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**GRT** **ANLYSIS OF ORGANIC CONSTITUTENTS IN  
VARIETIES OF CAPSICUM ANNUM AND  
CAPSICUMFRUTESCENS. I- TAN, NITROGEN, PROTEIN,  
POLYPHENOLS AND ASCORBIC ACID (VITAMINS C)**

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**Abstract:**-It is evident from present investigation that Capsicum species with varieties under study have great potential of organic acid accumulation in order to maintain the water balance. Organic acids generally bind to monovalent cations such as Na<sup>+</sup> and provide a buffering action. Apart from this leaves with higher acidity status indicates as centre of organic metabolism. Leaf contains highest value of protein than root, stem and fruit. This high value of protein in leaf may have metabolic significance.

Variety Sankeshwari is the best genotype from the view point of nitrogen uptake and assimilation.

Phenolic contents are high in varieties Pant C-1, Jwala, Lavangi and Black short as compared to varieties of DeonurBydadagi and Sankeshwari. This may reflect in higher disease resistance capacity in Pant C-1, Jwala, Lavangi and Black short.

The variation of ascorbic acid content between different varieties in present study is seen and it is in the range of 36.68 mg to 52.08 mg in 100 g dry red chilies. The ascorbic acid content in red fruits was maximum, while in early period of growth fruits turning red contained more ascorbic acid content than the green fruits.

These is varietal differences in organic acid metabolism, nitrogen-protein, polyphenols and Ascorbic acid of Capsicum varieties under study.

**Keywords:** K Organic constitutents , Capsicum annum and Capsicumfrutescens.

## INTRODUCTION

Webster's third New International Dictionary defines physiology as "a branch of biology dealing with the process, activities and phenomena incidental to and characteristics of life or of living organisms". B.M. Duggar (1911) made this somewhat more specific Plant Physiology-concerns itself with plant responses and plant behavior under all conditions; that is, with relation and processes readily evident of obscure, simple or complex, which have to do with maintenance, growth and reproduction of plants. Thus, physiological understanding provides a major part of the framework within which the breeder develops his generally implicate thought about what are ideal plants.

Besides the nutritive values, good quality foods are requirements of these days. In crops, like chilies fruit quality must be an important consideration in improvement programme. Breeding for improved quality initially requires a definition of the major parameter that contribute to it.

Number of workers such as Shukla et al. (1975), Soochetal. (1977), Bajaj et al. (1977, 1978), Lahadiya and Kulkarni (1978), Bajaj and Kaur (1986), Basiouny and Biswas (1982), Khadietal. (1987) studied chemical composition of chilies fruit only. But little work has been to illuminate the nutritional requirement of the Capsicum plants (Cotter, 1980). Therefore in present investigation an attempt has been made to understand the growth, yield, organic assimilation mineral nutrient uptake and accumulation in varieties of Capsicum annum viz. Black short, DeonurByadagi, Jwala, Pant C-1 and Sankeshwari and C. frutescens variety Lavangi. This information is useful for plant physiologists, breeders and food technologists.

The most significant characteristic of green plant is to synthesize food material from the simple substances in the presence of sunlight. It is considered as one of the fundamental and unique properties of the green plants. Plants build-up various kinds of complex molecules. The most important and abundant of these are the carbohydrates, lipids, amino acids, proteins, glycosides, enzymes, vitamins, polyphenols, alkaloids and numerous other organic compounds. Such compounds not only form the cellular organization but also provide energy for all vital activities. Hence it is important to study the various organic constituents present in plants. It has a special significance in economically important plants as their productivity is directly related to the metabolism and production of organic compounds.

#### **MATERIAL AND METHODS:**

In kharip season, varieties of Capsicum annum viz. Black short, DeonurByadagi, Jwala, Pant C-1 and Sankeshwari and C. frutescens variety Lavangi sown in experimental field to study growth, yield, organic and inorganic constituents analysis. Randomized Block Design was set. Three replications of each variety were made consisting of twenty plants. Plant to plant and row to row distance was kept 50 cm and 70 cm respectively.

