Indian J. Hort. 68(2), June 2011: 229-234

Effect of different planting material, planting dates and harvesting dates on growth, yield and quality of turmeric

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ABSTRACT

A field experiment was conducted for two years (2007-2009) at Ludhiana to study the effect of different planting material, planting dates and harvesting dates on growth, yield and quality of turmeric. Use of mother rhizomes as planting material resulted in significantly higher growth parameters *viz.,* number of leaves/plant, plant height and dry matter accumulation/plant as compared to primary and secondary finger planting material during both the years. The yield attributes, *viz.*, number and weight of rhizomes and fresh, dry and processed rhizome yield were also significantly higher with mother rhizome planting material during both the years. Growth parameters, yield and yield attributes were significantly higher with April 25 planting date as compared to May 10 and May 25 in both the years. Different harvesting dates had non-significant effect on growth parameter, yield and yield attributes. The quality parameters were non-significantly influenced by different planting materials, planting dates and harvesting dates.

Key words: Growth, yield, quality, turmeric, *Curcuma longa* L., Planting date.

INTRODUCTION

Turmeric (*Curcuma longa* L.) is a herbaceous plant belongs to family Zingiberaceae, largely used as spice. It is extensively used as stimulant, blood purifier, tonic, as a carminative, remedy against the skin diseases, pain and anthelmintic (Srimal, 8). During 2007-08, Indian export of turmeric was 49,250 tonnes valued at Rs. 15,700 lakhs contributing 11 percent of total spices export (Selvan, 7). India is a major producer, consumer and exporter of turmeric; but major part is consumed with in the country and export only accounts for about 5.9 percent of total production (Selvan, 7). However, its low productivity under Punjab condition is a chronic problem. In the present study, effect of different planting materials, planting dates and harvesting dates on growth, yield and quality of turmeric were studied to select the best combination, suitable for Punjab conditions.

MATERIALS AND METHODS

The field experiments were conducted in well drained sandy loam soil with irrigation at Punjab Agricultural University, Ludhiana (30°-54' N latitude and 75°-48' E longitude with an altitude of 247 m above mean sea level). The major nutrient status of the soil was low in available N and medium in P and K with pH 7.8. The experimental layout accommodated 27 treatment combinations, comprising three planting materials [mother rhizome (25-30 g), primary (15-20 g) and secondary fingers (5-10 g)], three planting dates (April 25, May 10 and May 25) and three harvesting dates (25 January, 15 February and 5 March). The experiment was laid out in randomized block design (factorial) with three replications and size of experimental plot was 2.30 m × 7 m. A common dose of 30 t ha^{-1} farmyard manure was applied before planting. The data on growth parameters, *viz.,* number of leaves/plant, plant height and dry matter accumulation/plant were recorded at 80, 110, 140, 170, 200 days after planting (DAP) and at harvest. The yield attributes (number and weight of rhizomes) and fresh, dry and processed rhizome yield (q/ha) were recorded at harvest dates. For estimating dry rhizome yield, 2 kg fresh rhizome from each plot was taken, washed with water and then boiled in vertical autoclave at 121°C temperature, 15 lbs/$inch^2$ pressure for at least 3 h. After boiling, the rhizomes were dried in sun for 2 to 3 days and then these were dried in oven at 60°C and dry weight was recorded. Thereafter, dry rhizome yield per hectare was computed. The oven-dried rhizomes were first polished (manually) and then grounded with the help of grinder and processed/powder rhizome yield per hectare was calculated. The oil content was estimated by distillation method and curcumin content was recorded by following the procedure of Thimmaiah (10).

