

## Studies on the Uptake of Nitrogen and Phosphorus in Two Green Gram Varieties

BY

K. VENUGOPAL<sup>1</sup> and Y. B. MORACHAN<sup>2</sup>

### ABSTRACT

Effects of nitrogen (0 to 30 kg / ha) and phosphorus (0 to 60 kg / ha) and its uptake by the crop were studied in two green gram varieties [Rajendran and Pusa Baisaki moong]. Nitrogen levels individually had no influence on seed yield while phosphorus levels showed significant influence. Variety, nitrogen interaction on seed yield was observed. N, P and K per cent in plant dry matter were maximum at pre-bloom stage and decreased thereafter. Varieties showed marked difference in nutrient [N, P and K] uptake. Pusa Baisakhi moong removed lesser N, P and K but gave higher seed yield. Crop removal of phosphorus ranged between 5 and 10 kg / ha.

### INTRODUCTION

In raising the pulses production to the targetted levels, main emphasis has now been placed on cultivation of high yielding short duration varieties of green gram (Swaminathan, 1972). The nutrient removal and their uptake pattern have been accepted as criteria for fixing up the dose and time of fertilization (Srivastava, 1970). A review of manurial experiments with green gram conducted so far in India reveal lack of nutrient uptake studies. Without such data on nutrient removal and uptake pattern, the manurial schedules proposed to green gram are empirical. The present investigation was hence undertaken to assess the effects of N and P, their interaction and uptake in green gram

### MATERIALS AND METHODS

The experiment was conducted during *kharif*, 1972 at the Agricultural College Farm, Coimbatore. The soil in the experimental field was of calcareous sandy loam type, medium in available nitrogen and phosphorus (330 kg N and 22 kg P<sub>2</sub>O<sub>5</sub>/ha) and high in available potassium (914 kg K<sub>2</sub>O/ha). A split-plot design was adopted for the study. Four levels of nitrogen (0, 10, 20 and 30 kg N/ha) and four levels of phosphorus (0, 20, 40 and 60 kg P<sub>2</sub>O<sub>5</sub>/ha) were combined factorially and assigned to main plots. Rajendran and Pusa Baisakhi moong were the two varieties of green gram assigned to sub-plots.

The gross and net area of the plots were 7.5 and 5.4 sq. m. respectively.

1. Instructor and 2. Professor and Head, Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore 641003

Nitrogen and phosphorus in the forms of urea and super respectively were applied as broadcast and incorporated. Seeds were dibbled in rows giving a spacing of 30 × 10 cm. Two seedlings per hill were maintained. The crop was sown on 21-17-72 and harvested on 21-9-72. Data on pod number, total dry matter production, thousand-seed weight and seed yields were recorded.

Plant samples were taken at three stages of crop growth. The first, second and third samples were taken on 30th, 45th and 60th day of crop age representing pre-bloom, bloom and

maturity stages of the crop respectively. Five plants collected from each plot constituted one sample. The sample plants collected (whole plants inclusive of root portion) were dried, powdered and analysed for N, P and K content. Nitrogen content was determined by Micro-kjeldahl distillation, phosphorus by calorimetry and potassium with Flame photometer and were expressed as per cent of dry matter

RESULTS AND DISCUSSION

Pod number: Levels of phosphorus alone influenced the number of pods per plant (Table 1). Nitrogen

TABLE 1. Influence of N and P levels on pod number and seed weight

N,P levels and pod number				V×N interaction and pod number			Thousand-seed weight		Varietal differences		
N levels	Mean pod No.	P levels	Mean pod No.	N levels	Varieties Rajendran Pusa-Baisakhi moong		N levels	Mean seed wt. (g)	Varieties	Mean pod No.	Thousand seed wt. (g)
N <sub>0</sub>	6.8	P <sub>0</sub>	6.4	N <sub>0</sub>	4.6	9.16	N <sub>0</sub>	36.18	Rajendran	4.7	40.71
N <sub>1</sub>	7.3	P <sub>1</sub>	7.7	N <sub>1</sub>	5.08	9.33	N <sub>1</sub>	37.28	Pusa-Baisakhi moong	9.5	33.89
N <sub>2</sub>	7.1	P <sub>2</sub>	7.2	N <sub>2</sub>	5.00	9.66	N <sub>2</sub>	37.70	S. E.	0.17	0.32
N <sub>3</sub>	7.1	P <sub>3</sub>	7.1	N <sub>3</sub>	4.08	10.16	N <sub>3</sub>	38.02	C. D. (P=0.05)	0.47	0.91