The organic and inorganic constituent's analysis of different parts has been made after 100-110 days of plants after transplantation. The healthy and well developed plants were uprooted and brought to the laboratory. They were cleaned properly to remove the adherent dirt. The root, stem, leaves and fruits were separated and used for further study.

Quantitative estimation of following organic constituents was made. TAN (Titratable Acid Number), carbohydrates, nitrogen, polyphenols, chlorophyll content, coloring matter (capsicum), capsaicin (pungent principle) and ascorbic acid (vitamin C).

TAN represents the number of ml of decinormal NaOH required to neutralize the acid content from 100 g fresh material. TAN was determined by the method of Thomas and Beevers (1949). Nitrogen was estimated by digesting the plant material in H<sub>2</sub>SO<sub>4</sub> (1:1) and determining the N-contents by Nessler's reagent. The intensity of the color developed was measured by Spectronic-20 at the wavelength 520nm (Hawk et al., 1948). Proteins were estimated by multiplying the nitrogen content with factor 6.25.

The polyphenols were determined calorimetrically by using the method of Folin and Denis (1915).

Ascorbic acid determination by titrimetric method of Alberg (1958). For estimation of capsaicin, capsicum and ascorbic acid sundried red fruits were utilized.

#### **RESULTS AND DISCUSSIONS :**

TAN – Titratable acidity provides a measure of organic acids (total acidity) present in a sample. TAN content in different parts of varieties of Capsicum annum and C. frutescens variety Lavangi is presented in Table I and Figure I. From the table and figure it is clear that the leaves contain highest values of TAN than root, stem and fruits parts of the plants of all varieties under study. Acidity status in roots ranged in between 14.25 to 33.25. Variety Jwala and Black short are the limits of highest and lowest extremes respectively. Stem contains TAN in the range of 16.62 to 32.06. Variety Jwala and Pant C-1 showed maximum accumulation while variety Sankeshwari accumulates lowest TAN content. The acidity status in leaves was maximum in the variety Pant C-1 with value of 121.28 and minimum in the variety Sankeshwari with value of 53.43 in fruit, it varies from 22.31 to 40.08. Fruits of variety Black short showed the maximum value while fruits of variety Pant C-1

contains minimum TAN values.

**Table- I**  
**TAN\* (Titrable Acid Number) in different parts of**  
**Capsicumannuum and C.frutescens varieties.**

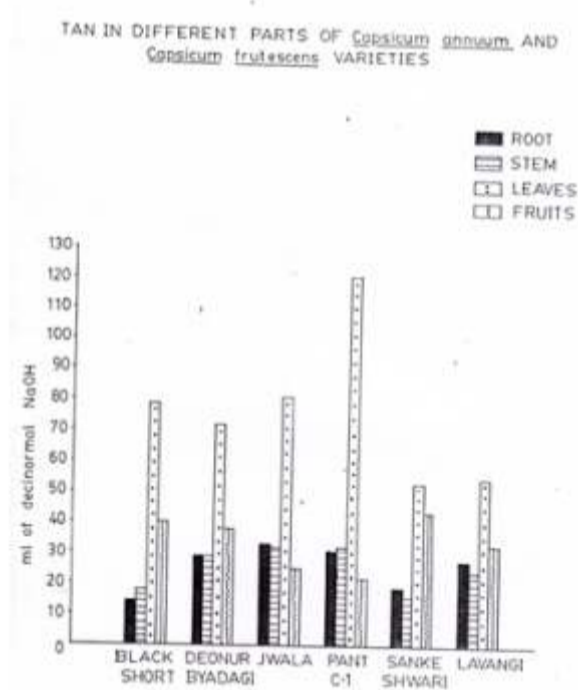
Variety	Root	Stem	Leaves	Fruit
Black short	14.25	17.81	78.73	40.08
DeonurByadagi	29.21	29.21	72.67	38.53
Jwala	33.25	32.06	81.22	23.93
Pant C-1	31.25	32.06	121.48	22.31
Sankeshwari	18.90	16.62	53.43	44.17
Lavangi	28.26	23.75	64.60	32.64

(\* TAN (Titrable Acid Number) represents the number of ml of decinormalNaOH required to neutralize the acid content from 100 g fresh material.)