RESULTS AND DISCUSSION

The maximum plant height, number of leaves and dry matter accumulation per plant were recorded when mother rhizome were used as planting material and all these growth parameters decreased with each decrease in weight of the planting material from mother rhizome to secondary finger at all the stages of crop

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growth during both the years (Fig. 1). The large sized rhizomes had more stored food material, which resulted in more vigorous plants, thus, the plant produced from mother rhizome had more height, number of leaves and dry matter accumulation. Maximum plant height, number of leaves and dry matter accumulation with mother rhizome planting material were reported by Kumar (6) and Deshmukh *et al.* (2). Mother rhizome as planting material produced maximum number of mother, primary, secondary and total rhizomes per plant. The number of mother, primary, secondary and total rhizomes per plant decreased significantly with each decrease in weight of planting material during both the years (Table 1). During both the

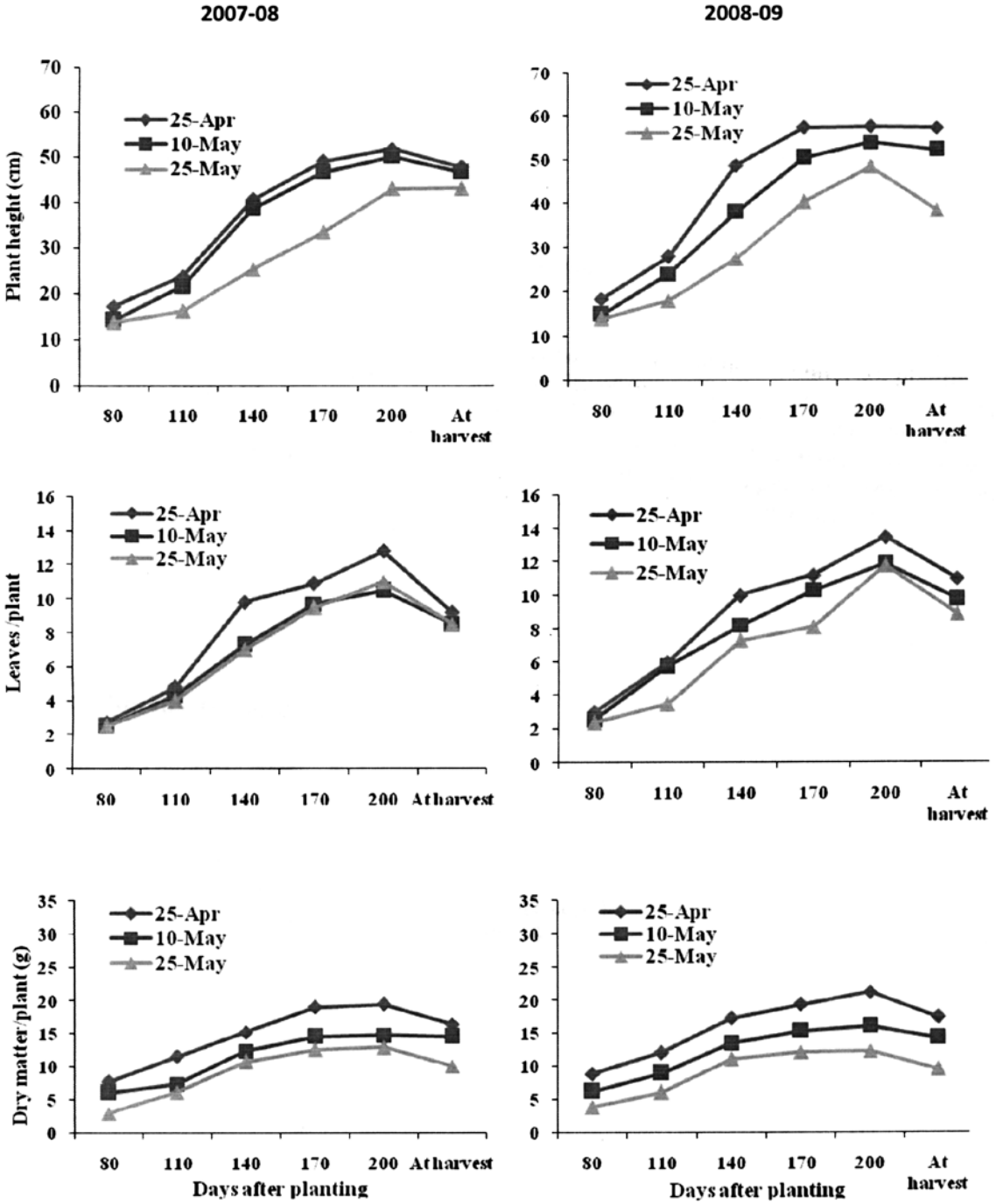

Fig. 1. Periodic plant height, number of leaves and dry matter accumulation as influenced by different planting material.

