

## UPTAKE OF NITROGEN, PHOSPHORUS, POTASSIUM, CALCIUM, AND MAGNESIUM BY GREENGRAM (*VIGNA RADIATA* (L) WILCZEK) AT DIFFERENT GROWTH STAGES IN RELATION TO YIELD

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The behaviour of the 15 genotypes of greengram with reference to uptake 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, but quantitatively the superiority of high yielding group was rather evident. Among these N and P showed positive association with yielding ability of the genotypes, while calcium and magnesium exhibited uncertain relationship. Potassium behaved rather favourably in most of the high yielders.

Pulses are generally not heavy feeders on nutrient elements but at the same time optimum level is obligatory. Genotype variation and specificity regarding uptake, utilization and transport of materials is enormous. A comparative study of the nutritional pattern 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 (T44, 11/395, LAM GG 127, ML 73, 10/303) and low (KM 1, PH 6, ML 62, DM/2, MH 1) yielders. In greengram, Moula and Krishnamoorthy (1972) noted that nitrogen particularly accu-

mulated in pods and other elements in vegetative portion and in respect of potassium there was only one peak which normally coincided with intensive vegetative growth and flower initiation. 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. Dalal (1980) reported that after high level of initial phosphorus, a decline was evident during flowering stage in pigeon pea.

### 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

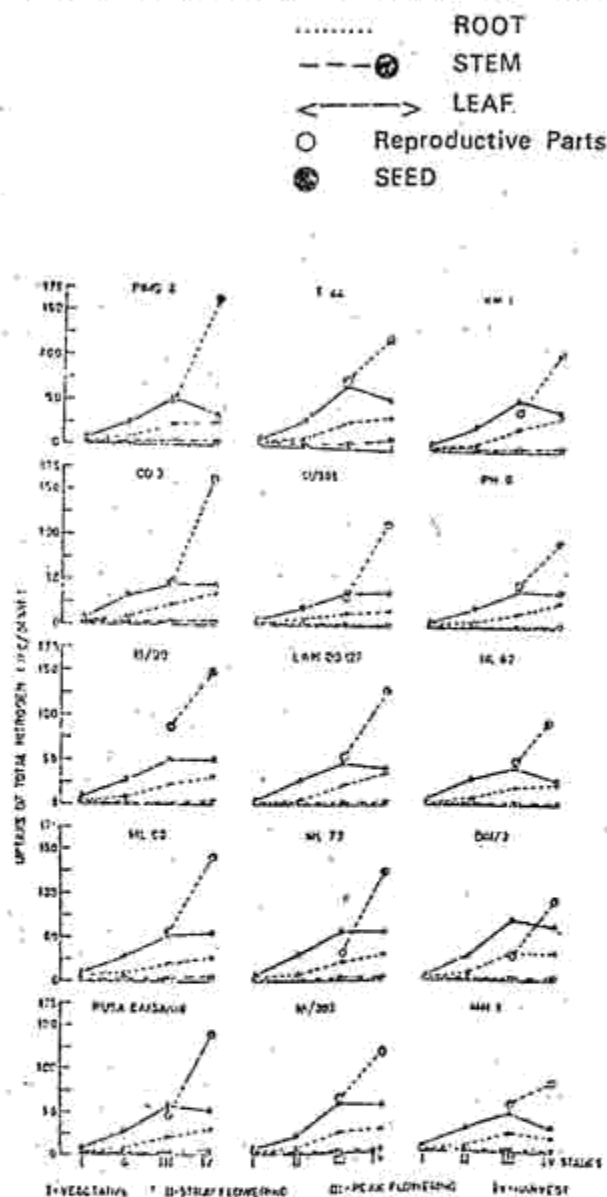
uptake of 15 genotypes of greengram at various stages of crop growth in different parts of plant. The 15 genotypes were arbitrarily grouped into high yielders (PIMS<sub>4</sub>, Co. 3, 11/99, ML 69 and Pusa Baisakhi), medium yielders T. 44, 11/395, LAM/GG 127, ML 73 and 10/303) and low yielders (KM<sub>1</sub>, PH<sub>6</sub>, 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 64th 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 root, 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, uptake has been determined with a view to have adequate information for comparative assessment of the genotypes.

