

COMPARATIVE YIELD POTENTIAL OF THREE STRAINS OF *CURCUMA DOMESTICA* HARVESTED AT ONE AND TWO YEARS AT PESHAWAR

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Abstract. *Cultivation trials were conducted on three strains of Curcuma domestica to judge their comparative yield potential under Peshawar climatic conditions. Results revealed that two years rotated crop would give more yield and net income to the farmer as compared to cumulative yield and net income obtained from crops harvested every year. Haripur and Changa-Manga strains are equally high yielding and appear to be suitable for cultivation in Peshawar area.*

Introduction. Turmeric (*Curcuma domestica*) is being cultivated as a valuable cash crop on about 1,638 ha (2) in different localities of Pakistan, e.g., Haripur, Bannu and Changa-Manga. In 1947, turmeric worth about twenty million rupees was imported annually from India (7). However, during the last twenty years, Pakistan became not only self-sufficient in the production of turmeric but is at present exporting some quantity to different countries of the world. There are three different strains of turmeric which are being cultivated in various parts of Pakistan. In order to determine the comparative yield potential of these strains (Haripur, Bannu and Changa-Manga), experiments were laid out at Peshawar during 1978.

Review of literature. Rehman and Faruque (7) reported the result of a study on the effect of number of eyes on the rhizome, spacing and depth of planting on the yield of turmeric in Mymensing. They concluded that higher yield was obtained from rhizome pieces having 2 or 3 buds and a planting distance of 15 cm, while depth of planting had slight effect on yield. Randhawa *et al* (8) obtained higher yield by planting rhizome sets in early April and upto 10th May, spaced at 22 x 22 cm. Said (11) described technique of cultivation, curing and processing of turmeric in Peshawar Region. Khan (5) reported the effect of time of sowing, irrigation, spacing, fertilizer application on the yield of turmeric in Punjab.

According to Narasimham (6) turmeric cultivated in the hills is of better quality than that raised in plains. The same variety when grown in the plains and on the hills showed distinct differences in quality and yield. Rao (9) recommended ploughing and turning over of soil to a depth of 30 cm and liberal manuring with farm yard manure.

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In Ceylon, planting at 15 x 15 cm, yielded significantly more rhizomes than at 30 x 30 cm or more (4). Also, the plants thrived best in partially shaded areas, but shade adversely affected the yield. Ambekar *et al* (1) described that yield was very variable ranging from 13.43 - 24.7 tonnes of green or raw turmeric per ha, even upto 28 tonnes/ha. Chaudhry (3) reported that one year old crop generally yielded 5.4 tonnes of rhizomes per ha while two years old crop gave a yield of about 9.1 tonnes/ha.

Material and Method. Three strains of turmeric were procured from Haripur, Bannu and Changa-Manga to determine the yield of rhizomes of various strains after one year and two years growth. The experiment was laid out in a factorial design with five replications. The plot size was 34 m². Experimental plots were thoroughly prepared and farm yard manure was applied at the rate of 15 tonnes/ha. 35 kg N and 56 kg P₂O₅ per ha were applied as a basal dose by thoroughly mixing in the soil at the time of planting. 480 rhizome pieces (measuring 4-5 cm with one to two buds in each), weighing 4 kg, were planted on 29th April, 1978 in rows at a spacing of 25 x 20 cm. Irrigation (10 cm) was provided immediately after planting the rhizomes and 18 subsequent irrigations (8 cm each) were provided after an interval of seven days in summer months and ten to fourteen days during monsoon and winter months, upto the third week of November, 1978. 4 hoeings and weedings were given to the crop during May, July, August and September, 1978. Vegetative portion of most of the plants dried up due to heavy frost on the night of 27th and 28th November, 1978 (min. temp. 0.6°C). Rhizomes were dug out from 15 plots after one year growth during the third week of January, 1979. These were cleaned from dirt and soil, and yield of rhizomes in kg per plot was recorded.

The remaining 15 plots were kept as such to record the yield of rhizomes after two years of growth. During April, 1979 the 15 harvested plots were thoroughly prepared and planted with rhizomes keeping the application of farm yard manure and fertilizers same as in the previous year. Only fertilizer (35 kg N and 56 kg P₂O₅/ha) was applied to the two years rotated crop before sprouting in April, 1979 and second dose of urea (46% N), @ 112 kg/ha was applied in September, 1979.

Rhizomes were finally dug out during 1st week of January, 1980 from all the 30 experimental plots (15 plots of one year rotated crop and 15 plots of two year rotated crop). Yield of fresh rhizomes in kg per plot was recorded after removing the soil and roots. For statistical analysis, yield of rhizomes obtained separately in two years was grouped in order to compare it with two-year growth yield.