Levels of N and P : S. E. — 0.29 C. D. (P=0.05) — 0.8

V × N interaction : S. E. D. — 0.46 C. D. (P=0.05) — 0.94

Thousand-seed weight : S. E. — 0.40 C. D. (P=0.05) — 1.15

TABLE 2. Influence of N and P levels on dry matter and seed yield

N	Total dry matter kg/ha			Seed yield kg/ha			
	Mean d. m. kg/plot	P levels	Mean d. m. kg/plot	N levels	Mean seed wt	P levels	Mean seed wt
N <sub>0</sub>	1.480	P <sub>0</sub>	1.860	N <sub>0</sub>	731.6	P <sub>0</sub>	698.3
N <sub>1</sub>	2.180	P <sub>1</sub>	1.960	N <sub>1</sub>	732.6	P <sub>1</sub>	781.6
N <sub>2</sub>	1.710	P <sub>2</sub>	2.070	N <sub>2</sub>	750.4	P <sub>2</sub>	731.1
N <sub>3</sub>	2.330	P <sub>3</sub>	1.820	N <sub>3</sub>	729.3	P <sub>3</sub>	731.1

Table 2 [ Continued ]

N × P interaction on seed yield kg/ha					P levels			Varietal differences		
N levels	P <sub>0</sub>	P <sub>1</sub>	P <sub>2</sub>	P <sub>3</sub>	Varieties	Seed yield kg/ha	Total d. m. kg/plot			
N <sub>0</sub>	686.4	839.8	764.0	656.7	Rajendran	502	2.326			
N <sub>1</sub>	714.4	765.6	689.6	767.2	Pusa-Baisakhi moong	989	1.528			
N <sub>2</sub>	724.3	787.0	676.5	813.4	S. E.	10.11	0.033			
N <sub>3</sub>	668.4	740.0	818.3	691.3	C. D. [P=0.05]	29.0	0.095			

Total dry matter : S. E. = 0.05 C. D. = 0.140 [ P = 0.05 ]

Seed Yield : S. E. = 12.7 C. D. = 36.9 [ P = 0.05 ]

N × P interaction : S. E. = 25.4 C. D. = 73.7 [ P = 0.05 ]

individually had no significant influence on pod number. However, there was a significant variety × nitrogen

interaction (Table 1). The variety Pusa Baisakhi moong has shown greater response to applied nitrogen.

TABLE 3. N, P and K percentage in plant dry matter

Stage	Nitrogen		Phosphorus		Potassium	
	V <sub>1</sub>	V <sub>2</sub>	V <sub>1</sub>	V <sub>2</sub>	V <sub>1</sub>	V <sub>2</sub>
Pre - bloom	6.02	5.45	0.30	0.29	1.10	1.04
Bloom	3.36	3.10	0.20	0.21	0.60	0.63
Bhusa	1.63	1.27	0.17	0.12	0.47	0.47
Seed	4.47	4.05	0.25	0.28	0.73	0.69

V<sub>1</sub> — Rajendran

V<sub>2</sub> — Pusa - Baisakhi moong

Thousand-seed weight: Varietal difference was highly apparent (Table 1). The seeds of Rajendran were much larger and hence have shown increased thousand-seed weight. Nitrogen at higher levels N<sub>2</sub> and N<sub>3</sub> (20 and 30 kg N/ha) have increased the thousand-seed weight significantly. Lavelleye and Steppe (1966) have observed similar response in soybean.