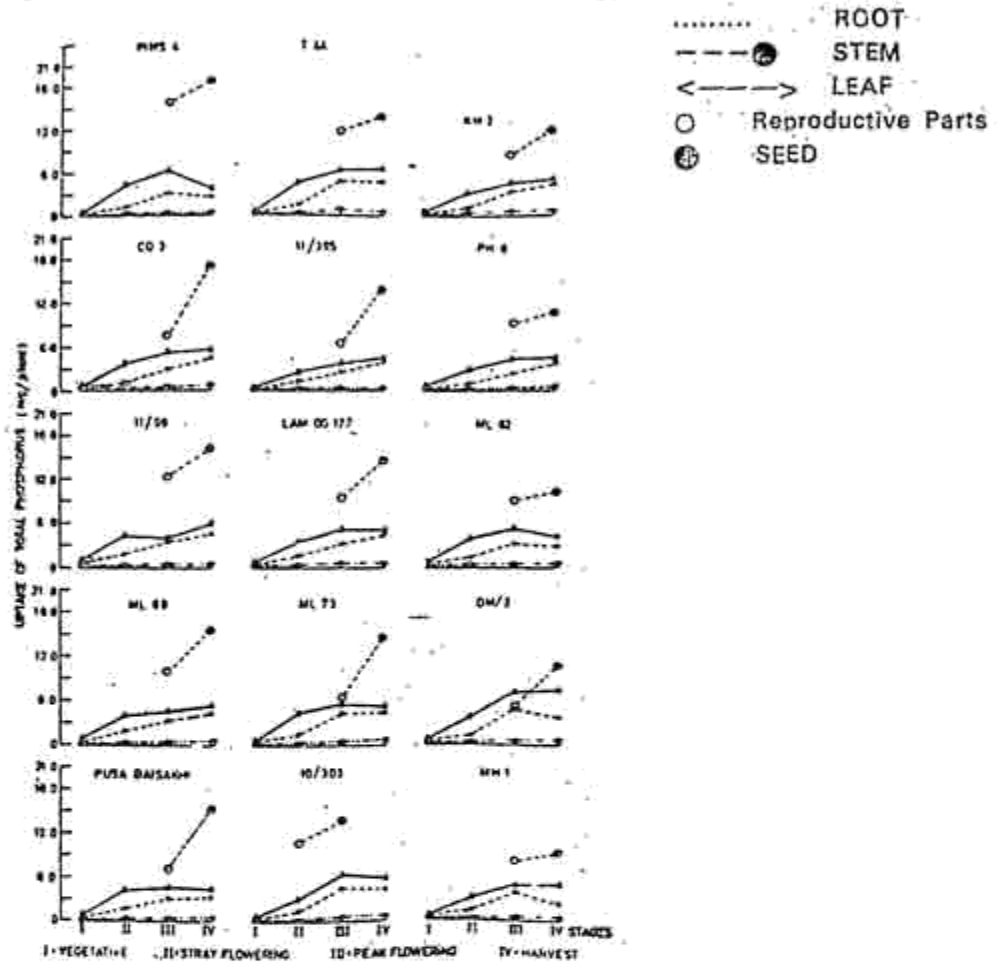
i) *Nitrogen* (Fig. 1): In considering the uptake pattern in root, a progressive improvement towards harvest was evident in most of the genotypes. Another feature was that a more rapid rise from stray flowering to peak flowering was generally in-

FIG 1. UPTAKE OF TOTAL NITROGEN IN 15 GENOTYPES OF GREEN GRAM



dicated. Uptake of nitrogen in the stem was maximum between stray and peak flowering in all the genotypes, with gradual rise towards harvest. Regarding uptake in leaf in most of the genotypes rapid increase was suggested till peak flowering, and there after a decline was clear. But the uptake pattern in reproductive parts or seed can be related to the genotype belonging to each group.

