The Andhra Agric. J 57(1):91-98, 2010

Leaf Nutrient (NPK) Status of Cashew Gardens in Coastal Districts of Andhra Pradesh

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ABSTRACT

The investigation was carried out during 2006 - 07 in 12 mandals cashew farmers' orchards of coastal districts of Andhra Pradesh. The leaf nutrient contents N, P, and K ranged from 1.25 to 2.38% (low range), 0.056 to 0.168% (deficient to low range) and 0.117 to 0.715% (deficient to low range), respectively in these orchards. Non-fruiting terminals showed highest nutrient contents than fruiting terminals in all the months of study.

Key words : Cashew, Leaf Nutrients

Cashew (*Anacardium occidentale* L.) has very strongly developed root system and grow as satisfactorily even on poor soils where other crops fail and responds well to fertilizer application. Tissue analysis is an effective tool to diagnose the nutrient needs of the plant. Leaf being the major metabolic organ is the ideal choice for sampling to ascertain the fertilizer requirement. The value of tissue analysis, however, depends on the correct selection of tissues. The mineral composition of the leaves varies due to several factors *viz.,* season, position and age of leaf (Kumar *et al*. 1985). This study was under taken to understand the seasonal fluctuation in nutrient uptake pattern during its growth phases on both fruiting terminals and non-fruiting terminals for major nutrients.

MATERIAL AND METHODS

Five uniform trees of around ten years were selected in each orchard for leaf sampling. It was also ensured that the selected trees were distributed randomly in the orchard. The leaf samples were collected from fruiting and non-fruiting terminals of all the twelve orchards. Fifth leaf from the terminal bud of the branch was chosen and such leaves from all four sides of the trees were collected from fruiting and non-fruiting terminals, at bimonthly intervals from July 2006 to May 2007, as specified by Chapman (1964). The leaf sampling was adopted as per the standard procedures. The nutrient contents in leaf samples were determined by microkjeldahl method (Bermner and Mulvaner, 1982) for nitrogen, Vanado - molybdo phosphoric acid yellow colour method using a spectrophotometer (Jackson , 1973) for phosphorus and flame photometer method (Muhr et al., 1963) for potassium. The statistical analysis of complete randomized block design was performed as outlined by Panse and Sukhatme (1967).

RESULTS AND DISCUSSION

The data on periodical analysis for leaf nitrogen content presented in Table 1 revealed that the leaf N content ranged from 1.313 per cent of fruiting terminal in the month of May of Chinnaganjam mandal orchards of Prakasam district to 2.279 per cent of leaf N content by non- fruiting terminals in the month of November of Nidadavol mandal orchards of West Godavari district. It explains that N content was found to be ranging from deficient to low level as per the leaf analysis standards that were used for diagnosing nutrient status of cashew nut as suggested by Robinson *et al.* (1997). Based on leaf nutrient guide suggested by Robinson *et al.* (1997), it could be observed from the present study that all mandal orchards were found to be falling in low range in different months of study for leaf N content. This study thus clearly explains that the cashew nut orchards of coastal districts of Andhra Pradesh need nitrogen which is the major nutrient to be supplied through organic and inorganic forms to prevent any decline of cashew nut gardens in near future.

In general, the leaf nitrogen content was more in non-fruiting terminals than the fruiting terminals in all the months of study (Fig 1). The higher concentration of leaf N content in non- fruiting terminals could be attributed to the accumulation in non-fruiting terminals while utilization of the same (N) in fruiting terminals for flower bud differentiation, formation and fruit development phases. Harishukumar *et al.* (1982), noticed diversion of minerals to flowers and developing fruits which act as sink, thus they were found in the leaves during

Table 1. Monthly mean leaf N content (%) of fruiting terminals (FT) and non-fruiting terminals (NFT) of the 12 mandals cashew orchards.

