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# CULTIVATION, HARVESTING AND QUANTITATIVE ANALYSIS IN *CURCUMA LONGA*

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## ABSTRACT

The present investigation has been carried out to investigate the yield and quantitative analysis of Curcumin and Curcuminoids by HPTLC using methanolic extract in seventeen variety of *Curcuma longa* collected from different locality and research center. After harvesting it was observed that CL-69 yields maximum and CL-320 yields minimum of the total variety of *Curcuma longa*. Largest yield of CL-69 in the field was 2025 gm and lowest yield of CL-320 in the field was 43 gm. Least amount of Curcumin was present in CL-67 (0.26 by weight w/w). Least amount of Curcuminoids was present in CL-67(0.44 by weight w/w). Highest amount of Curcumin and Curcuminoids was present in NDH-14 (1.96 & 3.59 by weight w/w respectively).

**KEYWORDS:** *Curcuma longa*, Curcumin, Curcuminoids, HPTLC.

## INTRODUCTION

A number of economically useful plants serve as source of industrial oils, resins, tannins, saponins, natural rubber, gums, waxes, dyes, pharmaceuticals, pesticides and many specialty products.[1-3] Generally plant chemicals are often classified as either primary or secondary metabolites. Primary metabolites are the substances that are directly involved in normal growth, development, reproduction and in intrinsic function. In higher plants such compounds are often concentrated in seeds and vegetative storage organs and are needed for physiological development because of their role in basic cell metabolism. As a general rule, primary metabolites are obtained from higher plants for commercial use. Secondary metabolites are biosynthetically compounds that are derived from primary metabolites. These are restricted to a particular taxonomic group. Secondary metabolites are frequently accumulated by plants in smaller quantities than primary metabolites. Turmeric is cultivated in many Asian countries but India is the most important producer by far i.e. ca. 850 000 tons; 78% of the global market.[4] Turmeric powder and extracts are used in the western part of the world for arthritis treatment and wound healing. Curcumin is a secondary metabolite obtained from turmeric and it has been known in Ayurvedic medicine since long. Curcumin is used in inflammation, cancer and pathogenic invasions.[5] Curcumin was first isolated two centuries ago by Vogel in 1842. Curcumin has been shown to have protective effects in cancers of the blood, skin, mouth, lung, pancreas and intestinal tract. Curcumin is not only a popular spice, constituent of curry powder, but is also used as an ecological dye.[4] Curcumin prevents proliferation by interrupting the cell cycle and inducing apoptosis. Curcumin has been reported to inhibit the multiplication of HIV. Several studies has shown that Curcumin, a major Curcuminoid, acts as a potent anti-inflammatory[6], anti-diabetic[7], anti oxidant[8], anti-bacterial[9] and anticarcinogenic agent.[10-12] Curcuminoids are yellow-orange pigments of turmeric rhizomes. These natural phenol are distinctive genetic and chemotaxonomical trait. These have anti-oxidant and anti inflammatory action and are used in the treatment of skin tumors. Due to beneficial effects of Curcuminoids for human health, several analytical methods have been continuously proposed and developed by scientist to analyze Curcuminoids in plant sources, food, and in pharmaceutical products. Curcuminoids in food and pharmaceutical products is very important for quality control aspects. Curcuminoids are also important for ensuring the efficacy and effectiveness as active compounds in several pharmaceutical dosage forms and functional food preparations.[13] Most spices, condiments, teas, and other beverages such as coffee and cocoa owe their individual properties (flavours and aromas) to the pharmacologically active secondary plant metabolites that they contain. *Curcuma longa* (Turmeric) is a perennial herb of family Zingiberaceae. The most active constituent of turmeric is Curcumin. This orange yellow crystalline powder makes 2-5% of this spice. In Pakistan and India turmeric powder of *Curcuma longa*, is widely used as a culinary additive for imparting a distinctive yellow-orange color. In the present investigation 17 varieties of *Curcuma longa* has been studied for cultivation, harvesting, comparison of yield and quantitative analysis.

## MATERIAL AND METHOD

### Preparation of soil

Different varieties of *Curcuma longa* were procured from local Horticultural Research Station and Training Centre and also from Kirshi Vigyan Kendra. Good quality of rhizomes were selected in the month of March. Plots of 10x10 m were prepared at Botanical garden M. S. College Saharanpur for field cultivation. 3 quintal of farmyard manure was added along with 2 kg Nitrogen, 4 kg Phosphorous and 4 kg of Potash in the form of Urea, Superphosphate and muriate of Potash respectively. All the Haldi varieties were also cultivated in 18 inch (45 centimeters) diameter earthen pots. Ridges were made at distance of 8-10 cm. About 10gm sample was taken of each variety. Rhizomes were sown in the month of April. Plant emerges after few days. Watering was done at the interval of 10 days during summer. Germination of all the varieties was very good. No pre treatment for any pesticide was done.[14]

### Harvesting and Observation

Harvesting was done in the month of November and rhizomes of each variety were weighted and yield of each variety is given table-1

**Table.1**

| Name of Variety | Harvested in gm |
|---|---|
| 1. VAYMA | 1425 gm |
| 2. NDH – 18 | 1060 gm |
| 3. CL – 73 | 958 gm |
| 4. CEL – 324 | 1101 gm |
| 5. CEL – 321 | 550 gm |
| 6. SWARNA | 650 gm |
| 7. CL – 320 | 43 gm |
| 8. CEL – 318 | 1713 gm |
| 9. CL – 69 | 2025 gm |
| 10. ROMA | 1150 gm |
| 11. NDH – 14 | 1410 gm |
| 12. CL – 17 | 1300 gm |
| 13. CL – 66 | 620 gm |
| 14. CL – 68 | 590 gm |
| 15. CL – 67 | 625 gm |
| 16. CL – 315 | 960 gm |
| 17. CL – 72 | 300 gm |

