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PERFORMANCE OF DIFFERENT TURMERIC CULTIVARS IN DERA ISMAIL KHAN

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Three experiments were conducted at three different localities of Dera Ismail Khan, to evaluate the performance of turmeric cultivars including Duggirala, Zedory and Krishna at Dera Ismail Khan in 2008-09. The data were taken on days to sprout, plant height (cm), number of leaves plant^{-1}, number of tillers plant^{-1}, leaf length (cm), leaf width (cm), number of fingers plant^{-1}, finger length (cm), finger width (cm), finger weight plant^{-1} (g) and finger weight per plot^{-1} (g). The results showed the supremacy of Krishna over the other two cultivars in all the three localities, as Krishna took significantly least number of days (44.67, 46.00 and 48.33) to sprouting, maximum plant height (78.54, 73.64 and 75.43 cm), leaves per plant (13.74, 12.97 and 13.73), leaf width (8.733, 7.30 and 7.80 cm), maximum finger per plant (31.43, 54.44 & 37.00) in all the three localities. On the basis of good performance Krishna is recommended as a promising turmeric cultivar for general cultivation in Dera Ismail Khan.

Keywords: Turmeric, cultivars, finger, yield, rhizome

INTRODUCTION

Turmeric (*Curcuma longa* L.) belongs to the Family *Zingiberaceae*. Turmeric is valued for its underground orange coloured rhizome which is used as natural colouring agent for food, cosmetics and dye. It is an ancient spice and a traditional remedy that has been used as a medicine, condiment and flavoring Curcuminoids the active principles in turmeric rhizomes is known to have some medicinal properties and has been used efficiently in the treatment of circulatory problems, liver diseases, dermatological disorders (Osawa *et al.,* 1995; Senwal *et al.,* 1997). Apart from the rhizome's richness in curcuminoid pigments (6%) and essential oils (5%). It also contains 69.43% carbohydrate, 6.30% protein and 3.50% mineral on dry weight basis (Olojeda *et al.,* 2005). India is the major producer and exporter of turmeric with average annual production (during 1989-94) of 349,000 tons (Nazeem, 1995). No production statistics are available from other producers which are Bangladesh, China, and Thailand, except Pakistan which produced 3,100 tons in 1995 (Source: Pakistan Agricultural Information Center).

It can be grown under diverse tropical conditions at altitude ranging from sea level to 1500 m above the sea level. It requires a well drained sandy or clay loam soil and temperature ranging between 20-30^{0}C with annual rainfall of 1500 mm or more. Chandra *et al.* (1999) reported that PCT13, PCT11, GL Puram and PCT15 showed no significant differences and had higher yield, indicating their suitability for cultivation, under mid hill conditions of Meghalaya. Jana and Bhattacharya (2001) found tallest plants in PTS-19 (160.13 cm), maximum rhizome length and width were recorded for Sugandham (21.16 cm) and PCT-14 (13.92 cm), respectively. PTS 38 and Duggirala as long duration, CLI 317 as medium duration and PCT 13 as short duration turmeric cultivars, gave more cured yield (Rao *et al.*, 2004). Chaudhary *et al.* (2006) reported that the variety Krishna recorded the highest fresh (405.60 q/ha) and cured rhizome (65.80 q/ha) yield followed by Rajendra Sonia and Suvarna. Krishna also produced more rhizomes (11.48), maximum length (10.20 cm) and girth (2.45 cm) followed by Rajendra Sonia. Hrideek *et al.* (2006) reported that variety IISR Prabha showed superiority for yield and yield contributing traits followed by IISR Kedaram. Nayak *et al.* (2006) reported that the rhizome yield per plant varied significantly from 77.66 to 350 g among 17 cultivars. Detpiratmongkol *et al.* (2009) reported that Phisanulok cultivar had more plant height, number of leaves, stem and leaf dry weight than Surat-Thani cultivar. Olojede *et al.* (2009) stated that 2 cultivars of turmeric (vars. NCL1 and NCL2) were only significant on rhizome number but not rhizome yield and other yield parameters in the two years. Though wide genetic variability exists in this crop with regard to the yield and yield attributes, however, not much work has been done on crop improvement through the selection of superior types with high yield in Pakistan.

Hence, the present study was carried out to evaluate the performance of different cultivars for the better yield production of turmeric under Dera Ismail Khan conditions.