FIG 2. UPTAKE OF TOTAL PHOSPHORUS IN 15 GENOTYPES OF GREEN GRAM

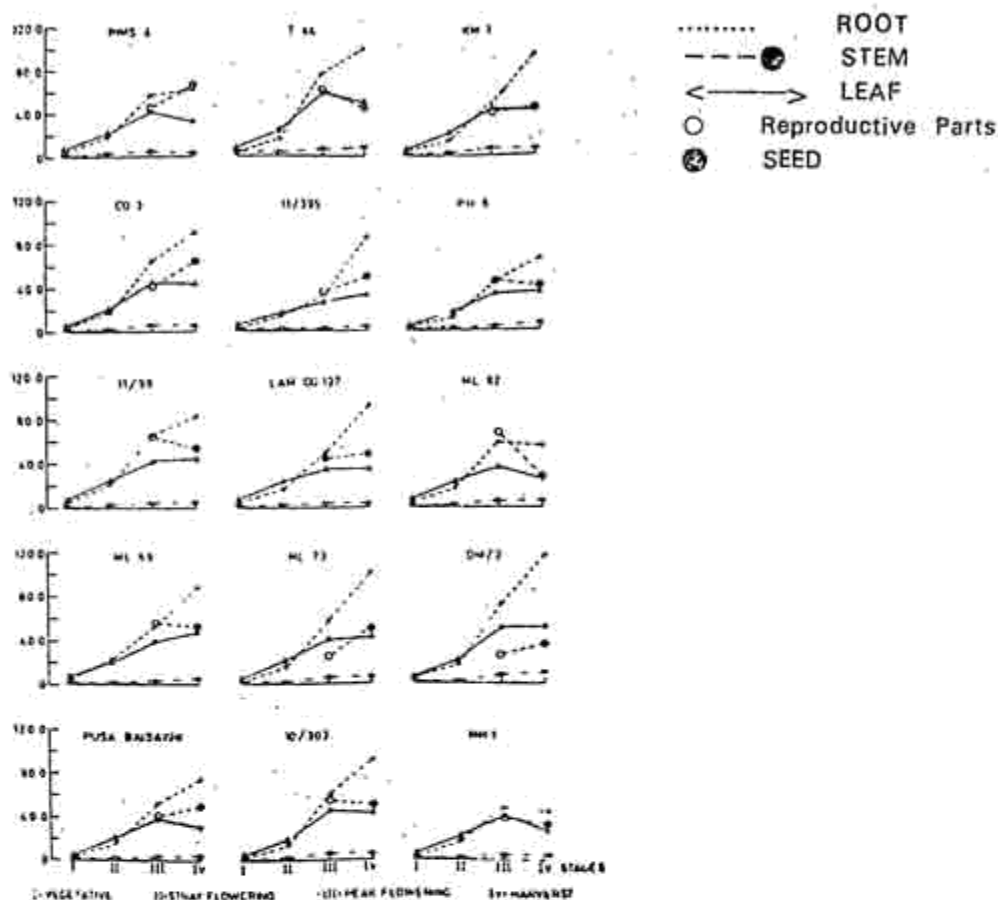


In the five high yielding genotypes the uptake varied from 137.06 to 163.33 mg/plant whereas in low yielders it ranged from only 82.78 to 106.97 mg/plant. The medium yielders showed a range of values from 114.64 to 127.2 mg/plant. The nitrogen uptake in nodules was estimated and reported in table 1. The uptake in nitrogen showed that with lower initial values a peak was recorded at peak flowering succeeded by a good drop towards harvest. The uptake was on the high range in some of the genotypes belonging to both medium and high yielding groups. The final total uptake gave

a very reliable indication of the differential partitioning of nitrogen into the seed.

ii) *Phosphorus* (Fig 2) : Regarding the pattern of uptake in root (0.04 to 0.84 mg/plant), the differences were not specific among the genotypes. Considering the uptake of phosphorus in stem, it was better than in the root. Regarding the uptake of phosphorus by leaf the initial values were rather low, ranging from 0.53 to 0.99 mg/plant with perceptible improvement at stray flowering. Thereafter while some of the genotypes recorded a peak at the third stage, others showed maximum

FIG. 3 UPTAKE OF POTASSIUM IN 15 GENOTYPES OF GREEN GRAM



value towards harvest. The uptake by the reproductive parts as judged from the peak flowering and values in the seed, showed that final values in the seed ranged from 15.13 to 18.70 mg/plant in high yielders, 13.60 to 14.51 mg/plant in medium yielders and 9.14 to 11.74 mg/plant in low yielders respectively. The variation among genotypes was mostly in the partitioning of the material into the seed and subsequent conversion to the final product.

iii) *Potassium* (Fig. 3) : The pattern of uptake in root did not show specific differences among genotypes.

Regarding the uptake in stem the initial value was rather low which was picked up at stray flowering, and subsequently rapid improvement towards peak flowering, and harvest in most of the genotypes. The initial uptake by the leaf was better than by root or stem. At subsequent stages of stray and peak flowering a rapid elevation was indicated as compared to initial reading. The uptake pattern in reproductive parts perhaps indicated some trends associated with the performance of the genotypes. While in some of the geno-

types there was reduction in the up-  
take by the reproductive parts corre-  
sponding to the third stage, in other  
there was a fairly higher rate in the  
harvested seed. Considering the up-  
take in final stage (seed) indicated

