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NUTRIENT CONTENT OF NITROGEN, PHOSPHORUS, POTASSIUM, CALCIUM AND MAGNESIUM IN GREENGRAM (*Vigna radiata* (L) WILCZEK) AT DIFFERENT GROWTH STAGES IN RELATION TO YIELD

V. THANDAPANI

The effect of the 15 genotypes of greengram with reference to content of nitrogen, phosphorus, potassium, calcium and magnesium was studied at chosen growth stages in different parts of the plant. The trend of events during the crop growth did not differ much. Nitrogen and phosphorus showed positive association with yielding ability of the genotypes, while calcium and magnesium exhibited uncertain relationship. Potassium content had favourable relationship in most of the high yielders.

Genotype variation and specificity regarding content, utilization and transport of materials is there. A comparative study of the nutritional content of genotypes at various stages of crop in different parts of the plant will be useful. On the basis of the above background and with the objective of making a comparative assessment and evaluation, 15 genotypes of greengram were chosen for the present study which were arbitrarily grouped into three units namely high (PIMS4, Co.3. 11/99, ML 69, Pusa Baisakhi) medium (T.. 11/395, LAM GG 127, ML 73. 10/303) and low (Km 1, PH 6, ML 62, DM/2, Mll 1) yielders. In blackgram, Vijayalakshmi (1980) studied the distribution

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of elements in 12 genotypes. The nitrogen status was markedly high at peak flowering with progressive depletion towards harvest. In greengram, Moula and Krishnamoorthy (1972) stated that in respect of potassium there was only one peak which normally concided with intensive vegetative growth and flower initiation. Dalal (1980) reported that after high level of initial phosphorus a decline was evident during flowering stage in pigeon pea. Ohlrogge (1960) stated that tenfold range of (0.26 to 2.80 per cent) of calcium and 15 fold increase in magnesium concentration were noted in soybean.

MATERIALS AND METHODS

Investigations outlined in this paper was carried out during 1978-81 in the Department of Crop physiology, Tamil Nadu Agricultural University, Coimbatore-3. In the present study an attempt was made to bring out the differences in nutrient content of 15 genotypes of greengram at various stages of crop growth in different parts of plant. The 15 genotypes were arbitrarily grouped into high yielders ($PIMS_4$, Co 3, 11/99 ML 69 and Pusa Baisakhi), medium yielders (T 44, 11/395, LAM GG 127, ML 73 and 10/303) and low yielders (KM_1, PH_6 ML 62, DM/2 and MH 1). Plant samples were taken at four stages of crop growth namely vegetative, stray flowering, peak flowering and harvest correspondingly to 22nd, 36th, 50th and 64 th day after sowing when nutritional changes are expected. A total of 30 plants per genotype (10 from each replication) were taken per sample. The plants were dried, pooled and separated into stem, leaf, reproductive parts and seed. These independent parts were powdered and analysed for nitrogen (Humpheries, 1956), phosphorus (Jackson, 1962) potassium (Flame photometer method), calcium and magnesium (Titre method).

RESULTS AND DISCUSSION

For the critical judgement, the content has been determined with a view to have adequate information for comparative assessment of the genotypes.

i) *Nitrogen* (Table 1) : Regarding content in the stem impressive feature was that in most of the genotypes, either at vegetative or stray flowering maximum values were recorded, and thereafter a declining trend was evident. Leaf nitrogen in all the genotypes was higher than values recorded either in root or stem. As in the case of stem, maximum nitrogen was recorded either at vegetative or stray flowering stage and subsequently a gradual drop followed by a steep fall towards harvest was seen. The content either in the reproductive parts or seed did not show distinctly the individuality of genotypes. The nitrogen content in nodules was estimated and reported in Table 2. The values relating to content did not provide any particular trend to associate the character with genotypic efficiency.

ii) *Phosphorus* (Table 3) : In the case of stem there was a progressive decrease in values in the content from vegetative (2.50 to 3.30 mg/g) to harvest (1.00 to 1.60 mg/g). The decline after peak flowering suggested again the possible transport of material to reproductive sector. The content in leaf, peak values were recorded either at vegetative or stray flowering stages but there was no particular variation among genotypes.

Table 1 : Total nitrogen content (mg/g) in 15 genotypes of greengram.