**Table II**  
**Nitrogen content in different parts of CapsicumannuumandC.frutescens varieties**

Variety	Root	Stem	Leaves	Fruit
Black short	0.95	1.00	4.25	1.90
DeonurByadagi	1.54	1.10	4.10	1.25
Jwala	1.57	0.80	4.20	1.75
Pant C-1	1.05	1.05	3.50	1.80
Sankeshwari	1.67	1.82	2.60	2.87
Lavangi	0.98	1.10	4.80	1.20

Values expressed in g per 100 g dry matter

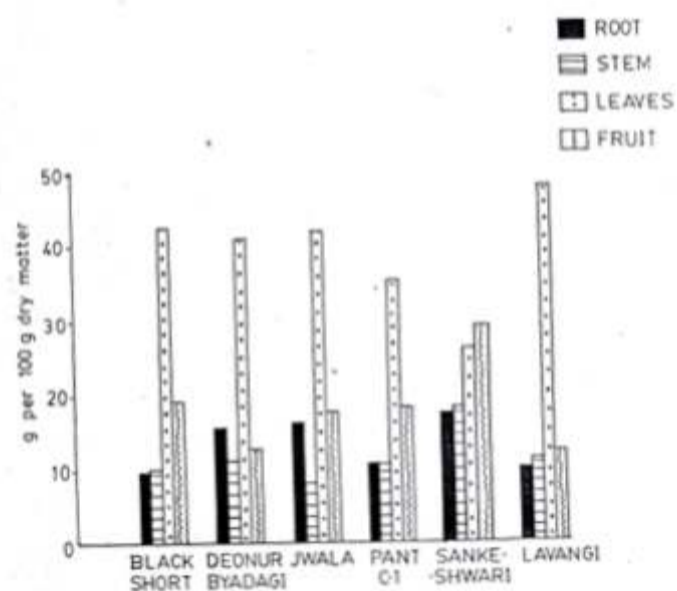


Gujar (1983) observed variations in acidity status in leaves of *Nicotianarustica* and *N.tabacum*. Bhandari (1988) recorded 20.42 and 21.05 TAN in leaves of NP.46 and Pant C-1 variety of *Capsicumannuum*. These observations are in consistency with the present investigations. It is evident from present investigation that *Capsicum* species with varieties under study have great potential of organic acid accumulation in order to maintain the water balance. Organic acids generally bind to monovalent cations such as Na<sup>+</sup> and provide a buffering action. Apart from this leaves with higher acidity status indicate as centre of organic metabolism.

Nitrogen - Nitrogen plays a very important role in the life of a plant. It is an indispensable constituent of the protein molecule, which in turn is a vital part of protoplasm. Nitrogen exists as inorganic nitrogen and also in proteins, amino acids and various other nitrogenous compounds.

Table II shows nitrogen content in different parts of *Capsicumannuum* varieties Black short, DeonurByadagi, Jwala, Pant C-1 and Sankeshwari and *C.frutescens* variety Lavangi. From the table and figure it is obvious that nitrogen content in leaves is more than nitrogen content in root, stem and fruit of varieties under study. Range of nitrogen content in roots is 0.95 to 1.67 g per 100 g dry matter. Variety Sankeshwari and Black short are the two extremes highest and lowest, respectively. Stem contains 0.8 to 1.82 g nitrogen per 100 g dry matter. Stem of variety Sankeshwari has shown maximum nitrogen accumulation while variety Jwala accumulates lowest nitrogen in stem. The nitrogen content in leaves is maximum in variety Black short (4.25 g per 100 g dry matter) and minimum in variety Sankeshwari (2.6 g per 100 g dry matter). The nitrogen content in fruit varies from 1.20 to 2.87 g per 100 g dry matter. *Capsicumannuum* variety Sankeshwari and *C.frutescens* variety Lavangi are the two extremes highest and lowest, respectively.