Table 1. Effect of different planting material, planting date and harvesting date on yield attributing characters of turmeric.

Treatment	No. per plant								Weight per plant (g)							
	Mother rhizome		Primary rhizome		Secondary rhizome		Total rhizome		Mother rhizome		Primary rhizome		Secondary rhizome		Total rhizome	
	2007-08	2008-09	2007-08	2008-09	2007-08	2008-09	2007-08	2008-09	2007-08	2008-09	2007-08	2008-09	2007-08	2008-09	2007-08	2008-09
Planting material																
Mother rhizome (25-30 g)	3.4	3.8	7.6	7.9	6.2	5.7	17.2	17.4	60.9	86.2	35.1	38.3	10.7	10.8	106.7	135.3
Primary finger (15-20 g)	2.2	2.9	6.1	6.2	4.0	4.0	12.3	13.1	56.5	66.8	31.3	32.5	7.8	7.9	95.6	107.2
Secondary finger (5-10 g)	1.8	2.1	5.0	5.2	3.0	3.0	9.8	10.3	26.1	30.9	25.1	25.9	5.8	5.7	57.0	62.5
$CD_{0.05}$	0.2	0.3	1.0	0.9	0.4	1.0	2.0	1.8	2.9	4.8	3.6	2.2	1.7	1.8	6.0	9.2
Planting date																
April 25	3.1	3.8	7.4	7.8	5.9	5.4	16.4	17.0	49.7	68.4	35.8	36.9	9.8	10.0	95.2	115.2
May 10	2.3	3.0	6.2	6.4	4.2	4.2	12.7	13.6	48.8	60.6	29.7	32.7	8.4	8.2	86.8	101.5
May 25	2.0	2.0	5.1	5.1	3.1	3.1	10.2	10.2	45.0	54.9	26.0	27.1	6.1	6.2	77.8	88.2
$CD_{0.05}$	0.2	0.3	1.0	0.9	0.4	1.0	2.0	1.8	2.9	4.8	3.6	2.2	1.7	1.8	6.0	9.2
Harvesting date																
January 25	2.4	2.8	6.1	6.2	4.6	3.9	13.1	12.6	47.0	58.6	28.5	31.5	7.7	7.4	83.2	97.5
February 15	2.5	3.0	6.3	6.5	4.2	4.2	13.0	13.7	48.0	61.6	31.2	32.3	8.0	8.0	87.2	101.9
March 5	2.2	3.0	6.3	6.6	4.4	4.5	13.2	14.1	48.6	63.7	31.8	32.8	8.7	9.0	89.1	105.5
$CD_{0.05}$	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

years, weight of mother, primary, secondary and total rhizomes per plant was maximum with mother rhizome as planting material and it was significantly more as compared to primary and secondary fingers as planting material. Similarly, planting of primary fingers produced significantly more rhizome weight per plant (mother, primary, secondary and total rhizomes) than the secondary finger as planting material (Table 1). More number and weight of rhizomes per plant with mother rhizome planting material might be due to more plant height with higher number of leaves, which had resulted in accumulation of more photosynthates and ultimately led to higher number and weight of rhizomes per plant. Tayde and Deshmukh (9) and Kumar (6) also reported significantly more yield attributes (number and weight of rhizomes per plant) with mother rhizome as planting material. The mother rhizome planting material produced significantly more fresh, dry and processed rhizome yield than the primary finger planting material which was also significantly better than the secondary and primary finger planting material during both the years (Table 2). It was also showed similar trend. It was revealed that use of primary and secondary fingers as planting material resulted in 23.1 and 47.5 per cent reduction in fresh rhizome yield, respectively as compared to mother rhizome as planting material. Increased rhizome yield with mother rhizome planting material might be due to better crop growth, which had resulted in higher number and weight of rhizomes per plant, which ultimately contributes to higher yield. Maximum yield with mother rhizomes planting material was also reported by Hossain *et al.* (3), and Deshmukh *et al.* (2). The oil and curcumin content decreased with each decrease in weight of planting materials during both the years, although the differences were non-significant (data not shown).