MATERIALS AND METHODS

The experiments were conducted to screen out different turmeric cultivars and adaptation of cultural practices for better yield in Dera Ismail Khan (geographical coordinates are 31.83^{O} latitude and d 70.90^{O} longitude). For this purpose, following three different localities of Dera Ismail Khan were selected and all turmeric cultivars were tested.

Location #	Different experimental Localities	Types of Soils
01	Department of Horticulture research area, at new campus, Gomal University, D.I.Khan	Clay
02	Farmer's field near Daraban road, Dera Ismail Khan	Clayey loamy
03	Horticultural section, Agricultural Research Institute, Ratta Kulachi Dera Ismail Khan	Sandy Loam

The trials were laid out in randomized complete block design (RCBD) with three replications using three cultivars of turmeric viz. Duggirala, Zedory and Krishna. The net plot size was 6 x 3 m and rhizomes were planted in second week of March with ridge and furrow method with a spacing of 60 x 30 cm. After the sowing, they were irrigated soon after, and the irrigation was applied after every 6-7 days and fortnightly in summer and winter, respectfully. Fertilizer was applied @ 60-50-120 NPK kg ha^{-1}. All phosphorus and potash were applied one month after sowing. Nitrogen was applied in two equal split doses, i.e. first dose was applied after 45 days of sowing and the second dose was applied 90 days after sowing. Sources of nitrogen, phosphorus and potash were Urea**,** Triple super phosphate (TSP) and sulphate of potash (SOP), respectively. All the cultural and agronomic practices were carried out regularly for all the three locations. Harvesting was done after 10 months, i.e. second week of January. The land was ploughed and the rhizomes were gathered by hand and then they were cleaned of mud and other extraneous matter adhered. The data were taken on days to sprouting (days were counted from sowing to sprouting), plant height in cm (plant height was measured from the soil surface to the tip of flag leaf with the help of measuring tape), number of leaves $plant^{-1}$ (number of leaves per plant was counted), number of tillers $plant^{-1}$, leaf length in cm (leaf length was measured with the help of the measuring tape, before they started to fall down), leaf width in cm (leaf width was measured in cm with measuring tape), number of fingers $plant^{-1}$ (numbers of fingers per plant was counted and the average was calculated.), finger length in cm (finger length was measured in cm with the help of venire caliper, after the harvesting and average was calculated), finger width in cm (finger width was measured in cm with the help of venire calipers and average was computed.), finger weight $plant^{-1}$ in gm (finger weight $plant^{-1}$ was taken using the electric balance and average was computed) and finger weight $plot^{-1}$ gm (total finger weight $plot^{-1}$ was weighed by using electric balance in g). The mean data collected on various parameters were analyzed statistically (Steel *et al.,* 1997). Subsequently, the significant means were separated by the least significant difference test by using the MSTATC.

RESULTS AND DISCUSSION

Location 1. Department of Horticulture research area: The results shown in Table 1 clearly revealed the performance of three turmeric cultivars for various parameters at location 1 (Department of Horticulture, Faculty of Agriculture, Gomal University, Dera Ismail Khan).

The results revealed that all turmeric cultivars depicted significant differences for all the parameters studied, except for number of stems $hill^{-1}$. Least days to sprouting (44.67) were taken by Krishna, followed by Zedory and Duggirala with 48.00 and 49.33 days, respectively. Significantly maximum plant height (78.54 cm) and leaves $plant^{-1}$ (13.47) were recorded in Krishna, followed by Zedory with 68.34 cm long plants and 11.67 leaves $plant^{-1}$. The least response was recorded in Duggirala with 62.86 cm long plants and 10.50 leaves $plant^{-1}$. Similar results were quoted by Detpiratmongkol *et al.* (2009) who also reported significant variations in plant height and number of leaves in different turmeric cultivars as, Phisanulok had more plant height and number of leaves than Surat-Thani. Maximum leaf length (49.72 cm) was recorded in Zedory, followed by Krishna with 42.72 cm long leaf and both these cultivars showed a non-significant behaviour for each other. The least response was recorded in Duggirala with 32.92 cm leaves. Similar results were found in Krishna and Zedory as maximum leaf width (8.73 and 7.03 cm) was recorded for them, respectively. Whereas, Duggirala produced 6.13 cm wide leaves. The results regarding the yield and yield components clearly showed the supremacy of Krishna over the other two cultivars. Significantly highest number of fingers $plant^{-1}$ (31.43), finger length (7.11 cm) and finger width (2.75 cm) was recorded in Krishna followed by Zedory and Duggirala with 16.50 and 15.73 fingers $plant^{-1}$, 5.19 and 5.54 cm long fingers and 2.07 and 2.00 cm wide fingers, respectively and both Zedory and Duggirala produced similar results for all these three parameters. Our results get support from the previous findings of Chaudhary *et al.* (2006) who also reported that Krishna produced more rhizomes, maximum length and width of rhizomes as compared to other cultivars. Statistically similar results were found for finger weight