Total Dry matter: Generally both nitrogen and phosphorus have increased the dry matter production (Table 2). However phosphorus at P<sub>3</sub> level (60 kg P<sub>2</sub>O<sub>5</sub>/ha) have reduced the total dry matter production as compared to control. Jefren *et al.* (1972) observed reduction in growth of all plant parts with addition of phosphorus in excess. In the present investigation, the phosphorus dosage (60 kg P<sub>2</sub>O<sub>5</sub>/ha) might have been in excess of the crop's need. The variety Rajendran produced more dry matter than Pusa Baisakhi moong (Table 2).

Seed yield: Nitrogen levels individually had no significant influence

on seed yield whereas phosphorus levels had significant influence (Table 2, Fig. 1). Phosphorus at P<sub>1</sub> level

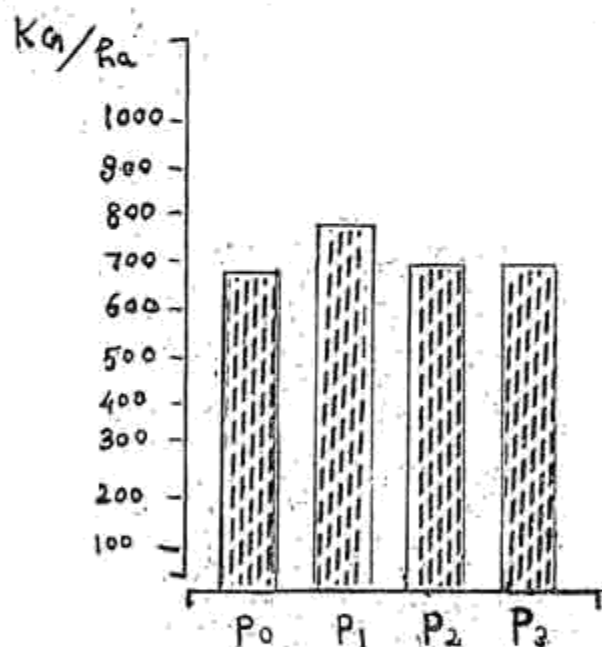


Fig. 1 - Effect of Phosphorus levels on seed yield.

(20 kg P<sub>2</sub>O<sub>5</sub>/ha) gave maximum seed yield and further additions gave lesser yield increments. The reasons for maximum yield seems to be the contribution from maximum pod number at P<sub>1</sub> level (Table 1) and not the seed weight (Table 2). The nitrogen, phos-

phorus interaction was highly significant (Table 4), (Fig. 2). No  $P_1$ ,  $N_2$ ,  $P_3$

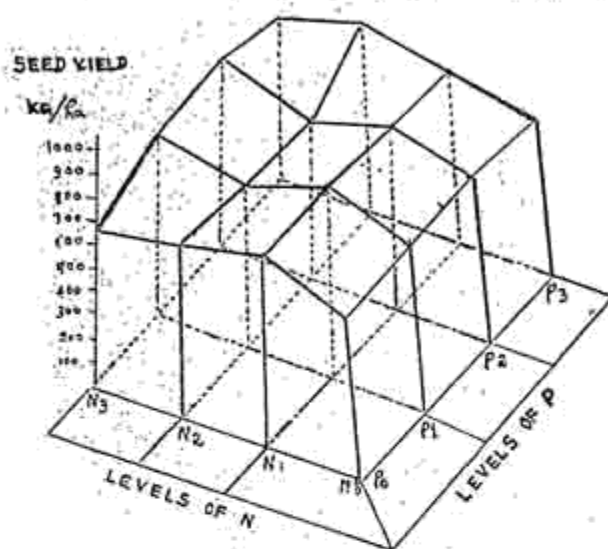


Fig. 2. N x P interaction effect on seed yield.

and  $N_3 P_2$  combinations gave more than 800 kg seed yield/ha while the  $N_3 P_3$  combination gave only 691 kg/ha which correspond to the yield of control ( $N_0 P_0$ ). Thus fertilizer nutrients over a certain level (as in  $N_3 P_3$ ) tended to reduce the seed yield. The variety Pusa Baisakhi moong gave a mean yield of 989 kg/ha while Rajendran gave 502 kg/ha only (Table 1; Fig. 3).  $N_0 P_1$  level was the most economical dose.

