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Studies on the Response of Co. 2 Green Gram (*Phaseolus aureus* Roxb.) to Phosphorus Application*

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An experiment was laid out to study the response of green gram (Co.2) to phosphorus application under irrigation. Phosphorus application through soil increased the plant height on 45th day and at harvest but there was no difference between P levels tested. Foliar application of P decreased the height. Leaf area index and the yield components such as number of pods per plant, number of seeds per pod and thousand grain weight were not influenced by P application. Neither grain yield nor stalk yield was affected by P application. For a short duration variety like Co.2, P application produces little response in a soil with medium available P status.

Pulses constitute a major component of average Indian diet. Though India has the largest area under pulses, production is for below the requirement. This is mainly because these crops are grown in marginal lands with poor management practices. To achieve a sustained high yield in short duration pulses, a suitable fertilizer management programme has to be evolved. Pulses, being legumes, fix atmospheric nitrogen (N) in their nodules and so do not generally respond to N application. But, most pulses respond to P application. Early workers like Desphande and Bathkal (1965), Rajendra Prasad (1968), Anand Prakash (1969), Bhatia and Chowdhury (1972), Venugopal (1973) Gorde and Kibe (1973) have reported the response of green gram to various doses of NP fertilizer and also their time and mode of application. In general, the response to P application depends on the variety and soil conditions. Variety, Co.2, which matures in 65 days, is popular among farmers of Tamil Nadu and so an investigation was undertaken with a view to ascertain the response of this variety to P application.

MATERIAL AND METHODS

The experiment was conducted in a randomised block design with three replications at the Tamil Nadu Agricultural University Coimbatore. The treatment schedule is given in Table I. The soil of the experimental field was sandy clay loam, which was medium in available N (265 kg/ha) and P_2O_5 (14 kg/ha) and high in available K_2O (850 kg/ha). The pH was 8.3 and EC 0.64 mmhos/cm. The crop was raised under irrigation following the package of practices recommended by the Tamil Nadu Agricul-

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TABLE I. Treatment schedule

Symbol	Details
P_0	Control
P_{10S}	10 kg P_2O_5/ha, all basal
P_{10F}	10 kg P_2O_5/ha, all foliar (20th day)
P_{20S}	20 kg P_2O_5/ha, all basal
$P_{10S+10F}$	10 kg P_2O_5/ha basal+10 kg foliar (20th day)
P_{20F}	20 kg P_2O_5/ha all foliar in two splits (20th and 30th day)
P_{30S}	30 kg P_2O_5/ha, all basal
$P_{15S+15F}$	15 kg P_2O_5/ha basal + 15 foliar in two splits (20th and 40th day)
P_{30F}	30 kg P_2O_5/ha, all foliar in three splits (20th, 30th and 40th day)
P_{40S}	40 kg P_2O_5/ha, all basal
P_{20+20F}	20 kg P_2O_5/ha basal + 20 kg/ha foliar in two splits (20th and 40th day)

Nitrogen : 10 kg/ha No Potassium
Spacing : 25 x 10 cm
Plot size : Gross—5 x 3 m
Net —4 x 2 m

tural University, Coimbatore. For estimation of dry matter accumulation, five plants were removed from sampling rows (outside net plot area) at weekly intervals, dried and weighed. Observations were taken on the crop and the data obtained were subjected to statistical scrutiny.

RESULTS AND DISCUSSION

Plant height (Table II): On 45th day and at maturity, the effect of P application on height was significant. In general, there was a slight reduction in height in treatments with foliar application of P. A mild scorching on the leaves was noticed after the spray of P. This might have caused a setback in growth resulting in reduced height. Warsi (1973) reported similar reduction in height of sorghum due to foliar application of N.

Leaf area index (Table II): LAI at flowering was not influenced by the treatments. Whereever soil application of P was resorted to, there was a slightly higher LAI than in plots receiving foliar application of P. This may be attributed to the scorching effect of P spray. But the LAI observed in the study was lower and this is probably due to the genetic make-up of the variety. A significant correlation between LAI and grain yield was observed ($r = 0.5894^{**}$).

Dry matter accumulation (Table II): No discernible difference was noticed in dry matter accumulation at different stages of crop growth due to P application. The soil of the experimental field was medium in available P and the crop requirement for P was rather small (10 kg/ha). The soil P would have been sufficient to meet the crop requirement and so there was no response to applied P. At early stages of growth, dry matter accumulation was rather slow but after flowering to maturity, it increased rapidly. A significant correlation existed between dry matter produced at maturity and grain yield ($r = 0.627^{**}$).

