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Assessment of elite cardamom lines for dry matter distribution and harvest index

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Abstract

Twelve selected clones of cardamom (*Elettaria cardamomum* Maton) were evaluated along with local check for yield, dry matter distribution and harvest index in a randomised block design with four replications in clonal nursery. Clones differed significantly among themselves for dry matter content and per cent dry matter (to total dry matter) distribution to roots, rhizome, leaves, tillers, panicles and capsules. There was a significant difference for harvest index among the clones. Maximum percentage of dry matter distribution towards economic parts (capsules) was observed in selected clones viz. Sel.9, Sel 7, Sel.12, Sel.4 and Sel.10 and minimum was observed in local check indicating their differential yielding ability and superiority of selections (lines). Clones had high harvest index compared to local check.

Key words : Cardamom, dry matter, partitioning, economic yield, biological yield, harvest index.

Introduction

Small cardamom of commerce is the dried fruit of a tall perennial herbacious plant, *Elettaria cardamomum* belonging to the family Zingiberaceae. It is indigenous to the evergreen rainforests of western ghats of South India from where it is spread to some other tropical countries such as Sri Lanka, Tanazania and a few Central American countries [4]. Presently, it is being cultivated in not less than twelve countries of three continents lying between 20° latitude north and south [4]. The genetic resources available in our vicinity are of little use until they have been evaluated and exploited for improving yields. Low productivity in cardamom is a major concern where production is stagnant since the last decade [4]. Studies on dry matter partitioning and harvest index could be useful in improving cardamom for higher yields [2]. Such studies will help the breeders to set their methodology for developing desired ideotype which would be high yielding. No scientific information is available on partitioning of biomass and harvest index of elite clones in cardamom. With this view in mining, high yielding clones identified at a farmer's plantation were assessed for dry matter distribution and harvest index.

Material and methods

Experimental was conducted at M/S Chettoli estate, Chettalli, Madikeri in Coorg District of Karnataka. With the extensive survey in cardamom plantations of Coorg, more than hundered clones were collected and assessed for yield in preliminary trial. Twelve clones were selected based on yield and quality parameters and were used in the present study (Table-1).

Twelve clones selected for high yield along with local check (Malabar local) were planted in clonal

Table-1. Salient features of cardamom clones

Clone	Panicle lenght	Capsule length	Capsule boldness	Yield
Sel.1	Medium	Long	Bold	High
Sel.2	Medium	Short	Bold	High
Sel.3	Short	Long	Very bold	High
Sel.4	Long	Medium	Very bold	Very high
Sel.5	Medium	Medium	Bold	High
Sel.6	Short	Long	Medium	High
Sel.7	Short	Short	Small	Very high
Sel.8	Medium	Short	Medium	High
Sel.9	Medium	Medium	Medium	Very high
Sel.10	Medium	Medium	Medium	High
Sel.11	Medium	Long	Bold	High
Sel.12	Long	Long	Bold	High
Local check (Malabar local)	Very long	Medium	Small	Low

Note : All the clones are Malabar type having prostrate panicles

Table-2. Distribution of dry matter (g) in differnt components of plant in selected clones

Clones	Roots	Rhizome	Panicles	Capsules	Tillers (pseudo stem)	Leaves	Total dry biomass
Sel.1	260	730	10	121.0	1850	1420	4391.0
Sel.2	440	550	20	159.5	2350	700	4219.5
Sel.3	295	550	15	13.2	2640	1150	4663.2
Sel.4	340	455	20	217.8	1190	1270	3492.8
Sel.5	205	350	10	63.8	2255	725	3608.8
Sel.6	225	555	15	149.6	2340	1100	4384.6
Sel.7	250	485	20	227.7	2520	1080	4582.7
Sel.8	275	795	5	105.6	2220	1270	4676.6
Sel.9	150	315	25	234.3	1320	535	2579.3
Sel.10	170	280	20	150.7	1940	840	3400.7
Sel.11	200	300	20	122.1	2350	810	3802.1
Sel.12	190	400	15	160.6	1240	740	2745.6
Local check (Malabar local)	130	260	10	33.0	3485	935	4853.0
G. Mean	240.76	463.46	15.76	135.3	2131.0	967.30	3953.83
SE m±	14.026	17.532	1.483	6.893	51.597	36.523	
F test	**	**	**	**	**	**	
CD at %	40.3	50.4	4.3	27.0	148.2	104.9	
CV at (%)	5.8	3.8	9.4	5.1	2.4	3.8	

** F test significant at P = 0.01

nursery in trench system of planting with the spacing 1.8 m x 0.6 m in a replicated trial of four replications with randomised block design (RBD) having 12 plants in each plot on 17th March, 1989. Observation were recorded in the second year of planting (at the end of 20th month of planting). After taking the total dry weights of capsules and panicles, plants were uprooted and observations on dry weight of tillers, leaves, rhizome and roots were recorded and total dry weight was computed in each entry (selection) of each replication on per plant basis. Per cent dry matter in roots, rhizome, panicles, capsules, tillers and leaves of the total dry matter was computed. Harvest index was computed as under :

$$\text{Harvest index} = \frac{\text{Dry weight of capsules}}{\text{Total dry weight}}$$

Replication means of each entry were subjected to statistical analysis.