**Nutrient content:** The N, P and K per cent in plant dry matter were maximum at pre-bloom stage and decreased thereafter (Table 3). This is in agreement with the findings of Norman (1963) in soybean and Harisankar and Kushwaha (1971) in black gram. Rajendran had more nitrogen per cent at all stages of plant growth. It is interesting to note that in Pusa Baisakhi moong, the phosphorus and potassium per cent was higher than Rajendran at bloom stage alone. It is already seen

that Pusa Baisakhi moong gave higher seed yield. Thus there is need for relatively high P and K per cent in plant dry matter at bloom stage for higher seed yield.

Effect of fertilizer nitrogen and phosphorus on the N, P and K per cent in plant dry matter at pre-bloom stage was studied. At low levels of nitrogen, increased applications of phosphorus favoured nitrogen uptake. In the absence of applied nitrogen ( $N_0$ ), high levels of phosphorus ( $P_2$  and  $P_3$ ) did not effect a corresponding increase in P content. In the absence of both N and P applications, the K per cent in plant dry matter was found lowest. Also, combination of N and P at their highest level viz.  $N_3 P_3$  have caused a

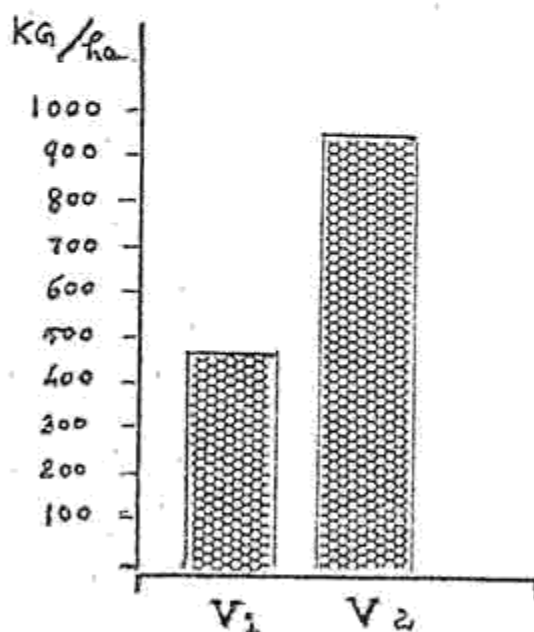


Fig. 3. Varietal difference in seed yield.

reduction in potassium per cent. This low potassium percentage in plant dry matter at pre-bloom stage would have caused reduction of seed yield; since it was seen already that  $N_0 P_0$  and  $N_3 P_3$  combinations gave poor seed yield.

Nutrient uptake: The nutrient (N, P and K) removal / ha was estimated for each variety separately (Table 4). Rajendran removed more N, P and K and produced more total dry matter. Pusa-Baisakhi moong removed lesser N, P and K, produced lesser total dry matter but gave higher

TABLE 4. Estimated removal of N, P and K (kg/ha)

Variety	Nutrients	Removal through		Total
		Stalk	Seed	
Rajendran	N	66.8	22.4	89.2
	P	7.0	1.2	8.2
	K	19.0	3.7	23.3
Pusa-Baisakhi moong	N	25.8	40.0	65.8
	P	2.5	2.1	4.6
	K	9.6	6.7	16.3

seed yield. Reasons for this may be attributed to the higher harvest index of the variety-Pusa Baisakhi moong Ohlrogge (1963) observed that a soy bean crop with an yield of 3362 kg/ha removed 314 kg N and 33.6 kg P/ha. The ratio of nitrogen and phosphorus

uptake by green gram observed in the present investigation is in close proximity with the above finding. The phosphorus removal by green gram ranged between 5 and 10 kg/ha. Green gram with this low uptake capacity when raised in a soil medium in available phosphorus (22 kg of P<sub>2</sub>O<sub>5</sub> /ha), naturally cannot be expected to respond well to the additions of fertilizer phosphorus. Hence, efforts have to be made to evolve high fertility strains in green gram.

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