The plant height, number of leaves and dry matter accumulation per plant were maximum with April 25 planting date and decreased with each delay in planting dates from April 25 to May 25 at all the stages of crop growth during both the years (Fig. 2). Similar results were also obtained by Bandopadhyay (1) and Kandiannam and Chandaragir (5). April 25 planting date produced maximum number and weight of mother, primary, secondary and total rhizomes per plant during both the years which decreased significantly with delay in planting (Table 1). The maximum number and weight of rhizomes per plant with April 25 planting date might be due to longer period of crop growth, which resulted in better growth, development and yield. The maximum fresh, dry and processed rhizome yield was produced with April 25 planting dates during both the years, which reduced significantly with delay in planting. Similar trend was

Table 2. Effect of different planting material, planting dates and harvesting dates on yield of turmeric.

Treatment	Fresh yield (q/ha)			Dry yield (q/ha)			Processed yield (q/ha)		
	2007-08	2008-09	Pooled	2007-08	2008-09	Pooled	2007-08	2008-09	Pooled
Planting material									
Mother rhizome (25-30 g)	174.3	204.0	189.2	37.6	46.9	42.3	34.2	44.5	39.3
Primary finger (15-20 g)	136.4	154.7	145.6	27.0	31.7	29.4	25.6	29.4	27.5
Secondary finger (5-10 g)	100.1	98.6	99.4	20.9	20.7	20.8	18.9	19.3	19.1
$CD_{0.05}$	18.8	16.3	16.2	6.2	4.3	7.3	5.6	3.9	4.2
Planting date									
April 25	168.3	174.0	171.2	37.5	38.3	37.9	35.2	36.0	35.5
May 10	135.4	153.2	144.3	28.7	33.7	31.2	25.4	31.6	28.4
May 25	107.2	130.1	118.6	19.3	27.3	23.3	18.1	25.6	21.8
$CD_{0.05}$	18.8	16.3	16.3	6.2	4.3	7.3	5.6	3.9	4.2
Harvesting date									
January 25	129.0	143.0	136.0	26.1	32.0	29.1	23.8	29.9	26.8
February 15	137.2	153.2	145.2	29.3	32.9	31.1	27.2	31.0	29.1
March 5	144.7	161.1	152.9	30.0	34.4	32.2	27.7	32.3	30.0
$CD_{0.05}$	NS	NS	NS	NS	NS	NS	NS	NS	NS

observed with pooled data. Planting date of May 10 and May 25 resulted in 15.7 and 30.7 per cent reduction in fresh rhizome yield as per pooled data. April planting result maximum yield and yield attributes was also reported by Ishimine *et al.* (4). The oil and curcumin content tended to decrease with delay in planting from April 25 to May 25, through the differences were not significant (data not shown).

Different harvesting dates did not influence significantly the number and weight of rhizomes per