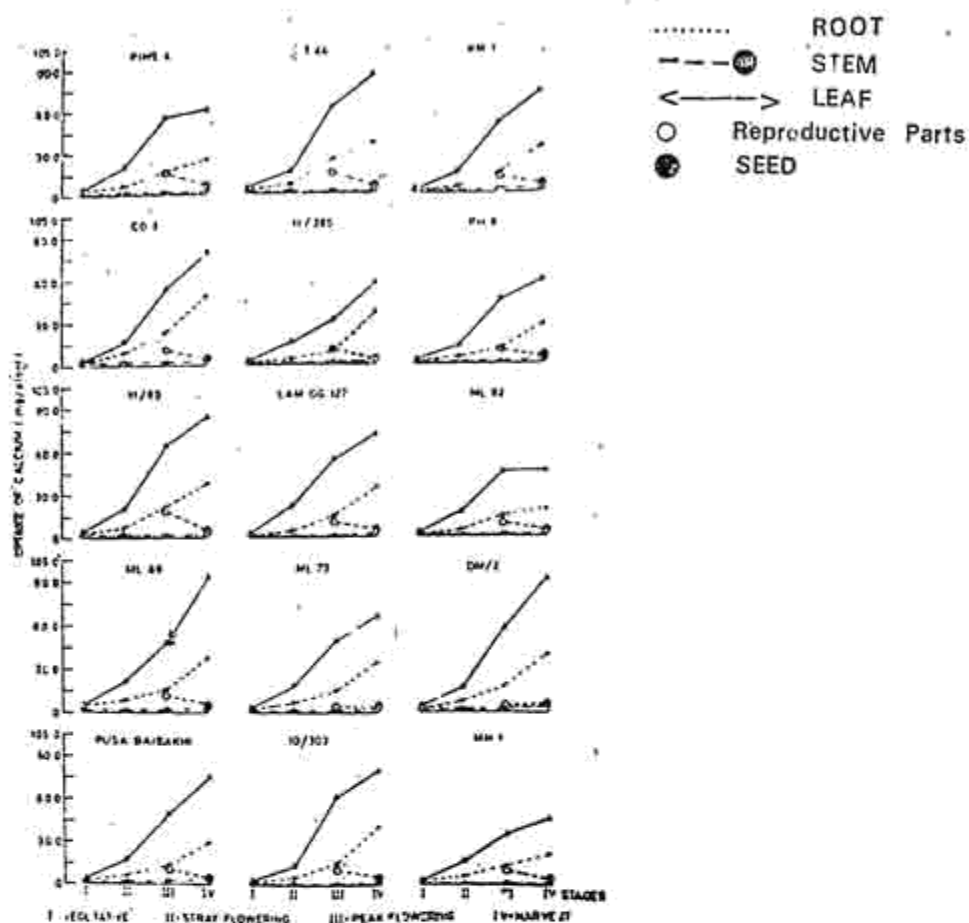
that the low yielders (32.68 to 41.32  
mg/plant), medium yielders (45.73 to  
49.93 mg/plant) and high yielders  
(50.55 to 65.45 mg/plant) which  
shows genotypic yielding ability.

Table 1 Total nitrogen uptake (mg/plant) in nodules of 15 genotypes of greengram.

Genotype No. / Name	Nodule				yield/plant(g)
	I	II	III	IV	
G1 PIMS 4	2.46	3.92	4.04	1.97	4.25
G2 CO3	2.59	3.02	6.55	2.55	4.15
G3 11/99	2.08	3.92	6.38	2.99	3.80
G4 ML 69	2.10	2.88	5.46	1.58	3.58
G5 Pusa Baisakhi	2.14	3.23	5.47	3.10	3.56
G6 T44	2.87	3.96	5.61	1.46	3.30
G7 11/395	1.62	2.42	5.06	1.44	3.26
G8 LAM GG 127	1.28	2.66	5.46	1.38	3.19
G9 ML 73	1.80	2.80	4.60	1.50	3.16
G10 10/303	1.80	2.59	4.49	1.06	3.09
G11 KM 1	0.73	2.23	3.25	1.39	2.83
G12 PH 6	0.90	1.55	5.44	1.47	2.56
G13 ML 62	2.05	1.91	3.39	1.07	2.42
G14 DM/2	1.40	1.92	3.45	1.18	2.38
G15 MH 1	2.52	1.88	2.53	1.25	2.15
S. E.	—	—	—	—	0.25
C. D.	—	—	—	—	0.73**