Genotype	Root				Shoot				Nodule		Yield/ plant
	I	II	III	IV	I	II	III	IV	III	IV stages (seed)	(g)
PIMS 4	14.7	14.0	13.3	8.4	26.6	26.0	25.2	18.2	20.3	38.5	4.25
CO 3	13.3	18.2	12.6	11.9	27.3	29.4	19.6	16.1	21.0	39.2	4.15
11/99	16.3	13.3	11.2	10.5	25.3	23.8	19.6	16.1	25.2	38.5	3.80
ML 69	13.3	12.6	11 9	9.1	27.3	25.2	23.1	18.2	23.1	38.5	3.58
Pusa Baisakhi	14.7	16.8	13.3	13.3	27.3	26.6	27.3	21.7	21.7	38.5	3.56
T 44	13.3	15.4	12.4	11.9	25.2	28.0	25.3	18.2	26.6	37.1	3.30
11/395	12.6	17.5	13.3	9.1	27.3	27.3	25.3	17.5	18.9	36.4	3.26
LAM GG 127	11.2	14.0	14.0	13.3	25.6	27.3	21·7	16.1	22.4	39.9	3.19
ML 73	16.8	14.0	12.6	10.5	23.8	28.7	26.6	21.7	25.2	39.2	3.16
10/303	14.0	18.2	14.0	9.1	23.8	26.9	23.1	19.6	22.4	37.1	3.09
KM 1	12.6	17.5	14.0	13.3	25.3	30.8	25.3	16.1	20.5	37.8	2.83
PH 6	16.1	13.3	11.2	12.6	28.7	26.5	22.4	17.5	21.0	36.4	2.56
ML 62	13.3	16.8	11.2	11.9	29.4	28.7	19.6	15.4	20.3	37.8	2 42
DM 12	13.3	16.8	14.0	9.1	25.3	26 9	25.3	18.2	21.7	38.5	2.38
MH 1	12.6	16.1	14 0	10 5	31.0	28.0	23.1	16.8	22.4	38.5	2.15
SE	—	—	—	—	—	—	—	—	—	—	0.25
CD	—	—	—	—	—	—	—	—	—	—	0.73**

I = Vegetative ; II = Stray flowering ; III = Peak flowering ; IV = Harvest.

Table 2: Total nitrogen content (mg/g) in nodules of 15 genotypes of greengram.

Genotype	Nodule				Yield/ plant (g)
			III	IV Stages	
PIMS 4	57.20	39.20	37.10	37.10	4.25
CO 3	53.00	37.80	36.40	35.40	4.15
11/99	46.20	38.20	39.90	32.20	3.80
ML 69	42.00	38.50	36.40	36.40	3.58
Pusa Baisakhi	45.50	38.50	33.60	37.80	3.56
T 44	52.50	37.80	39.20	37.10	3 30
11/395	40.60	37.10	40.60	40.60	3.26
LAM GG 127	49.00	39.90	42.00	36.40	3.19
ML 73	50.00	38.50	38.50	40.60	3.16
10/303	53.00	39.90	35.70	34.30	3.09
KM 1	55.80	37.80	35.70	44.10	2.83
PH 6	49.00	35.00	36.40	36.40	2.56
ML 62	49.00	35.00	35.70	41.30	2.42
DM/2	36.40	39.20	41.30	39.20	2.38
MH 1	57.00	33.60	35.70	41.30	2.15
SE	—	—	—	—	0.25
CD	—	—	—	—	0.73**

: Vegetative ; II = Stray flowering ; III = Peak flowering ; IV = Harvest

Table 3 : Total phosphorus content (mg/g) in 15 genotypes of greengram.

Genotype	Stem				Leaf				Reproductive parts		Yield/ plant (g)
	I	II	III	IV	I	II	III	IV	III	IV Stages (seed)	
PIMS 4	3.3	2.8	1.9	1.4	3.3	4.1	2.5	1.9	4.2	4.4	4.25
CO 3	3.2	2.6	1.6	1.6	3.8	2 6	2.2	2.0	3.6	4.2	4.15
11/99	3.0	2.8	1.8	1.6	3.4	4.2	1.7	2.0	3.7	4.3	3.80
ML 69	3.1	3.1	1.9	1.5	4.3	3.8	2.2	1.9	3.9	4.4	3.58
Pusa Baisakhi	3.4	3.1	1.9	1.5	3.9	3.7	2.2	1.9	3.6	4.3	3 56
T 44	3.2	3.2	2.1	1.6	3.2	4.4	2.2	2.1	4.0	4.2	3.30
11/395	2.8	2.7	2.4	1.6	3.6	3 2	2.4	1.9	3 7	4.3	3.26
LAM GG 127	3.1	3.4	2.0	1.5	3.6	3.3	2.3	2.0	4.2	4.6	3.19
ML 73	3.3	3.3	2.4	1.4	3.9	4.4	2.6	2.1	4.9	4 6	3 16
10/303	3.1	3.4	2.5	1.5	3.7	3.8	2.5	2.1	4 0	4.4	3.09
KM 1	3.2	3.1	1.9	1.5	3.9	3.7	2.4	1.8	3.9	4.2	2 83
PH 6	3.1	2 8	1.7	1.6	4.0	3 6	2.3	1.9	3.3	4.2	2 56
ML 62	2.8	2.9	1.8	1.4	3.8	3.7	2.4	2.1	3.6	4 3	2 42
DM 2	2.5	2.7	2.4	1.0	3.6	3 6	2.6	2.1	4.4	4.5	2 38
MH 1	3.0	3.3	2.4	1.5	3.2	3.6	2.4	2 0	3.7	4.3	2.15
SE	—	—	—	—	—	—	—	—	—	—	0.25
CD	—	—	—	—	—	—	—	—	—	—	0.73**

