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ORIGINAL ARTICLE

Organic contents in intraplant varieties and species of Capsicum.

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Abstract:
Intrapalnt content of nitrogen, protein and carbohydrate in Capsicum revealed that leaves contain more organic content than root, stem and fruits. Similary
Intervarietal differences are also prevailing in nitrogen, protein and carbohydrate content in Capsicum. Carbohydrate study revealed that starch is the main constituting fraction in chillie varieties under study. The values of reducing sugars are less than total sugars and starch. It may suggest that the reducing sugars are not accumulated but are immediately converted into disaccharides and polysaccharides. Total sugars and starch even though synthesizing in lamina, they are not accumulated there but are translocated to fruit, root and stem where they are stored.

INTRODUCTION:-

Organic contents has a special significance in productivity of economically important Capsicum. It is because productivity is directly related to the metabolism and synthesis of organic compounds.

Nitrogen is an indispensable constituent of the protein molecule. The protein is major building block of the plant. The level of carbohydrates in plants reflect all the general physiology of the growth and development at the plant.

Study of organic contents in intraplant of varieties and species of Capsicum will reveal information of physiology of productivity. It may help in selection of parent in breeding programme.

MATERIALS AND METHODS :-

In kharip season of varieties of Capsicum annuum viz. Blank short, Deonur Byadagi, 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 constituents 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.

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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 organic constituents - TAN (Titratable Acid Number), carbohydrates, nitrogen was made.

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). The carbohydrates were analyzed calorimetrically by Nealson's method (1944). Nitrogen was estimated by digesting the plant material in H2SO4 (1:1) and determining the N-contents by Nessler's reagent. The intensity of the colour developed was measured by Spectronic-20 at the wavelength 520 nm (Hawk et al. ,1948). Proteins were estimated by multiplying the nitrogen content with factor 6.25.

In order to determine the moisture percentage in different parts of varieties of Capsicum the plant material was weighed accurately in a perteidish and transferred to the oven at 80° C. The dry weight of the material were taken repeatedly still constant weight is obtained. The loss in weight per 100 g was expressed as moisture percentage.

RESULTS AND DISCUSSION :-

TABLE- I

TAN* (Titrable Acid Number) in different parts of Capsicum annuum and C. frutescens varieties.

Variety	Root	Stem	Leaves	Fruit
Black short	14.25	17.81	78.73	40.08
Deonur Byadagi	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 (Titratable Acid Number) represents the number of ml of decinormal NaOH required to neutralize the acid content from 100 g fresh material.)

Gujar (1983) observed variations in acidity status in leaves of Nicotiana rustica and N. tabacum. Bhandari (1988) recorded 20.42 and 21.05 TAN in leaves of NP.46 and Pant C-1 variety of Capsicum annuum. 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+ and provide a buffering action action. Apart from this leaves with higher acidity status indicate as centre of organic metabolism.

TABLE-II

Nitrogen content in different parts of Capsicum annuum and C. frutescens varieties

Variety	Root	Stem	Leaves	Fruit
Black short	0.95	1.00	4.25	1.90
Deonur Byadagi	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)

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 Cpsicum annuum varieties Black short, Deonur Bhadagi, Jwala, Pant C-1 and Snakeshwari 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 furit varies from 1.20 to 2.87 g per 100 g dry matter. Capsicum annuum variety Sankeshwari and C. frutescens variety Lavangi are the two extremes highest and lowest, respectively.

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 Capsicum annuum varieties Black short, Deonur Byadagi, Jwala, Pant C-1 and Sankeshwari and C. frutescens variety Lanvangi are shown in Table II-IV.

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 annuum and C. frutescens varieties

Variety	Root	Stem	Leaves	Fruit
Black short	5.93	6.25	26.56	11.87
Denour 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.

(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 abd 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 up tale 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 dipper root system. Such plants are usually large in size and have greater capacity for photosynthesis, nitrogen uptake and addimilation. It is clear from the Table II and Table III that variety Sankeshwari is the best genotype from the view point 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.

Carbohydrate - Next to protein very important organic constituent is carbohydrate. In fact photosynthesis exists to synthesize this energy generating molecule. The level of carbohydrates in plants reflect all the general physiology of the growth and development of the plant.