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

FIG 4. UPTAKE OF CALCIUM IN 15 GENOTYPES OF GREEN GRAM

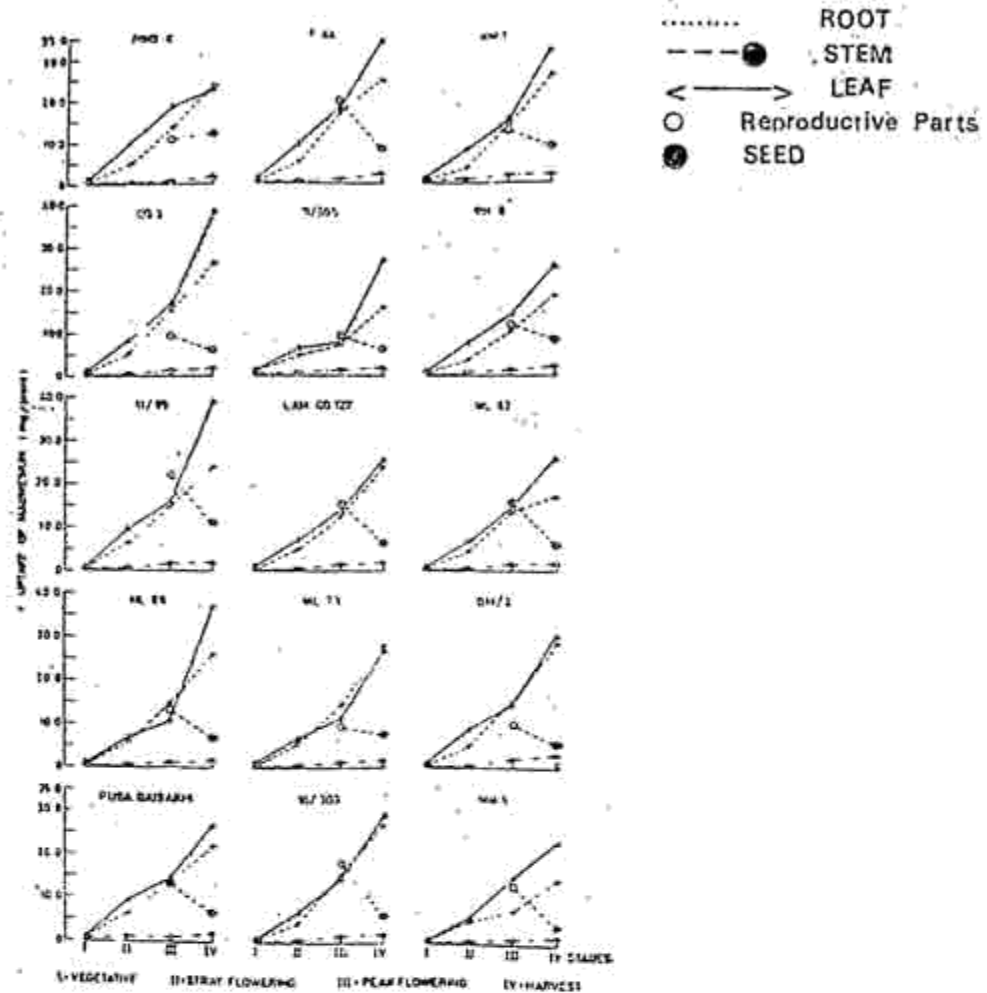


iv) *Calcium* (Fig. 4) : The trend of uptake in root had no relationship with the specificity of the genotype. The uptake of the element in stem showed active utilization from stage to stage. The uptake pattern in leaf showed a progressive increase from vegetative to harvest ranging from 73.61 to 91.25 mg/plant and low yielding genotypes recorded rather low level of uptake towards harvest. The uptake in reproductive parts showed a decline from rather a high level to low level between the third and fourth stages. There was not

much of a difference between high and medium yielders. The low yielders registered low uptake except KM 1 and PH 6.

(v) *Magnesium* (Fig. 5) : The uptake of magnesium in root was rather low with negligible values at vegetative stage which progressively improved to a maximum of only 3.33 mg/plant in DM/2. The uptake in stem showed a progressive improvement from vegetative to harvest in all the genotypes. Between each group, members showed low as well as high uptake and thus not providing any particular

FIG 5. UPTAKE OF MAGNESIUM IN 15 GENOTYPES OF GREEN GRAM



variation. The uptake in leaf showed a consequent improvement from vegetative to harvest in all the genotypes. This was rather high in Co. 3, 11/99 and ML 69 among high yielders. Among medium yielders except T. 44, other members showed comparatively lower uptake; similarly except KM. 1 and DM/2 the rest of the three genotypes is low yielders recorded low uptake. Regarding uptake in reproductive parts except PIMS 4 in which the value increased in the seed, the rest of the genotype a drop in the uptake was noticed from third to final stage. Between groups there was no suggestion of

any variation, each member behaving independently irrespective of the final performance.

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