Table 1. Morphological characteristics of turmeric cultivars on Location I (Department of Horticulture, Faculty of Agriculture, Gomal University, Dera Ismail Khan)

Varieties	Days to sprouting	Plant Height (cm)	Leaves plant^{-1}	tillers plant^{-1}	Leaf length (cm)	Leaf Width (cm)	Finger plant^{-1}	Finger length (cm)	Finger width (cm)	Finger Weight plant^{-1} (g)	Finger weight Plot^{-1}(g)
Duggirala	49.33 a	62.86 b	10.50 b	3.17 a	32.92 b	6.133 b	15.73 b	5.540 b	2.00 b	100.3 a	3051 a
Zedory	48.00 a	68.34 ab	11.67 ab	4.00 a	49.72 a	7.033 ab	16.50 b	5.190 b	2.07 b	71.67 b	1611 b
Krishna	44.67 b	78.54 a	13.74 a	3.67 a	42.72 ab	8.733 a	31.43 a	7.113 a	2.75 a	112.0 a	3300 a
$LSD_{0.05}$	1.85	14.98	2.62	2.20	16.11	2.031	14.30	0.7484	0.5219	20.93	624.9

Table 2. Morphological characteristics of turmeric cultivars on Location II (farmer field, near Daraban Road, Dera Ismail Khan)

Varieties	Days to sprouting	Plant Height (cm)	Leaves plant^{-1}	tillers plant^{-1}	Leaf length (cm)	Leaf Width (cm)	Finger plant^{-1}	Finger length (cm)	Finger width (cm)	Finger Weight plant^{-1} (g)	Finger weight Plot^{-1}(g)
Duggirala	50.67 a	63.61 b	7.87 b	2.83 a	31.33 b	5.40 b	32.20 ab	4.90 a	2.00 ab	43.00 a	2520 a
Zedory	48.67 a	63.52 b	6.93 b	3.07 a	48.89 a	6.13 b	20.13 b	4.21 a	0.80 b	32.04 b	1957 b
Krishna	46.00 a	73.64 a	12.97 a	3.44 a	44.87 ab	7.30 a	54.44 a	5.03 a	2.77 a	47.00 a	2567 a
$LSD_{0.05}$	5.45	8.45	1.34	0.875	15.13	0.99	24.04	1.23	0.962	10.34	275

Table 3. Morphological characteristics of turmeric cultivars on Location III (Horticulture Section, Agriculture Research Institute, Ratta Kulachi, Dera Ismail Khan)

Varieties	Days to sprouting	Plant Height (cm)	Leaves plant^{-1}	tillers plant^{-1}	Leaf length (cm)	Leaf Width (cm)	Fingerplant^{1}	Finger length (cm)	Finger width (cm)	Finger Weight plant^{-1} (g)	Finger weight Plot^{-1}(g)
Duggirala	51.23 a	60.38 b	10.33 b	3.05 a	33.50 b	5.93 b	20.67 b	4.43 a	2.13 b	98.67 a	2368 a
Zedory	50.22 a	62.70 b	11.00 b	3.40 a	49.14 a	6.50 b	26.33 b	4.76 a	2.66 a	78.3 b	1880 b
Krishna	48.33 a	75.43 a	13.73 a	2.95 a	43.60 ab	7.80 a	37.00 a	4.76 a	2.78 a	107.3 a	2576 a
$LSD_{0.05}$	3.00	7.83	2.50	0.80	14.11	1.20	7.40	0.77	0.39	10.17	336

plant^{-1} (g) and plot^{-1} (g) in Krishna and Duggirala. As Krishna produced finger weight of 112 g plant^{-1} and 3300 g plot^{-1}, closely followed by finger weight of 100.3 g plant^{-1} and 3051 g plot^{-1}. The least response was obtained by Zedory for finger weight of 71.67 plant^{-1} and 1611 g plot^{-1}.

