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STANDARDISATION OF PERIOD OF SAMPLING FOR FOLIAR DIAGNOSIS IN PEPPER IN RELATION TO NITROGEN, PHOSPHORUS AND POTASSIUM*

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Basic studies for practising foliar diagnosis in pepper have been carried out by Deward (1969) in Sarawak who identified the physiologically important months for pepper as January, April and July which synchronised with periods of fruit initiation, berry enlargement and harvest respectively. Standardisation of season or period of sampling for foliar diagnosis in pepper has not been attempted under the agroclimatic conditions of Kerala which is characterised by intermittent wet and dry periods characteristically different from the climatic conditions of Sarawak. In Kerala, new flushes are formed with the onset of premonsoon showers, in the middle of May. Berry development takes place after two to three months and harvest begins from December onwards. Considering the agro-climatic conditions and physiological aspects of the crop in general, an attempt was made to standardise the season best suited for the collection **of leaf** sample.

Materials and Methods

The study was conducted during 1979-81 by drawing samples from pepper vines (variety, Panniyoor 1) grownunder a NPK fertilizer trial, commenced in 1975 in a 3^3 factorial experiment totally confounding NP^2K^2 in a randomised block design with two replications. The levels of nutrients applied were 50, 100 and 150 g N/ vine/year, 50, 100 and 150 g P_2O_5/vine/year and 50, 100 and 150 g K_2O/vine/year. The fertilizers are applied annually during August to September.

In order to standardise the optimum season for drawing samples for dianostic purpose, the first **older** mature leaf of fruit bearing laterals which was reported to be the index leaf for foliar diagnosis in pepper under Kerala conditions (Sushama *et al.*, 1982) was collected during the following periods,

Sl. No.	*Periods*	*Months*
1	After the harvest of berries	March
2	Prior to flushing	May
3	One month afterflushing	July
4	Two months after flushing	August
5	Three months after flushing	September
6	Four months after flushing	October
7	Five months after flushing	November
8	Six months after flushing	December
9	Seven months after flushing	January

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The content of total N, P and K in the index leaf was determined using the analytical procedures outlined by Jackson (1958).

The statistical procedure suggested by Snedecor and Cochran (1967) was followed for establishing relationship between mean yield of pepper and nutrient levels in leaf at different periods (Table 1). In order to reduce year-wise variation in yield, the tota! yield of vines for the period 1976–77 to 1980-81 was expressed as the mean yield of black pepper/ha/year.

Results and Discussion

Data on the effect of NPK treatment and period of sampling on percentage of N, P and K in leaf are presented in Table 2.

Nitrogen

The data revealed that in general the content of N in leaf remained high before flushing. With the onset of flushing, rapid increase in the dry matter production of vines resulted in dilution of nutrient concentration of leaf tissue and the N content of leaf continuously decreased upto the 4th period. Consequent to fertilizer application, the leaf N content increased during the 5th and 6th periods. Since the demand of nutrients, for berry development was high, the level of N in leaf then declined till the stage of harvest. The N level in leaf decreased from a value of 3.53% recorded at 6th period to 2.72% at harvest.

The maximum requirement of N for the crop took place at the onset of flushing. The N content of leaf at this period markedly differed in accordance with the levels of fertilizer application, the leaf nutrient levels being 3.42, 3.82 and 4.14% for for n_0, n_1 and n_2 levels. However, this increase in the N content due to increase in N application was not found uniformly reflected at all other periods. This indicated that leaf sample collected just before the flushing of vines was most sensitive for levels of nitrogen.

Phosphorus

When the distribution of phosphorus in the index leaf over different periods of sampling was examined, it was seen that the phosphorus contents of the first mature leaf at the first and second periods were relatively low as 0.119% and 0.116% respectively and then increased gradually and steadily. This continuous increase in the P content of leaf after the flushing of vines was a clear indication of active P absorption synchronizing with the distribution of rain over the different periods of sampling. The maximum P content of leaf was recorded at the 7th period as 0.209% and thereafter a genera! decline occurred which coincided with the berry enlargement. However, the soil was able to provide a steady supply of P irrespective of the level of fertilizer application.

On examining the effect of NPK treatments on P content of leaf, it was revealed that the P content increased with the increase in levels of P application

Table 1

The mean yield of black pepper (1976-77 to 1980-81}

Sl. No.	Treatment NKP	Mean yield kg/ha
1	000	599.20
2	001	882.00
3	002	1,022,60
4	010	1,214.40
5	011	875 60
6	012	1,491.60
7	020	648.80
8	021	903.80
9	022	1,738.00
10	100	722.80
11	101	799.00
12	102	679.40
13	110	781.80
14	111	1,281.40
15	112	805.80
16	120	1,233.40
17	121	1,066.80
18	122	581.00
19	200	862.00
20	201	802.00
21	202	915.20
22	210	711.40
23	211	1,107.60
24	212	1,089.80
25	220	462.20
26	221	1,090.00
27	222	794.40

irrespective of the period of sampling. The mean values for P percentage in leaves corresponding to P_0, P_1 and P_2 levels of application were 0.163, 0,167 and 0.174 respectively when the effects of periods were pooled.

Coefficient of simple linear correlations between cumulative yield of pepper and P content of leaf were significant for the 5th period ($r = 0.462^*$) and 7th period ($r = 0.405^*$) of sampling at 5% levels of significance.

