	**	—	3
TRI 2024	1	—	*	3
TRI 2021	3	***	*	3
DG 7	3	****	—	3
DT 1	1	***	—	1
TRI 2024 (> 1500 lb)	3	**	—	3
K 136	1	*	**	3
KP 204	2	—	**	3
GMT 9	1	*	**	—
DN	1	****	***	4
MPA 1	2	**	***	2
W 3	3	****	**	1
TRI 2024	2	*	*	3
NK 4B/29	2	****	***	3
QT 1/5	1	*	****	4
DG 3	3	**	**	—
PA 22	1	—	***	5
PO 26	1	—	**	3
W 2/145	3	*	**	3
T 5/3	1	*	—	—
E 7/27	3	**	**	3
EN 31	1	**	**	3
TRI 2043	2	*	*	5
TK 48	1	***	**	3
KEN 15/7	1	***	**	3
UH 9/3	1	—	***	4
SEED	1	*	***	—
TRI 2022	2	—	*	4
NL 4/2	1	—	****	1
TRI 2016	2	**	—	4
CY 9	1	**	**	—
TRI 2046	3	**	*	5
K 150 (> 1000 lb)	1	—	***	3
CH 13	2	***	***	4
MG 3B1	2	*	**	3
DG	3	****	**	3
TRI 777	1	**	***	1
CV 5 B1	1	****	**	4
TGK 2	3	****	**	—
TRI 2045	3	*	*	—
CR 4	1	***	*	4
NAY 3	2	***	**	3
TRI 2039	2	***	*	—
MG	2	—	***	—
D	2	***	***	3
CV 4B1	1	****	***	3
ML 7	3	**	**	—
TRI 2020	2	****	***	3
OT 5/8	2	****	****	—
H 6 A1	2	**	—	—

		Score	Galleries
Excellent	****	> 80%	< 20%
Good	***	> 60%	< 40%
Moderate	**	> 40%	< 60%
Poor	*	> 20%	< 80%
Very poor	—	< 20%	> 80%

It is seen from Table 4 that the clones in Experiment MVP1 are relatively higher yielders than those in the other experiments, with 13 clones yielding over 1500 lb made tea per acre per year. Clones in Experiment MVP2 are poor in their yield as none of these clones yielded 1500 lb. The clones of Experiment MVP3 are moderate yielders with three clones yielding over 1500 lb. Although clone TRI 2026 has poor manufacturing quality (Kirtisinghe *et al* 1968), drought resistance and shot-hole borer tolerance, it has yielded well. Although clone TRI 2025 has little manufacturing quality and poor borer tolerance, it is a good drought resistance clone and also yields well. Clone H 6A1 (Helbodde), the poorest clone, has still not formed into a bush even six years after planting.

The inclusion of the clones in Experiment MVP3 has made no remarkable change to the previous list of clonal characteristics. The clones TRI 2023 and DG 39 still maintain their leading positions.

These observations are applicable only to mid-country districts and the rank in the list of clonal characteristics is subject to alteration as and when fresh evidence becomes available.

SUMMARY

Twelve clones of Experiment MVP3 planted in 1963 have been assessed for their tolerance and susceptibility to shot-hole borer infestation, and their performances are compared with similar observations on 32 clones of Experiment MVP1 planted in 1961 and 16 clones of Experiment MVP2 planted in 1962. The clones of Experiment MVP3 are relatively more susceptible to borer attack. Clone Wootton 3 has excellent quality, is drought resistant, shows moderate borer tolerance and is also a promising clone in respect of yield. The list of clones is revised to include clones of Experiment MVP3. Clones TRI 2023 and DG 39 still appear to be the best clones for propagation in the mid-country wet zone.

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