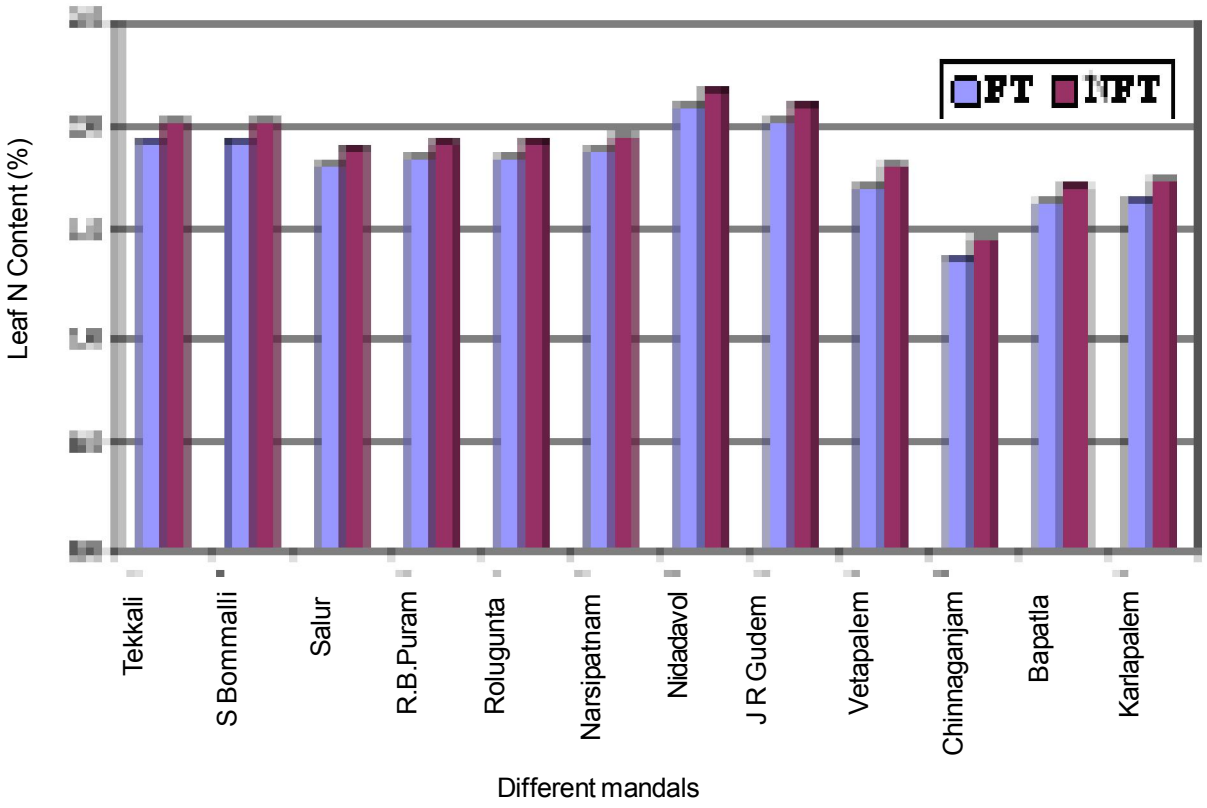
Orchards	Jul-06		Sep-06		Nov-06		Jan-07		Mar-07		May-07		Mean	
	FT	NFT	FT	NFT	FT	NFT	FT	NFT	FT	NFT	FT	NFT	FT	NFT
Tekkali	1.923	2.048	1.941	2.072	2.035	2.176	1.916	2.029	1.922	1.947	1.863	1.896	1.933	2.028
S. Bommalli	1.913	2.023	2.033	2.157	2.032	2.149	1.906	2.023	1.913	1.938	1.854	1.886	1.942	2.029
Salur	1.811	1.896	1.832	1.956	1.893	1.998	1.804	1.906	1.799	1.824	1.784	1.824	1.821	1.901
R. B.Puram	1.833	1.918	1.918	2.042	1.947	2.054	1.826	1.928	1.821	1.846	1.806	1.842	1.859	1.938
Rolugunta	1.831	1.915	1.911	2.038	1.913	2.031	1.824	1.926	1.819	1.844	1.804	1.846	1.850	1.933
Narsipatnam	1.862	1.949	1.945	2.073	1.994	2.058	1.855	1.974	1.867	1.885	1.779	1.835	1.884	1.962
Nidadavol	2.023	2.183	2.395	2.521	2.172	2.279	2.016	2.104	1.997	2.026	1.996	2.032	2.100	2.191
J.R. Gudem	2.011	2.135	2.106	2.234	2.081	2.187	2.004	2.095	1.988	2.024	1.984	2.021	2.029	2.116
Vetapalem	1.701	1.825	1.776	1.905	1.813	1.954	1.694	1.796	1.689	1.714	1.638	1.674	1.719	1.811
Chinnaganjam	1.373	1.462	1.459	1.594	1.487	1.604	1.366	1.468	1.361	1.386	1.313	1.346	1.393	1.477
Bapatla	1.741	1.864	1.823	1.961	1.854	1.961	1.491	1.593	1.486	1.511	1.435	1.471	1.638	1.727
Karlapalem	1.651	1.736	1.734	1.892	1.763	1.878	1.644	1.746	1.639	1.664	1.558	1.624	1.665	1.757
Range	1.373	1.462	1.459	1.594	1.487	1.604	1.366	1.468	1.361	1.386	1.313	1.346		
	2.023	2.183	2.395	2.521	2.172	2.279	2.016	2.104	1.997	2.026	1.996	2.032		
Mean	1.806	1.913	1.906	2.037	1.915	2.027	1.779	1.882	1.775	1.801	1.735	1.775		
SEm±	2.01	2.14	2.08	2.19	2.11	2.23	2.00	2.02	1.99	2.10	1.98	2.02		
CD (0.05)	0.21	0.26	0.22	0.25	0.21	0.17	0.15	0.27	0.20	0.20	0.20	0.19		
CV (%)	8.91	10.27	9.80	10.70	9.36	8.14	7.13	10.81	9.02	8.17	8.70	7.62		