Table 2

The content of nitrogen, phosphorus and potassium in leaf in relation to period of sampling and levels of N, P and K

Treatment	Period of sampling								
	1	2	3	4	5	6	7	8	9
				Nitrogen %					
n_0	3.39	3.42	3.39	2.73	3,55	3.28	2.61	2.84	2.69
n_1	2.85	3.82	3.17	2.37	3.28	3,18	2.58	2.73	2.63
n_2	3.51	4.14	3.13	3.01	3.74	3.71	2.62	3.00	2.82
Mean	3.26	3.86	3.23	2,67	3.53	3.37	2,60	2.86	2.27
				Phosphorus %					
P0	0.121	0.126	0.163	0.173	0.137	0.202	0.193	0.158	0.194
p_1	0.115	0.113	0.162	0,193	0.146	0.204	0.222	0.163	0.190
p_2	0.122	0.109	0.155	0,189	0.148	0,219	0.204	0.174	0.208
Mean	0.119	0.116	0.160	0.182	0.144	0.209	0.207	0.165	0.198
				Potassium %					
k_0	1.26	1.16	1.37	1.64	1.72	1.13	1.32	1.22	1.06
k_1	1.46	1.54	1.50	1.77	1.78	1.61	1.32	1.31	1-34
k_2	1.58	1.66	1.47	1.89	2.01	1.76	1.61	1.17	1.39
Mean	1.44	1.46	1.44	1.77	1.84	1.50	1.42	1.23	1.26
C. D. (0.05) for comparing levels of N, P and K				0.182		0.003		0.092	
C. D. (0.05) for comparing periods				0.316		0.006		0.160	

Potassium

The pattern of variation in the K content of leaf over the different periods of sampling varied significantly with different levels of K applied. In general, the K content increased with the increasing periods of sampling upto the 5th period and declined thereafter. Potassium content of the leaf during initial sampling remained almost stable due to the fact that the growth of the plant was limited due to dry weather conditions. The high accumulation of K at the 5th period was due to increased uptake of K applied after the 4th period of sampling. The decline in the content of K in leaves from this period onwards may be due to withdrawal of the element from the leaf tissue to the developing berries. This was in conformity with the findings of Dewaard (1969). As in the case of P, the increased accumulation of K with advancing periods of sampling after flushing may be attributed to the increased rate of absorption of this nutrient from the soil consequent to the onset of monsoons. The percentage of K in the first period was 1.44 which increased to a value of 1.84 at 5th period and then declined to 1.26 in the last period.

Potassium content of leaf irrespective of period of sampling increased with the increasing levels of potassium application. When the effect of period of sampling was pooled, the percentage of K in leaves corresponding to K_0, K_1 and K_2 levels of application were 1·31, 1.51 and 1.64 respectively.

Simple linear coefficients of correlation between the cumulative yield and K content of leaf were significant for the 1st, 2nd, 5th, 6th and 8th period of sampling while the coefficients of partial linear correlation between the same set of variables were significant only for the 2nd period at 1 % level of significance(0.571). The multiple correlation coefficient was worked out to be 0.469 which was significant at 5% level of significance for these variables.

These observations tend to suggest that the period just prior to flushing is the most suitable one for the collection of leaf sample for foliar diagnosis. The collection of sample for foliar diagnosis at this stage will bo most advantageous since addition of fertilizers can be done simultaneous with spike initiation which takes place during flushing by which time the results of foliar diagnosis can also be made use of in working out the fertiliser requirement of crop,

Summary

A study was conducted at the College of Horticulture, Vellanikkara to standardise the most suitable season for foliar diagnosis in pepper. The first mature leaf of fruit bearing laterals of Panniyoor 1 pepper vines grown under the NPK fertilizer trial at the Pepper Research Station Panniyoor, Taliparamba. Cannanore district was made use of. The period just before flushing appeared to be the most suitable for the collection of samples intended for foliar diagnosis of nitrogen, phosphorus and potassium.

സംഗ്രഹം

കുരുമുളക് വള്ളികളിലെ പോഷണമൂലക പരിശോധന നടത്തുന്നതിന് മുപ്പെത്തിയ, പ്രവർത്തനക്ഷമമായ ഇലകളും ശേഖരിക്കേണ്ട ഏറ്റവും പറ്റിയ സമയം കണ്ടുപിടിക്കുന്നതിനുവേണ്ടി, വെള്ളാനിക്കര ഹോർട്ടിക്കൾച്ചർ കോളേജിൽ ഒരു പരീക്ഷണം നടത്തുകയുണ്ടായി. പന്നിയൂർ കുരുമുളക് ഗവേഷണ കേന്ദ്രത്തിൽ പാനവിധേയമായ പന്നിയൂർ–1 ഇനത്തിന്റെ ഒരു രാസവള പരീക്ഷണ തോട്ടത്തിലെ പൂക്കുന്ന ശിഖരങ്ങളിൽനിന്നും ഇലകളും തിരഞ്ഞെടുത്ത് രാസനിർണ്ണയം ചെയ്യുകയുണ്ടായി. പാകൃജനകം, ഭാവഹം, ക്ഷാരം എന്നീ മൂലകങ്ങളുടെ തോത് വിളവുമായി ബന്ധപ്പെടുത്തുന്നതിന് വള്ളികളും തളിരിടുന്നതിനു തൊട്ടു മുൻപുള്ള സമയം അനുയോജ്യമാണെന്നു കണ്ടു.

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