NITROGEN CONTENT IN DIFFERENT PARTS OF *Capsicum annuum* AND *Capsicum frutescens* VARIETIES



Intraplant species differences to nitrogen were recognized many years ago (Harvey, 1993; Hoener and De Turk, 1938; Smith, 1934).

The protein contents in various parts of *Capsicumannuum* varieties Black short, DeonurByadagi, Jwala, Pant C-1 and Sankeshwari and *C.frutescens* variety Lanvangi are shown in

Table II.

Deonon and Knott (1968) found that each 100 g of edible portion of fruits of egg plant contains 1.0 g protein. While tomato fruits also contains 1.0 g protein per 100 g edible portion of fruits

**Table III**  
**Protein content in different parts of Capsicum annum and C.frutescens varieties**

Variety	Root	Stem	Leaves	Fruit
Black short	5.93	6.25	26.56	11.87
Deonur Byadagi	9.62	6.87	25.62	7.81
Jwala	9.81	5.00	26.25	10.93
Pant C-1	6.56	6.56	21.87	11.25
Sankeshwari	10.43	11.37	16.25	17.93
Lavangi	6.12	6.87	30.00	7.50

Value expressed in g per 100 g dry matter.

**Table IV**  
**Polyphenol content in different parts of Capsicum annum and C.frutescens varieties**

Variety	Root	Stem	Leaves	Fruit
Black short	0.384	0.323	0.622	0.527
Deonur Byadagi	0.324	0.254	0.480	0.375
Jwala	0.345	0.146	0.603	0.538
Pant C-1	0.233	0.278	0.977	0.636
Sankeshwari	0.169	0.102	0.589	0.405
Lavangi	0.288	0.303	0.622	0.327

Value expressed in g per 100 g dry matter.

(Anonymous, 1961). Sidhu et al. (1982) observed total proteins in the Solanum melongena fruits in the range of 0.570 g to 0.970 g%. Misra and Jha (1972) estimated 10.36 g and 9.31 g% total protein in leaves and fruits of Capsicum respectively. In present investigation leaf contains highest value of protein that root, stem and fruit. This high value of protein in leaf may have metabolic significance.

Differences in plant protein must be considered while considering differential nitrogen uptake and accumulation by plant genotypes selecting for high protein is an integral part of many plant breeding programmes.

Nitrogen uptake and metabolism are energy dependent and hence greater photosynthetic activity is required to support higher uptake (Bhatia and Rabson, 1976). Plants flowering late are having larger leaf area and possibly deeper root system. Such plants are usually large in size and have greater capacity for photosynthesis, nitrogen uptake and assimilation. It is clear from the Table II and Table III that variety Sankeshwari is the best genotype from the viewpoint of nitrogen uptake and assimilation. Thus only the parents used in the crosses or the material in the final stages of breeding programme is analyzed for nitrogen to confirm that they have more than average nitrogen uptake and translocation efficiency.

Polyphenols- Polyphenols are almost universally distributed in plants. They occur in leaves, wood, bark, unripe fruits and many other plant parts. They are commonly known as tannins. Recently considerable importance has been given to this group as some of the phenolic compounds act as phytohormones. Vendring and Buffel (1961) have suggested that transcaffeic acid may be an important natural growth regulator not less important than Indole-3-acetic acid. Nanda (1977) has

concluded that phenolics resemble IAA, since both need an adequate supply of available nutrition for stimulating root production.

Resistant varieties contain more chlorogenic acid than the susceptible (Patiletal., 1964). Chlorogenic acid is a competitive inhibitor of IAA oxidase and may be involved in diseases where resistance is increased with IAA content of plant.