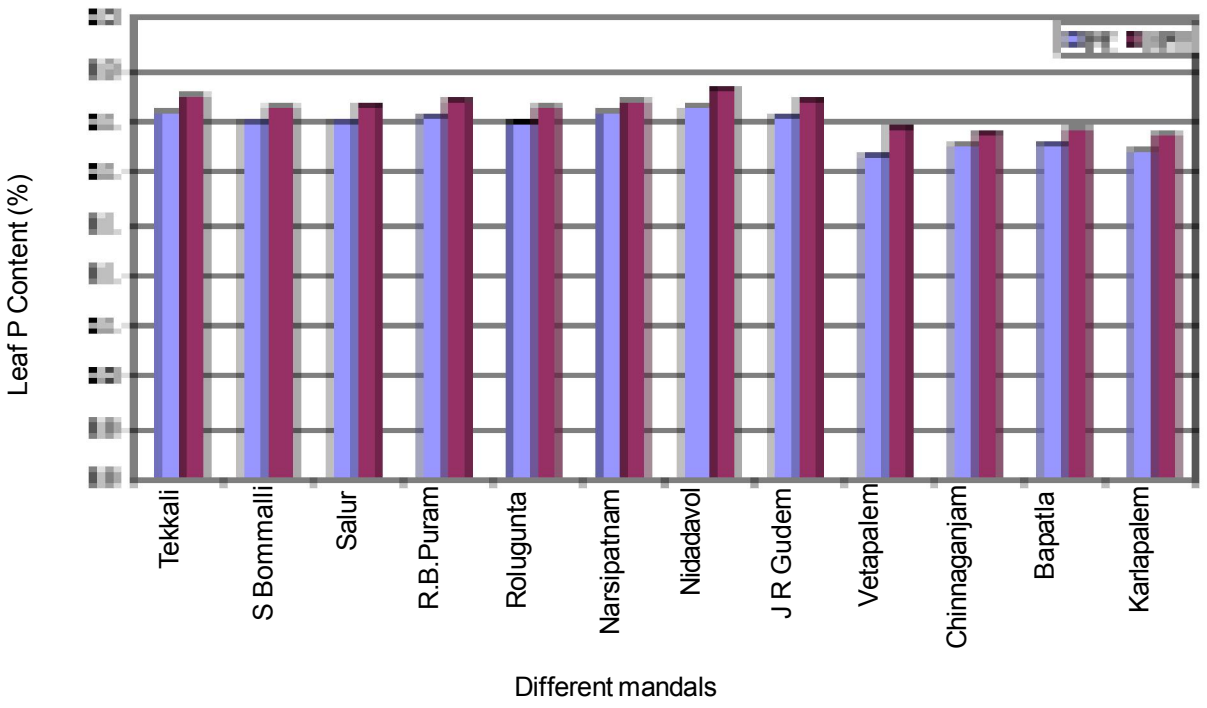
Table 2: Monthly mean leaf P content (%) of fruiting terminals (FT) and non-fruiting terminals (NFT) of the 12 mandals cashew orchards.