Rate of dry matter accumulation. Here also, the effect of P application was not discernible, except for a slight reduction in plots receiving foliar application of P, immediately after the spray. This is due to scorching effect of the spray solution and setback caused as a result. The rate of dry matter accumulation increased gradually reaching a peak on 36th day. Thereafter it declined upto 43rd day and again there were

TABLE II. Growth components and drymatter accumulation

Treatments	Plant height (cm)		LAI	Drymatter accumulation (kg/ha)			
	45th day	Maturity		15th day	29th day	43rd day	Maturity
P_0	26.2	32.6	1.685	61.4	446.9	1743.8	4574.6
P_{10S}	22.2	30.3	1.069	73.4	397.9	1606.6	4229.1
P_{10F}	17.2	27.0	1.259	60.0	352.0	1305.0	4417.1
P_{20S}	22.5	29.8	1.510	60.6	333.4	1595.0	4109.1
$P_{10S+10F}$	16.6	27.9	1.056	58.6	388.0	1428.4	3790.4
P_{20F}	17.9	26.7	1.303	56.0	353.4	1156.6	3821.6
P_{30S}	21.5	31.4	1.473	57.4	368.8	1420.0	4732.9
$P_{15S+15F}$	18.0	27.7	1.103	56.0	417.6	1413.4	4139.1
P_{30F}	19.6	26.5	1.464	61.4	353.9	1456.6	4510.0
P_{40S}	24.5	31.7	1.588	61.4	386.4	1422.1	4257.1
$P_{20S+20F}$	20.0	27.5	1.969	61.6	331.1	1450.0	4838.8
S.E.	1.65	0.71	0.2179	7.2	48.5	230.7	380.2
C.D. (5%)	4.80	2.10	N.S.	N.S.	N.S.	N.S.	N.S.

Note : N.S. = Not significant

peaks on 50th and 64th days. The crop was passing through the vegetative phase upto about 5 weeks after sowing and then reproductive phase started. For about a week flowering continued. During this phase (39 to 45 days), there was a drop in the rate of dry matter accumulation since the plant was switching over from vegetative or reproductive phase.

At pod formation stage the rate of dry matter accumulation increased reaching a peak. After this period, there was a considerable drop in the rate of dry matter accumulation. This might be due to the dropping of flowers and senescent leaves, which might have neutralised whatever accmulation of dry matter during that period. Again the rate picked up due to reflush of vegetative growth.

Yield components (Table III): The statistical scrutiny of the data indicated that non of the characters studied viz., number of pods per plant and number of grains per pod were significantly influenced. Though there was some difference in thousand-grain weight, the trend was erratic. Hence it can be inferred that P application failed to induce any response in the yield components studied.

Grain and stover yield (Table III) : Phosphorus application did not produce

TABLE III. Yield components and yield

Treatments	No. of pods per plant	No. of grains per pod	1000 grain weight (g)	Grain yield (kg/ha	Stover yield (kg/ha)
P_0	10.7	9.7	39.4	527.5	4047.3
P_{10S}	7.3	8.6	37.7	561.1	3868.0
P_{10F}	10.2	9.1	37.7	439.2	3977.3
P_{20S}	7.5	9.2	38.9	479.2	3629.6
$P_{10S+10F}$	8.1	9.3	38.8	485.2	3305.3
P_{20F}	9.2	9.3	38.9	448.4	3373.2
P_{30S}	9.7	9.3	40.1	462.9	4270.0
$P_{15S+15F}$	8.1	8.9	39.6	452.7	3686.6
P_{30F}	8.9	9.0	37.9	478.1	4031.9
P_{40S}	10.9	9.1	39.9	425.2	3831.9
$P_{20S+20F}$	11.3	9.0	39.9	497.3	4341.5
S.E.	1.58	0.36	0.48	75.69	380.61
C.D.5 (%)	N.S.	N.S.	N.S.	N.S.	N.S.

any significant response in grain and stover yield. As stated earlier, the soil of the experimental field was medium in available P and the crop removal was about 10 kg/ha. So the soil P itself would have taken care of the crop requirement. Bhango and Albritton (1972) reported that there was no yield increase for applied P in soils having residual P.

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