Results and discussion. Comparative mean yield in kg/plot of three strains of *Curcuma domestica* recorded after one and two-year rotation is given below:

Strain	Mean yield (kg) per plot of 34 m ²		
	One-year* rotation	Two-year rotation	Strain means
Bannu	30.9	65.5	48.2
Changa-Manga	38.4	65.6	52.2
Haripur	43.3	78.2	60.7
Mean	37.5	69.8	
LSD for strain mean yield (5%)	9.02		
ISD for period mean yield (1%)	10.3		

*Data for two-year combined

Haripur strain proved best as compared to Bannu but was mutually non-significant with Changa-Manga. Two years rotation gave significantly higher yield of rhizome (69.8 kg/plot) as compared to cumulative yield of rhizomes of two individual year growth (37.5 kg/plot). Generally the farmers however, prefer to grow Changa-Manga strain due to its thick fingers of rhizomes.

Roots and rhizomes were separated. Their mean yield, as recorded from different strains per plot (34 m²), and their proportions, are as follows:

Strain	Fresh weight of rhizomes (kg)	Fresh weight of roots in (kg)	Rhizome (%)	Root (%)
Bannu†	30.9	5.6	84.7	15.2
Bannu*	65.4	7.4	89.8	10.2
Changa-Manga†	38.4	7.6	83.4	16.5
Changa-Manga	65.6	4.5	93.6	6.4
Haripur*	43.3	7.9	84.6	15.4
Haripu†	78.2	5.9	93.0	7.0

*Yeld recorded after two year rotation (1978-79)

†Cumulative yield of two individual years (1978 & 79)

Results indicated that the weight of fresh roots was less in the rhizome harvested after two years growth as compared to the cumulative fresh weight of roots harvested in two individual years (1978 & 1979). The percentage of roots varied from 7 to 16% of the total weight of the yield while that of rhizomes ranged from 84-93 percent.

For curing of the rhizomes, five samples of 3 kg each were taken at

random from all the varieties under trial. Each sample was boiled in water for 2 hours and when the rhizomes became soft they were taken out and dried in the sun for a period of seven days. Ratio of yield of fresh and cured rhizomes was determined as under:

Strain	Fresh weight of rhizome in kg	Weight of cured rhizomes in kg	%
Bannu	3	0.6	19.6
Haripur	3	0.7	22.6
Changa-Manga	3	0.5	18.0

The above results indicate that the outturn of the processed product ranges from 18-22% of the fresh material.

Cost of cultivation of growing turmeric and the expenditure incurred under different major heads were calculated. Expenditure involved on planting rhizome during the year, 1978 and 1979 were worked out separately and summed up to compare with the expenditure incurred on two years old crop (1978-79) as below:

	Cost of cultivation for the years, 1978 & 1979		Cost of cultivation of 2 years rotated crop (1978-79)	
Cost of 1100 kg seed @ Rs. 8/- per kg in 1978 and @ Rs. 5.40/kg in 79.	Rs.	14840.00	Rs.	8800.00
Land rent @ Rs. 3000/ha per annum.	Rs.	6000.00	Rs.	6000.00
Supplies and material i.e., manure and fertilizer etc.	Rs.	2088.00	Rs.	2088.00
Expenditure on labour for agriculture operations @ Rs. 10/labour in the year, 78 and Rs. 12/labour in 1979.	Rs.	3680.00	Rs.	3000.00
Total:	Rs.	26608.00	Rs.	19888.00

Yield of fresh rhizome of various strains were calculated on one hectare basis to determine the economics of growing turmeric strains for a period one and two years as under:

Cost and return for annual and biennial crops per hectare

Source and crop	1978				1979			
	Yield (kg)	Value (Rs.)	Cost (Rs.)	Net value (Rs.)	Yield (kg)	Value (Rs.)	Cost (Rs.)	Net pre- sent value as of 1978 for both years as of 1978
Bannu†	4132	16528	14344	1184	4956	19828	12564	7264
Bannu *	—	—	14344	-14344	19249	76996	5544	6392
Changa-Manga†	5168	20672	14344	6328	6118	24472	12559	62877
Changa-Manga *	—	—	14344	-14344	19297	77188	5544	10479
Haripur†	7523	30095	14344	15751	7523	30095	12564	63046
Haripur *	—	—	14344	-14344	22999	91996	5544	15427
								76077
								61723

1. Considering the rate of raw turmeric as Rs. 4/- per kg (average rate for the last three years) compounded value @ 13.75% interest.

† Annual crop.

* Biennial crop.

The data indicate that growing turmeric as a biennial crops is far more profitable than gowing it as an annual crop.

Conclusion. 1. The biennial crop of turmeric gives more yield and net income to the farmers.

2. Changa-Manga and Haripur strains of *Curcuma domestica* are equally high yielding, and appear to be suitable for cultivation under Peshawar climatic condition.

Acknowledgement. The authors are indebted to the PL-480 authorities for financing this project and to their senior colleagues working in the Pakistan Forest Institute for guidance and inspiration. We are grateful to Raja Walayat Hussain and Mr. Hassan Abbas and Dr. Sultan Maqsood Khan for help in statistical analysis.

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