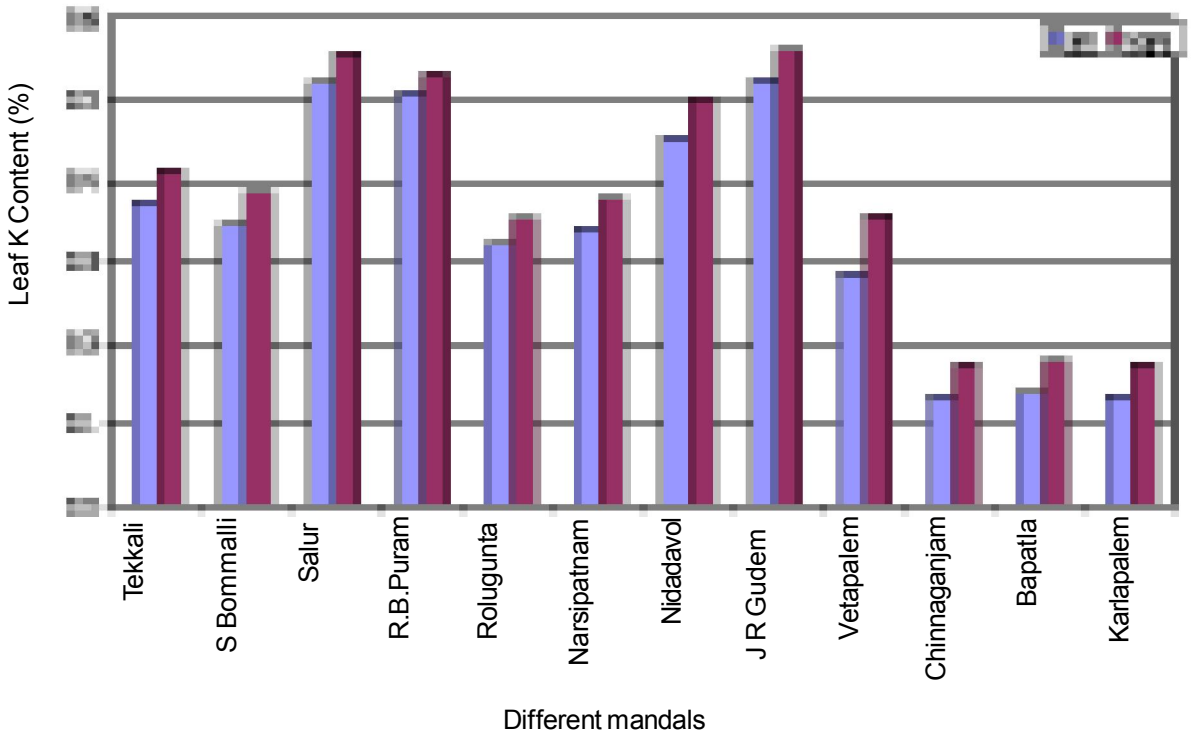
Orchards	Jul-06		Sep-06		Nov-06		Jan-07		Mar-07		May-07		Mean	
	FT	NFT	FT	NFT	FT	NFT	FT	NFT	FT	NFT	FT	NFT	FT	NFT
Tekkali	0.146	0.148	0.151	0.158	0.153	0.166	0.151	0.155	0.148	0.152	0.113	0.121	0.144	0.150
S. Bommalli	0.142	0.142	0.148	0.156	0.151	0.165	0.147	0.151	0.145	0.148	0.111	0.115	0.141	0.146
Salur	0.141	0.146	0.146	0.153	0.149	0.163	0.145	0.150	0.143	0.148	0.119	0.122	0.141	0.147
R. B.Puram	0.143	0.147	0.149	0.157	0.152	0.165	0.147	0.151	0.145	0.149	0.122	0.123	0.143	0.149
Rolugunta	0.141	0.145	0.147	0.154	0.148	0.162	0.146	0.153	0.144	0.150	0.108	0.111	0.139	0.146
Narsipatnam	0.142	0.143	0.149	0.156	0.152	0.165	0.149	0.152	0.146	0.149	0.122	0.125	0.143	0.148
Nidadavol	0.147	0.150	0.152	0.159	0.154	0.168	0.150	0.164	0.146	0.151	0.124	0.128	0.146	0.153
J.R. Gudem	0.144	0.148	0.148	0.155	0.150	0.164	0.147	0.153	0.149	0.154	0.121	0.124	0.143	0.150
Vetapalem	0.137	0.138	0.142	0.149	0.145	0.159	0.144	0.147	0.139	0.142	0.056	0.094	0.127	0.138
Chinnaganjam	0.134	0.137	0.138	0.145	0.141	0.155	0.140	0.143	0.136	0.140	0.095	0.098	0.131	0.136
Bapatla	0.136	0.137	0.141	0.148	0.144	0.158	0.143	0.148	0.138	0.141	0.092	0.095	0.132	0.138
Karlapalem	0.133	0.136	0.136	0.144	0.139	0.153	0.141	0.146	0.134	0.139	0.089	0.092	0.129	0.135
Range	0.133	0.136	0.136	0.144	0.139	0.153	0.140	0.143	0.134	0.139	0.056	0.092		
	0.147	0.150	0.152	0.159	0.154	0.168	0.151	0.164	0.149	0.154	0.124	0.128		
Mean	0.141	0.143	0.146	0.153	0.148	0.162	0.146	0.151	0.143	0.147	0.106	0.112		
SEm±	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.04	0.04		
CD (0.05)	0.05	0.05	0.05	0.05	0.05	0.06	0.03	0.06	0.06	0.05	0.01	0.01		
CV (%)	9.85	8.38	8.64	7.26	8.64	8.12	9.41	9.23	11.59	9.07	8.48	7.56		