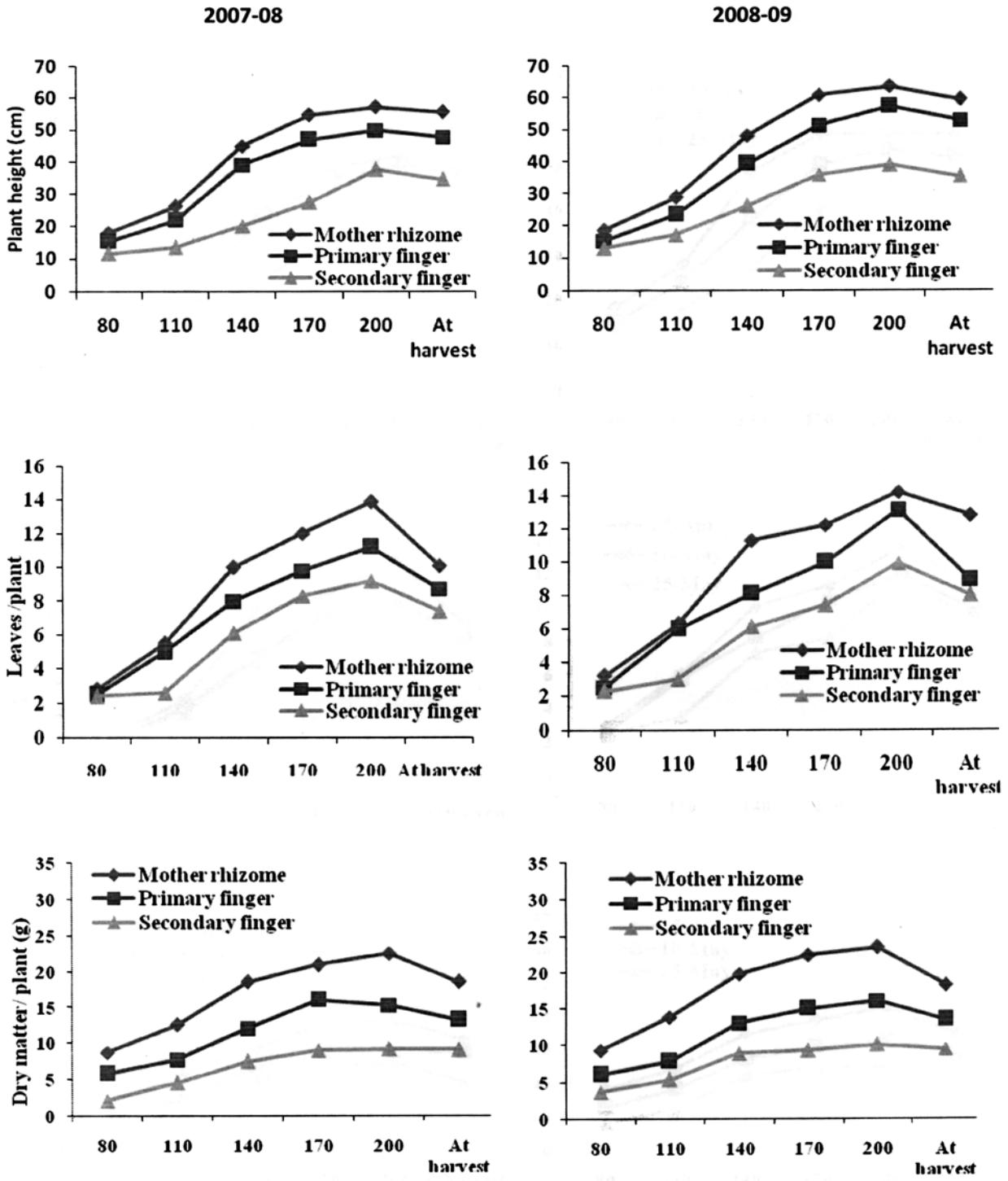

Fig. 2. Periodic plant height, number of leaves and dry matter accumulation as influenced by different planting dates.

plant during both the years (Table 1). The maximum yield was obtained with March 5 harvesting date and decreased with each early harvesting dates, though the differences were non-significant (Table 2). The delay in harvesting of turmeric tended to improve the oil and curcumin content during both the years, though the differences were non-significant (data not shown).

The study indicated that mother rhizome planting material produced more growth parameters, yield and yield attributes. All growth parameters, yield and yield attributes decreased with delay in planting from April 25 to May 25. The yield and yield attributes were non significantly influenced by harvesting dates. Hence, for Punjab conditions, the planting of turmeric on April 25, using mother rhizomes (25-30 g) as planting material and harvesting by the end of January is recommended.

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Received: December 2009; Revised: October, 2010; Accepted : December, 2010