Table IV and Figure IIIsummarises the polyphenol content in different parts of Capsicumannuum varieties Black short, DeonurByadagi, Jwala, Pant C-1 and Sankeshwari and C.frutescens variety Lavangi. In these six varieties of chilies, leaves contain maximum polyphenols than root, stem and fruit. The range of variation in polyphenol content in roots is from 0.169 g in variety Sankeshwari to 0.384 g per 100 g dry matter of root in variety Black short. The polyphenol content in stem varies in the range of 0.102 g to 0.323 g per 100 g dry matter. Variety Sankeshwari and variety Black short contains maximum and minimum polyphenols in stem. Range of polyphenol content in leaves is from 0.480 g to 0.977 g per 100 g dry matter. Variety Pant C-1 and variety DeonurByadagi are the two extremes. Fruits contain polyphenol in the range of 0.327 to 0.636 g per 100 g dry matter. Fruits of variety Pant C-1 have shown maximum accumulation while variety Lavangi accumulates lowest polyphenol content.

Sidhu etal(1982) found among varieties of Solanummelongena, the total phenolic content varied from 0.07 to 0.19% in fruits. In present investigation phenolic contents are high in varieties Pant C-1, Jwala, Lavangi and Black short as compared to varieties of DeonurByadagi and Sankeshwari. This may reflect in higher disease resistance capacity in Pant C-1, Jwala, Lavangi and Black short than DeonurByadagi and Sankeshwari as observed in our experimental field while considering the different genotypes (varieties) for leaf curl disease.

Ascorbicacid (Vitamin C) - One of the chilies extremely interesting attributes is its content of vitamin C (ascorbic acid) in fruits. The Hungarian scientist, Dr. Scent Gyorgyi, who own a Nobelprize in 1897 for his work for vitamin C found in Capsicum pods to be one of the richest of all sources of ascorbic acid.

**Table – V**  
**Ascorbic acid content in fruits of Capsicumannuum**  
**AndC.frutescens varieties.**

Variety	Ascorbic acid
Black short	39.68
DeonurByadagi	52.08
Jwala	50.84
Pant C-1	49.60
Sankeshwari	44.64
Lavangi	43.40

Ascorbic acid (Vitamin C) expressed as mg per 100 g sundried red fruit.

Table -V depicts ascorbic acid content of six different varieties of Capsicum under study. The range of variation in ascorbic acid content is 39.68 to 52.08 mg per 100 g sundried chilies. The maximum content of ascorbic acid is found in variety DeonurByadagi (52.08 mg%). It is followed by Jwala (50.84 mg%), Pant C-1 (49.60 mg %), Sankeshwari (44.64 mg %), Lavangi (43.40 mg %) and Black short (39.68 mg %).

Petersini (1952), Bajaj etal. (1978, 1980) and Khadietal. (1987) found variation in ascorbic acid content in fruits of varieties of chilies. The variation of ascorbic acid content between different varieties in present study is seen and it is in range of 36.68 mg to 52.08 mg in 100 g dry red chillies. In 20 populations of Capsicumannuum ascorbic acid content ranged from 147 to 224.8 mg/100 g fresh chillies. While Bajaj etal. (1980) found varietal variation form 53.70 to 221.90 mg per 100 g fresh weight of chilies. In addition to varietal difference the ascorbic acid content depends upon the maturity of fruits. Bajaj etal (1977) reported that at later stage of growth, ascorbic acid content in red fruits was maximum while in early period of growth, fruits turning red contained more ascorbic acid



content than the green fruits.

#### CONSLUSION:-

There are varietal differences in organic acid metabolism, carbohydrate assimilation and content of nitrogen, protein, polyphenols, chlorophylls, capsicum, capsaicin and ascorbic acid.

Highest value of TAN in leaves of varieties under study indicates that leaves are the main center of organic acid metabolism. The leaves contain higher nitrogen and proteins may have metabolic significance. Higher level of phenolic is observed in leaf curl disease resistant varieties under study. Ascorbic acid has high level in fresh fruits than the dried ones. What emerges from this overall discussion is that plant genotypes of *Capsicum annuum* and *C. frutescens* show important differences in their growth pattern, organic metabolism, uptake, translocation, accumulation and use of essential mineral elements. Advantage should be taken of these differences to improve plants for growth under defined or contained conditions.

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