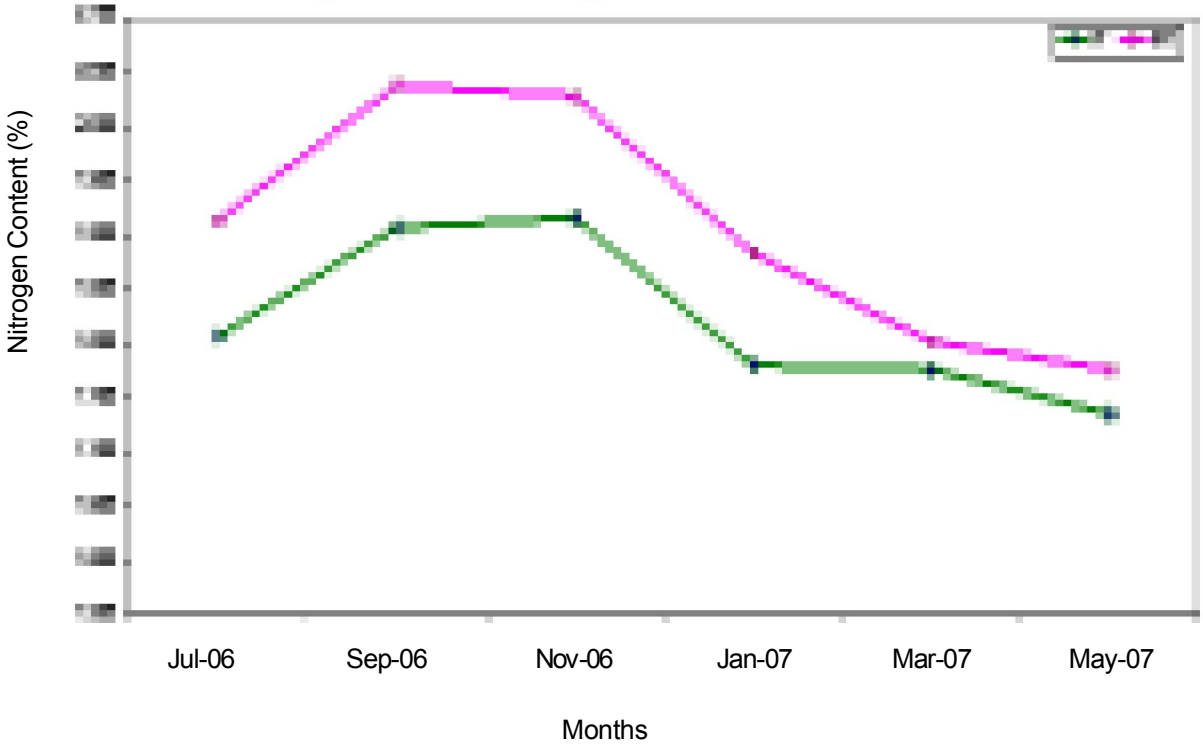
Table 3. Monthly mean leaf K content (%) of fruiting terminals (FT) and non-fruiting terminals (NFT) of the 12 mandals cashew orchards.