Results and discussions

The economic yield is derived from the large part of the biological yield partitioned to the sink part. Biological yield can be increased by increasing the photosynthetic efficiency of the plant, improving light interception and reducing respiration [6]. In the present investigation high yielding clones were assessed for their biological yield partitioning and harvest index.

Distribution of dry matter in different components of plants

Dry matter content of roots, rhizome, panicles, capsules, tillers (pesudostem) and leaves of different clones varied significantly (Table-2.) Highest total dry matter was observed in local check (4853 g/plant) followed by Sel.8 (4677 g/plant), Sel.3 (4663 g/plant) and Sel.7 (4582.7 g/plant).

Table-3. Harvest index and percentage distribution of dry matter in different components of plant in selected clones

Clones	Roots	Rhizome	Panicles	Capsules	Tillers (pseudo stem)	Leaves	Harvest index
Sel.1	5.92	16.62	0.23	2.76	42.13	32.39	0.028
Sel.2	10.42	13.03	0.47	3.78	55.69	16.59	0.038
Sel.3	6.32	11.79	0.32	0.28	56.61	24.66	0.003
Sel.4	5.45	10.58	0.44	5.97	59.99	23.57	0.062
Sel.5	5.68	9.70	0.28	1.77	62.49	20.09	0.018
Sel.6	5.13	12.66	0.34	3.41	53.36	25.09	0.034
Sel.7	9.73	13.03	0.57	6.23	34.07	36.36	0.050
Sel.8	5.89	17.02	0.10	2.36	47.53	27.19	0.023
Sel.9	5.81	12.21	0.97	9.08	51.18	20.74	0.091
Sel.10	5.00	8.23	0.59	4.43	57.05	24.70	0.044
Sel.11	5.26	7.89	0.53	3.21	61.80	21.30	0.032
Sel.12	6.92	14.57	0.55	5.85	45.16	26.95	0.059
Local check	2.68	5.36	0.21	0.68	71.81	19.27	0.006
SE m ±	0.419	0.497	0.015	0.189	1.205	0.8199	0.00173
F test	**	**	**	**	**	**	**
CD at 5%	1.203	1.429	0.044	0.550	3.460	2.360	0.0054
CV at (%)	6.80	4.20	3.50	4.90	2.3	3.3	4.6

** F test significant at P = 0.01

In a panicle generally flowering starts from May and continues upto October. Consequently set fruit will take 30 to 40 days for its complete maturity. Capsule harvesting is done with a weekly interval and capsule weight per plant includes the capsules harvested in all the pickings. Dry weight of capsules was maximum in Sel.9 (234.3 g/plant) followed by Sel.7 (227.7 g/plant), Sel.4(217.8 g/plant), Sel.12 (160.6 g/plant) and Sel.2 (159.5 g/plant) and the lowest dry weight of capsules among clones was observed in local check (33.0 g/plant) indicating its poor yield.

Percentage distribution of dry matter in different components of plants

Percentage distribution of dry matter in roots, rhizomes, panicles, capsules, tillers, leaves varied significantly among the clones (Table-2).

Maximum percentage of dry matter distribution towards capsules among the clones was observed in Sel.9 (9.08%) followed by Sel.7 (6.23%), Sel.12(5.85%), Sel.4 (4.97%) and Sel.10 (4.43%) and minimum was observed in local check indicating their potential yielding ability [3].

Harvest index

Harvest index differed significantly at p = 0.01 among the entries (Table-3). However, maximum harvest index was observed in Sel.9 (0.091) followed by Sel.4 (0.062), Sel.12 (0.059), Sel.7 (0.50) and Sel.10 (0.044) and lowest harvest index among the entries was observed in local check (0.006). The harvest index is more realistic than yield to judge the relative performance of genotypes [5].

Vegetative growth provides food materials required for reproductive growth and hence variablility in biological yield is prerequisite for yield improvement [2]. Exploitation of biological yield to produce higher yield requires funneling of genes responsible for partitioning efficiency. Partitioning efficiency reflected in per cent dry matter distribution towards capsules in the cardamom clones viz. Sel.9, Sel.7, Sel.4 and Sel.12 and their harvest index have clearly indicated their superior yielding ability

[3]. Despite some of the clones including local check had maximum total dry matter content, their yielding ability was far less because of their poor partitioning efficiency as also evident from earlier studies in sweet potato [1]. Plant breeder needs to plan his breeding strategies to combine high total dry matter production and high partitioning efficiency.

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