Location II. Farmer field: The results given in Table 2 clearly revealed the performance of three turmeric cultivars for various parameters. A non significant result was recorded for days to sprouting, number of tillers plant^{-1} and finger length (cm) for all the three turmeric cultivars. Maximum plant height (73.64 cm) and leaves plant^{-1} (12.97) were recorded for Krishna, followed by Duggirala and Zedory with 63.61 and 63.52 cm long plants and 7.87 and 6.93 leaves plant^{-1}, respectively and both these cultivars were statistically at par. Maximum leaf length (48.89 cm) was found in Zedory, followed by Krishna (44.87 cm) and both cultivars showed non-significant differences. The least response (31.33 cm) was recorded in Duggirala for leaf size. Maximum leaf width (7.30 cm) was recorded in Krishna followed by Zedory (6.13 cm) and Duggirala (5.40 cm) and both these cultivars showed statistically alike results. As far as the results regarding the finger production are concerned, here once again Krishna proved its superiority over Duggirala and Zedory. A similar trend was recorded for number of fingers plant^{-1} and finger width, as Krishna produced maximum fingers plant^{-1} (54.44) and finger width (2.77 cm), followed by Duggirala and Zedory with 32.20 and 20.13 fingers plant^{-1} and 2.00 and 1.80 cm wide fingers, accordingly. Similar results were quoted by Jana and Bhattacharya (2001) who also reported variations amongst turmeric cultivars for rhizome (finger) width. Statistically similar results were found for finger weight plant^{-1} and for Plot^{-1} for Krishna and Duggirala, as they produced finger weight of 47.00 and 43.00 g plant^{-1} and 2567 and 2520 g Plot^{-1}, respectively. Our results get support from the previous findings of Chandra *et al.* (1999) who also reported that PCT13, PCT11, GL Puram and PCT 15 showed no significant differences for higher yields in turmeric.

Location III. Horticulture Section, Agriculture Research Institute: Data regarding the performance of three turmeric cultivars for different parameters, at Location III (Horticulture section, Agriculture Research Institute, Ratta Kulachi, Dera Ismail Khan) is given in Table 3. It revealed that a non-significant behavior was evident amongst all the three turmeric cultivars for days to sprouting, number of tillers per plant and finger length (cm). Similarly, Hrideek *et al.* (2006) reported that all turmeric cultivars differed significantly with respect to growth characters except for the number of tillers per plant. The results showed that Krishna produced maximum plant height (75.43 cm) and leaves (13.73) plant^{-1}, followed by Zedory and Duggirala with 62.70 and 60.38 cm long plants and 11.00 and 10.33 leaves plant^{-1}, respectively and both cultivars behaved non-significantly with each other. Maximum leaf length (49.14 cm) was recorded in Zedory followed by Krishna (43.60 cm) and Duggirala (33.50 cm). Similar results were found for leaf width and number of fingers plant^{-1}, as Krishna recorded maximum leaf width (7.80 cm) and fingers (37.00) plant $^{-1}$. It was followed Zedory (6.50 cm) and Duggirala (5.93 cm) for leaf width and 26.33 and 20.67 fingers plant^{-1} respectively and were statistically at par. For finger weight plant^{-1} (g) and Plot^{-1} (g), both Krishna and Duggirala behaved statistically the same results as, maximum fruit weight (107.3 g) plant^{-1}and (2576 g) Plot^{-1} were recorded in Krishna, whereas Duggirala produced finger weight of 98.67 g plant^{-1} and 2368 g Plot^{-1}. The least response for both the parameters was found in Zedory with finger weight of 78.3 g plant^{-1} and 1880 g Plot^{-1}, respectively. Similarly, Nayak *et al.* (2006) also recorded variations in yield for different turmeric cultivars. Our results also get support from the previous findings of Rao *et al.* (2004) who also recommended Duggirala as a long duration high yield cultivars.

CONCLUSION

This study concluded that turmeric cv. Krishna showed better yield as compared to the other two cultivars in different soil characteristics in three different locations in Dera Ismail Khan.

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