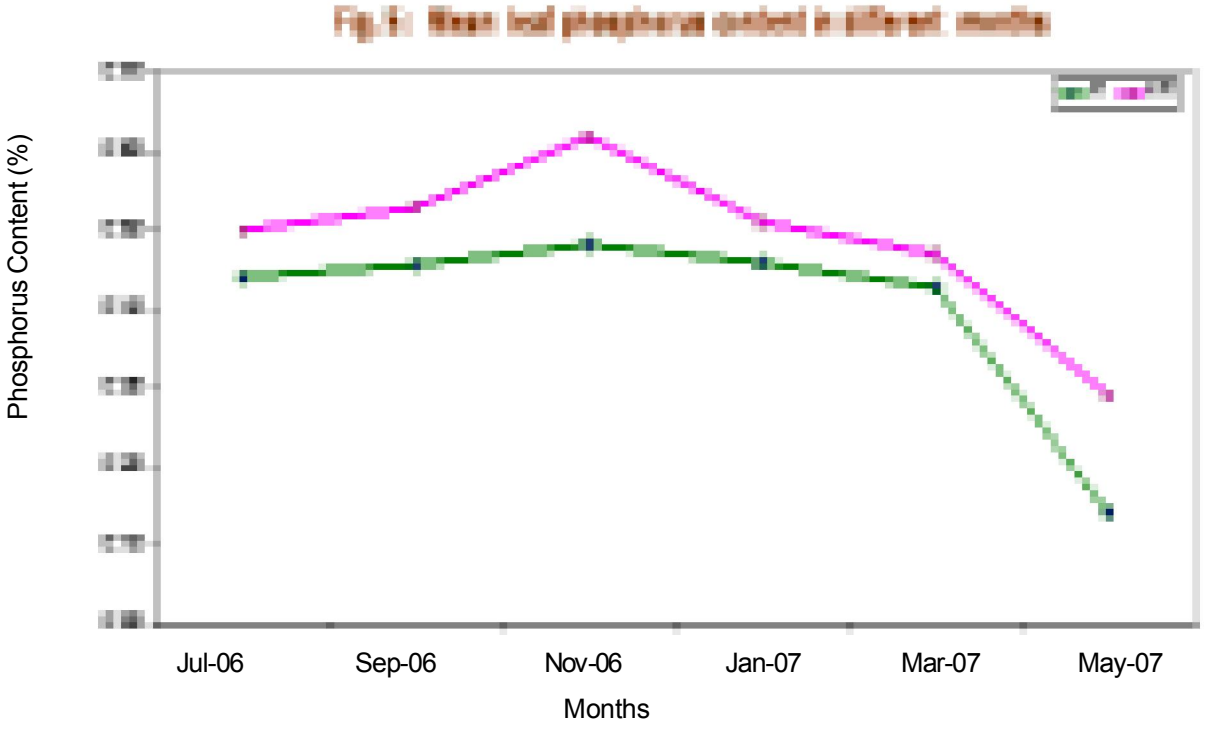
Orchards	Jul-06		Sep-06		Nov-06		Jan-07		Mar-07		May-07		Mean	
	FT	NFT	FT	NFT	FT	NFT	FT	NFT	FT	NFT	FT	NFT	FT	NFT
Tekkali	0.326	0.338	0.342	0.358	0.563	0.715	0.354	0.368	0.338	0.351	0.332	0.362	0.376	0.415
S. Bommalli	0.322	0.344	0.348	0.367	0.373	0.525	0.361	0.375	0.344	0.349	0.339	0.371	0.348	0.389
Salur	0.504	0.516	0.529	0.542	0.541	0.693	0.540	0.556	0.517	0.529	0.499	0.522	0.522	0.560
R. B.Puram	0.525	0.537	0.503	0.517	0.531	0.592	0.514	0.527	0.501	0.514	0.491	0.514	0.511	0.534
Rolugunta	0.309	0.321	0.315	0.329	0.339	0.491	0.327	0.341	0.311	0.323	0.327	0.329	0.321	0.356
Narsipatnam	0.293	0.305	0.299	0.317	0.323	0.475	0.311	0.325	0.295	0.308	0.528	0.543	0.342	0.379
Nidadavol	0.499	0.511	0.514	0.525	0.366	0.518	0.551	0.568	0.519	0.532	0.287	0.348	0.456	0.500
J.R. Gudem	0.507	0.519	0.521	0.535	0.545	0.694	0.533	0.547	0.537	0.549	0.520	0.531	0.527	0.563
Vetapalem	0.301	0.313	0.318	0.335	0.343	0.495	0.331	0.345	0.313	0.317	0.126	0.342	0.289	0.358
Chinnaganjam	0.119	0.131	0.133	0.147	0.156	0.308	0.144	0.159	0.129	0.142	0.122	0.153	0.134	0.173
Bapatla	0.122	0.134	0.152	0.160	0.161	0.313	0.149	0.158	0.134	0.147	0.127	0.157	0.141	0.178
Karlapalem	0.117	0.129	0.150	0.163	0.155	0.307	0.145	0.153	0.131	0.143	0.125	0.151	0.137	0.174
Range	0.117	0.129	0.133	0.147	0.155	0.307	0.144	0.153	0.129	0.142	0.122	0.151		
	0.525	0.537	0.529	0.542	0.563	0.715	0.551	0.568	0.537	0.549	0.528	0.543		
Mean	0.329	0.342	0.344	0.358	0.366	0.511	0.355	0.369	0.339	0.350	0.319	0.360		
SEm±	0.01	0.49	0.01	0.01	0.01	0.01	0.06	0.02	0.01	0.01	0.01	0.00		
CD (0.05)	0.03	1.39	0.03	0.00	0.04	0.04	0.17	0.05	0.01	0.00	0.01	0.01		
CV (%)	7.66	7.79	7.66	7.72	8.48	8.50	7.74	10.70	9.85	8.38	9.41	9.23		