Table IV summaries sugars, starch and total carbohydrate contents in different parts of Capsicum annuum varieties Black short, Deonur Byadagi, Jwala, Pant C-1 and Sankeshwari and C. frutescens variety Lavangi. It is clear from the table that the range of reducing sugar content in root, stem, leaves and fruit in six varieties under investigation is 0.094 to 0.183 g, 0.303 to 0.364g, 0.467 to 0.592 g and 0.148 to 0.196 g per 100 g dry matter respectively. Total sugar content in these varieties varies from 0.206 to 0.332 g in root ,0.303 to 0.460 g in stem, 1.414 to 1.496 g in leaves and 1.118 to 1.612 g per 100 g dry matter in fruits. Starch content varies from 7.50 to 8.74 g in root , 8.01 to 8.64 g in stem, 5.33 to 6.03 g in leaves and 7.72 to 7.99 g per 100 g dye matter in fruits. Total carbohydrate varies from 7.73 to 8.90 g in root of six varieties under study, 8.45 to

TABLE IV
Carbohydrates content in different parts of Capsicum annuum and C. frutescens.

Variety	Carbohydrate	Root	Stem	Leaves	Fruit
Black Short	Reducing sugar	0.140	0.345	0.516	0.196
	Total sugar	0.280	0.460	1.414	1.288
	Starch	8.620	8.640	6.030	7.990
	Total carbohydrates	8.900	9.100	7.440	9.270
Depnur Byadagi	Reducing sugar	0.094	0.303	0.516	0.163
	Total sugar	0.206	0.401	1.496	1.400
	Starch	7.810	8.170	5.380	7.880
	Total carbohydrates	8.016	8.611	7.370	9.280
Jwala	Reducing Sugar	0.153	0.336	0.544	0.156
	Total sugar	0.332	0.432	1.472	1.118
	Starch	7.590	8.310	5.460	8.160
	Total carbohydrates	7.920	8.740	6.930	9.270
Pant C-1	Reducing sugar	0.114	0.341	0.563	0.163
	Total sugar	0.249	0.439	1.459	1.330
	Starch	8.600	8.500	5.880	7.720
	Total carbohydrates	8.740	8.930	7.330	9.050
Sankeshwari	Reducing sugar	0.118	0.364	0.467	0.148
	Total sugar	0.236	0.504	1.430	1.120
	Starch	7.500	8.190	5.610	8.520
	Total carbohydrates	7.730	8.690	7.040	9.640
Lavangi	Reducing sugar	0.183	0.320	0.592	0.162
	Total sugar	0.210	0.440	1.435	1.400
	Starch	7.900	8.010	5.330	7.840
	Total carbohydrates	8.110	8.450	6.760	9.240

(Value expressed in g per 100 g dry matter.)

9.11 g in stem, 6.76 to 7.44 g in leaves and 7.72 to 8.52 g per 100 g dry matter of fruits of six varieties under study.

It is also evident from the table that the leaves of six varieties under investigation contains more reducing sugars and total sugar than root, stem and fruit. The higher values of reducing sugars and total sugars in leaves may be due to their active synthesis in photosynthesis. The values of reducing sugar are less than total sugars indicate that reducing sugar are not accumulated but are immediately converted into disaccharides and polysaccharides. Further it is also clear that the values of carbohydrates are maximum in the fruit and are followed by stem, root and leaves. Thus fruit represents a major sink for assimilates in capsicum species. Similar observation have also been reported by Hall (1977) in sweet pepper plants. Furthermore , the content of different sugars is critical to the quality of fruit for consumption. It must be mentioned here that pepper fruits are harvested both as unripe and ripe and sugar contents of fruit tissue depends strongly on the harvest time. However, in the present studies harvest is made when fruits are ripe. The ability of a fruit to impart and utilize assimilates is termed sink strength (Ho, 1988). Sucrose is the major product in the leaves of sweet pepper plants (Nielsen and Veierskov, 1990) and sucrose utilization is expected to be central to sink strength in the fruits (Nielsen et al. (1991).

It is known from the studies of Robinson et al. (1988), Yelle et al. (1988) and Schaffer et al. (1989) in tomato cultivars and Solanum muricatum, respectively, that the carbohydrate composition changes significantly during fruit development. These studies also demonstrated the great potential for the genetic variations of the carbohydrate metabolism in fruits among closely related species. In present investigation also it has been revealed that Capsicum species and varieties under study have a genetic variations of carbohydrate synthesis and accumulation.

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