I = Vegetative ; II = Stray flowering ; III = Peak flowering ; IV = Harvest

Regarding the content in the reproductive parts, there was a slight improvement between peak flowering and harvest (seed). Among the genotypes no variation was noticeable.

iii) *Potassium* (Table 4) : In stem maximum potassium content was recorded at vegetative phase with a very gradual decrease towards harvest. The leaf content of potassium was less than the values recorded in the stem. Initial values were the maximum noted and gradual decrease at snbsequent stages was rather clear. The potassium content in reproductive parts showed that with initial higher content a silight drop was seen in the seed in respect of all the genotypes.

iv) *Calcium* (Table 5): The study of the calcium content in stem showed that in general the contents were more in stem at reproductive stage. Further, most often there were two peaks, one at stray flowering and other at harvest stage. Calcium content in the leaf was much higher than stem and there was progressive increase from vegetative (11.2mg/g) to harvest stages (32.0/mg/g). Comparatively the high yielders recorded slightly better than low and medium yielders towards harvest. The content in the reproductive parts showed that

Table 4 : Potassium content (mg/g) in 15 genotypes of greengram

Genotype	Stem				Leaf				Reproductive parts		Yield/ plant (g)
	I	II	III	IV	I	II	III	IV	III	IV stages (seed)	
PIMS 4	38.0	36.6	33.2	33.2	22.5	21.2	17.8	15.8	20.6	15.4	4.25
CO 3	38.0	34.6	34.0	31.8	24.4	21.2	19.4	15.8	19.4	15.2	4.15
11/99	37.4	35.2	34.6	29.8	23.8	20.8	17.2	14.6	19.4	14.2	3.80
ML 69	38.8	34.6	31 2	30.8	24.4	20.6	17.8	15.8	19.6	14.6	3.58
Pusa Baisakhi	38.8	34.0	32.6	33 2	24.4	21.4	19.0	13.6	20.0	14.2	3.56
T 44	37.4	36.0	32.6	32.6	24.0	22.4	20.0	15.8	21.2	14.0	3.30
11/395	35.2	35.2	32.6	34.0	24.0	21.4	17.6	14.8	19.6	15.2	3.26
LAM GG 127	35.2	34.6	30.4	31.8	23.4	22.5	15·8	15.2	20.2	15.2	3.19
ML 73	37 4	33.6	32.6	33.2	23.8	23.8	19.4	16.4	21.4	15.8	3.16
10/303	38 0	35.2	34.0	31.8	23.6	23.6	18.2	15.4	20.2	14.8	3.09
KM 1	36.0	34.0	31.8	31.8	23.8	23.8	18.4	14.6	19.4	14.6	2.83
PH 6	38.0	33.2	33.2	29.0	24.4	23.2	19.0	16.4	19.0	15.4	2.56
ML 62	39.4	34.0	32.6	28.4	24.4	22.5	17.2	13.6	20.0	15.4	2 42
DM/12	38.8	36.0	35.2	33 2	22.5	22.5	18.8	14.8	21.8	15.4	2.38
MH 1	38.8	36.0	29.0	27.8	23.0	23.0	19 0	16.6	18.4	15.2	2.15
SE	—	—	—	—	—	—	—	—	—	—	0.25
CD	—	—	—	—	—	—	—	—	—	—	0.73**