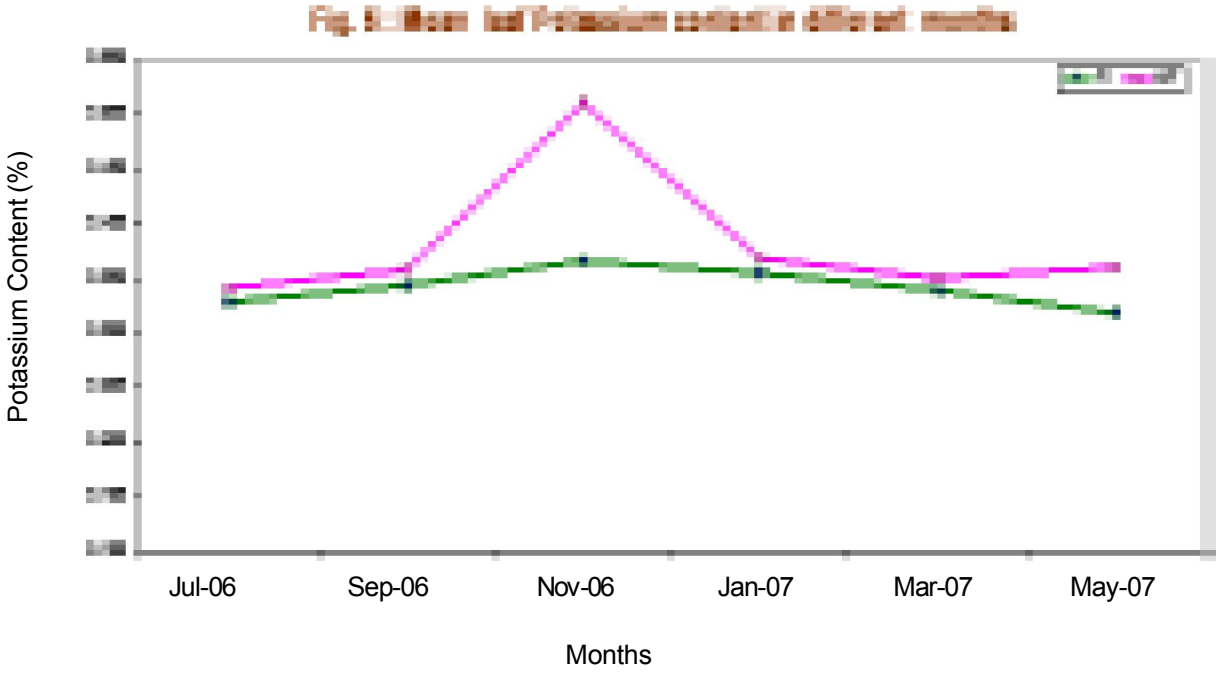

FT
NFT
Leaf N Content (%)
Tekkali
S Bommalli
Salur
R.B.Puram
Rolugunta
Narsipatnam
Nidadavol
J R Gudem
Vetapalem
Chinnaganjam
Bapatla
Karlapalem
Different mandals