### Quantitative Analysis

### Preparation of extract and phytochemical analysis

3 samples of each species (10 gm/rhizome) were taken. The rhizomes were washed in plain water and dried simply. Sample first was treated with 1% $NaHCO_3$, until Haldi smell did not come. Sample second was treated with 0.1% $NaHCO_3$, until Haldi smell did not come. Now red colour pigment came out in $NaHCO_3$ solution which was separated out and it was dried at 60° C in oven. Sample third (control) was dried in oven in 60° C. After 6-8 days when samples were dried, they were taken out from oven and ground to make powder. Preliminary phytochemical screening of methanolic and distilled water extract of rhizome of *Curcuma longa* was done by using standard procedures.[15] 50 mg rhizome (powder) samples of each variety were extracted with methanol (15x3) on water bath. Extracts were filtered through filter paper. Filtrates were collected and volume was made up to 50ml with methanol. These samples were applied for High Performance Thin Layered Chromatography (HPTLC) analysis. A camag's HPTLC system with Linomat IVR, TLC scanner, twin trough chamber and Cats V4.05 evaluation software was used for sample analysis.

### Formulae used

% of Curcumin=

$$\frac{\text{Conc. of std. (microgram) x Area of test sample}}{\text{Area of std. x Conc. of test sample}} \times 100$$

% of total Curcuminoids=

$$\frac{\text{Conc. of total curcuminoid in std. sample x Area of test sample}}{\text{Area of std. x Conc. of test sample}} \times 100$$

From these formulae we have calculated Curcumin and Curcuminoids (Table-2) percentage (w/w) in a given sample.[16]

**Table-2**

| Variety | Curcumin (% w/w) | | | Curcuminoids (% w/w) | | |
|---|---|---|---|---|---|---|
| | Control | 0.1% | 1% | Control | 0.1% | 1% |
| CL – 73 | 0.44 | 0.40 | 0.18 | 0.82 | 0.67 | 0.29 |
| CL – 66 | 0.52 | 0.32 | 0.30 | 0.83 | 0.50 | 0.50 |
| CL – 67 | 0.26 | 0.14 | 0.16 | 0.42 | 0.26 | 0.44 |
| CL – 68 | 0.52 | 0.52 | 0.64 | 0.81 | 0.86 | 1.04 |
| CL – 69 | 0.58 | 0.68 | 0.36 | 1.26 | 1.24 | 0.81 |
| CL – 70 | 0.76 | 0.74 | 0.48 | 0.97 | 1.28 | 0.97 |
| CL – 72 | 0.69 | 0.92 | 0.30 | 1.22 | 1.48 | 0.79 |
| CL - 320 | 0.52 | 0.14 | 0.34 | 1.05 | 0.58 | 0.74 |
| CL - 315 | 0.50 | 0.30 | 0.30 | 0.88 | 0.42 | 0.59 |
| CEL - 318 | 0.50 | 0.24 | 0.18 | 0.94 | 0.54 | 0.49 |
| CEL - 321 | 0.46 | 0.50 | 0.28 | 0.85 | 0.96 | 0.63 |

| | | | | | | |
|---|---|---|---|---|---|---|
| CEL - 324 | 0.70 | 0.36 | 0.24 | 1.10 | 0.51 | 0.57 |
| NDH - 14 | 1.96 | 1.98 | 1.70 | 3.59 | 3.59 | 3.17 |
| NDH - 18 | 0.80 | 0.64 | 0.17 | 1.62 | 1.33 | 0.72 |
| ROMA | 1.00 | 0.20 | 0.22 | 1.89 | 0.87 | 0.82 |
| VAYMA | 0.38 | 0.60 | 0.12 | 0.87 | 1.29 | 0.46 |
| SWARNA | 0.28 | 0.18 | 0.18 | 0.77 | 0.56 | 0.55 |

## RESULT AND DISCUSSION

After harvesting it was observed that CL-69 yields maximum and CL-320 yields minimum of the total variety of *Curcuma longa*. Largest yield of CL-69 in the field was 2025 gm and lowest yield of CL-320 in the field was 43 gm. In terms of yield CL-69 is the best variety. So this variety may be used for medicinal purposes and for isolation of Curcumin etc. There was quantitative variation in occurrence of Curcumin and Curcuminoids. Least amount of Curcumin was present in CL-67 (0.26 by weight w/w). It was followed by SWARNA (0.28 by weight w/w). Least amount of total Curcuminoids was present in CL-67 (0.44 by weight w/w). It was followed by SWARNA (0.55 by weight w/w). Highest amount of Curcumin and Curcuminoids was present in NDH-14 (1.9 & 3.59 by weight w/w respectively). It was followed by ROMA (1.0 & 1.89 by weight w/w Curcumin & Curcuminoids respectively). On treatment with alkali there was definite loss of total Curcumin in all the varieties except CL-72. This observation was performed 3 times but there is no explanation for this variation. Total Curcuminoids also decreased in all the varieties except they increase in CL-68. Thus among studied varieties of *Curcuma longa* NDH-14 have more Curcumin and Curcuminoids. Therefore it is more beneficial variety.

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