I = Vegetative ; II = Stray flowering ; III = Peak flowering ; IV = Harvest

Table 5 : Calcium content (mg/g) in 15 genotypes of greengram

Genotypes	Stem				Leaf				Reproductive parts		Yield/ plant (g)
	I	II	III	IV	I	II	III	IV	III	IV Stages (seed)	
PIMS 5	10.4	12.8	9.6	12.8	12.8	20.0	25.6	30.4	7.2	1.6	4.25
CO 3	12.0	16.0	12.0	16.8	14.4	16.0	23.2	28.8	5.6	1.6	4.15
11/99	9.6	12.0	11.2	13.6	12.8	18.4	25.6	28.0	5.8	1.6	3.80
ML 69	11.2	12.0	8 8	12 8	13 6	19.2	23.2	31.2	4.8	1.6	3.58
Pusa Baisakhi	8.8	9.6	8.0	12.8	14.4	16.8	23.2	32.0	5.6	1.6	3.56
T 44	8.8	12.8	10.4	12.0	12.8	15.2	21.6	27.2	4.8	1.6	3.30
11/395	10.4	11.2	9.6	14.4	12.8	20.0	20.8	25.4	5.6	1.6	3.26
LAM GG 127	8.0	8.8	9.6	12.0	13.6	22.4	24.8	28.8	4.8	1.6	3.19
ML 73	11.2	12.8	8.0	11.2	14.4	18.4	23.2	25.6	4.8	1.6	3.16
10/303	10.4	11.2	8.8	13.6	16.0	16.8	24.8	28.0	4.0	1.6	3.09
KM 1	8.8	9.6	8.0	11.2	16.0	16.8	21.2	26.4	5.6	2.4	2.83
PH 6	8.0	11.2	8.0	12.0	16.0	16.0	24.8	25.6	4.8	2.4	2.56
ML 62	9.6	10.4	8.8	13.6	11:2	15.2	20.8	25.3	4.0	1.6	2.42
DM/2	8.8	12.0	8 0	11.2	11.2	15.2	20.8	26.8	3.2	1.6	2.38
MH 1	10.4	11.2	8.2	12.0	12.0	16.8	19.2	27.6	4.0	1.6	2.15
SE	—	—	—	—	—	—	—	—	—	—	0.25
CD	—	—	—	—	—	—	—	—	—	—	0.73**

I = Vegetative ; II = Stray flowering ; III = Peak flowering ; IV = Harvest.

Table 6 : Potassium content (mg/g) in 15 genotypes of greengram

Genotypes	Stem				Leaf			Reproductive parts			Yield/ plant (g)
	I	II	III	IV	I	II	III	IV	III	IV Stages	
PIMS 5	7.7	10.6	8.2	8.7	5.8	9.6	7.2	11.5	5.3	2.9	4.25
CO 3	8.2	9.6	8.2	9.1	4.8	7.7	7.2	13.9	4.3	1.4	4.15
11/99	8.6	10.6	7.7	8.6	6.7	8.6	6.2	13.4	6.7	2.9	3.80
ML 69	7.7	9.1	8 6	9.1	6 3	6.7	5.3	12.5	5.8	1.9	3.58
Pusa Baisakhi	9.1	11.5	8.2	9.6	7.2	8.7	7.2	11.5	6.7	1.9	3.56
T 44	8.2	10.6	7.2	8.2	5.8	9.1	6.2	11.0	6.7	2.4	3.30
11/395	7.2	9.6	6.7	8.1	5.2	6.7	4.8	12.0	5.3	1.9	3.26
LAM GG 127	9.1	11.0	7.7	8.2	6.7	7.2	6.2	10.1	6.7	1.9	3.19
ML 73	9.6	11 5	8.2	9.1	4.8	6.7	5.3	10.6	7.7	2.4	3.16
10/303	8.6	10.1	8.6	9.1	7.2	8.6	5.8	10.6	6.7	1.9	3.09
KM 1	7.7	10.1	7.2	8 6	5.2	8.6	6.2	10.5	5.8	2.9	2 89
PH 6	7.2	9.6	7.2	8.2	5.8	9.6	7.7	11.0	5.3	3.4	2.56
ML 62	8.6	10.6	7.7	8.6	5.3	7.2	6.7	11.9	5.3	2.4	2.42
DM/2	9.1	10.1	7.2	8.2	48	9 6	5.3	10.6	8.2	2.4	2.38
MH 1	8.2	10.6	7.7	9.1	5.8	7.2	7.2	12.9	5.3	1.9	2.15
SE	—	—	—	—	—	—	—	—	—	—	0.25
CD	—	-	—	—	—	—	—	—	—	—	0.73**

I = Vegetative ; II = Stray flowering ; III = Peak flowering ; IV = Harvest

from the third of fourth stage there was a steep fall. Rather low content were recorded in the seed, being 1.6 mg/g in all the genotypes except KM. 1. and PH. 6.

v) *Magnesium* (Table 6). The content in stem showd that generally there were two peaks, one at stray flowering and other at harvest. The content of magnesium in leaf showed that although initially it was less than in stem, towards harvest there was an improvement and this was characteristics in all the genotypes employed. As in the case of stem, two peaks were evident at stray and peak flowering. Genotypic variation was negligible. The magnesium content in reproductive parts showed a decline from the third stage to harvested seed to less than half the value.

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