Leaf P Content (%)
Tekkali
S Bommalli
Salur
R.B.Puram
Rolugunta
Narsipatnam
Nidadavol
J R Gudem
Vetapalem
Chinnaganjam
Bapatla
Karlapalem
Different mandals


Leaf K Content (%)
Tekkali
S Bommalli
Salur
R.B.Puram
Rolugunta
Narsipatnam
Nidadavol
J R Gudem
Vetapalem
Chinnaganjam
Bapatla
Karlapalem
Different mandals


Nitrogen Content (%)
Jul-06
Sep-06
Nov-06
Jan-07
Mar-07
May-07
Months





the reproductive phase. Infact nitrogen is of the prime importance for synthesizing carbohydrates in their chlorophyll molecules it could have recorded more in non-fruiting terminals. Higher content of nitrogen noticed during November may be due to increased light intensity, where by the photosynthesis would have increased resulting in net synthesis of carbohydrates as described by Hoover *et al.* (1934).

The leaf nitrogen content (Fig 4) was found to be declining from November to May in both fruiting and non- fruiting terminals while its content in non-fruiting terminals showed maximum levels in the month of September and November and lower levels in other months of study. This low level in leaf N content of fruiting terminals observed in January, March and May could be attributed to utilization of

nitrogen for either formation of new shoots or flower buds under local prevailing agro-climatic conditions.

The leaf P content presented in Table 2 revealed that the P content ranged from 0.056 per cent in fruiting terminals in May of the cashew nut orchards of Karlapalem mandals of Guntur district to 0.168 percent of non- fruiting terminals of cashew nut orchards in Nidadavol mandal of West Godavari district.

It explains that the leaf P content was found to be varying from deficient and low ranges as per leaf nutrient guide of Robinson *et al.* (1997). Based on this leaf nutrient guide with respect to P content, the cashew nut orchards of Vetapalem, Chinnaganjam, Bapatla and Karlapalem mandals could be grouped in deficient range. In rest of eight mandal cashew nut orchards, the leaf phosphorus content was found to be low. It explains that the cashew nut growers of these mandals have to necessarily supply the phosphorus to the cashew nut gardens in order to maintain the optimum phosphorus level in deficient mandals and low ranges mandals to bring the P content to optimum level in these mandals. The mean leaf P content (Fig 5) was found to be increasing from July to November and thereafter *i.e.* from November to May it was showing a declining trend. This high accumulation of leaf phosphorus content in November and declining trend later indicates that phosphorus might have been utilized in flowering, fruit setting and fruit development during the period of November to March.

The leaf K content (Table 3) was found to be varying from 0.117 per cent of fruiting terminals in July month of Karlapalem mandal of Guntur district to 0.715 per cent in November month of non- fruiting terminals in Tekkali mandal of Srikakulam district cashew nut orchards. This shows that there was a variation in the leaf mean K content from mandal to mandal and month to month. These variations may be attributed to soil heterogeneity, irregular distribution of manures and fertilizers, cultural abuses etc., These values are, in general, were falling under deficient to low range in coastal districts of Andhra Pradesh. In general, based on leaf nutrient guide of Robinson *et al.* (1997), the cashew nut gardens of the Chinnaganjam mandals of Prakasam district, Bapatla and Karlapalem mandals orchards of Guntur district were falling under deficient range while remaining mandals orchards were low for K leaf content. In general, non-fruiting terminals recorded higher leaf K content than fruiting terminals in all the months of study (Fig.3). The lower K content in fruiting terminals could be attributed to utilization of K in fruit development of cashewnut. Although leaf K content (Fig.6) of both fruiting terminals and non-fruiting terminals, initially showed a declining trend, but gradually increased up to November and thereafter i.e. November to May showed a declining trend. This trend of decreased K content from November to May indicated the depletion of nutrients due to consequent mobility of potassium ions to developing fruits. These results are in conformity with Harishkumar *et al. (*1982) in cashew.

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(Received on 20.12.2009 and revised on 08.01.2010)