Plant Archives Vol. 20, Special Issue (AIAAS-2020), 2020 pp. 553-557 ***ISSN 0972- 5210***

STUDIES ON SUITABLE DOSE OF PHOSPHORUS FOR HIGHER YIELD OF GREEN GRAM (*VIGNA RADIATA* L.)

Ajai Singh[1,*], R.D. Singh[2], Amit Malviya[3] and R.K. Pathak[4]

[1]Department of Agronomy, Bhagwant University, Ajmer (Rajasthan)
[2]Department of Agronomy, K.N.I.P.S.S., Sultanpur (UP)
[3]ICAR-Indian Institute of Sugarcane Research, Regional Centre, Motipur (Bihar)
[4]Department of Soil Science & Agril. Chemistry, NDUAT, Kumarganj, Ayodhya (UP)

Abstract

The experiment was conducted at Agronomy Research Farm of the "Narendra Deva University of Agriculture & Technology, Narendra Nagar, Kumarganj, Ayodhya (UP). The farm is situated at south-east of Ayodhya-Raibareilly road in a main campus of the university which is 42 Km away from Ayodhya city. During the kharif season (June-September) of 2016 to find out the Impact of varieties and phosphorus levels on the relative yield of kharif mungbean (*Vigna radiata* L.) Wilczek. The experiment was laid out in Factorial Randomized Complete Block Design with four replications and constitute of four levels of phosphorous *viz*., 20 kg P_2O_5 ha^{-1}, 40kg P_2O_5 ha^{-1}, 60kg P_2O_5 ha^{-1}, control (no phosphorous application) in 25 varieties *i.e.* NDM-1, Meha, Samrat, Amrit, KM 1, Mohni, Pannt mung-1, Pant mung-2, PDM-11, Pusa-105, Pusa Vaisakhi, Sabarmati, Sunaina, Varsa, Type-1, Type-44, Type-51, ML-1, ML-5, ML-131, CO-4, Jawahar-45, K-851, Gujrat-1 and Gujrat-2 of mung. Results revealed that most of the growth characters such as initial plant population, plant height, number of leaves, number of branch $plant^{-1}$ were significantly increased due to application of phosphate fertilizer over control on the similar way application of phosphorous significantly increased the yield and also. The highest grain yield (11.02q ha^{-1} during 2014-15 and 11.31q ha^{-1} during 2015-16) was obtained with 60 kg P_2O_5 ha^{-1} having an increase of 31.85% and 31.92% over the control during first and second year respectively and the lowest with no phosphorous application (7.51 and 7.70q ha^{-1} in first and second years of investigation). Grain yield obtained by application of 40kg P_2O_5 was statistically at par with that of 60kg $P_2O_5ha^{-1}$.

Keywords: *Vigna radiata* (L.) wilczek, phosphorous levels, growth and yield and mungbean.

Introduction

Pulses are the important sources of proteins, vitamins and minerals for the predominantly vegetarian population (Brar *et al*., 2019) and are popularly known as "Poor man's meat" and "rich man's vegetable". Pulses contain two to three times more protein than cereals ranging approximately between 20 to 40 percent (Arora, 1989). Apart from this, pulses fix atmospheric nitrogen and improve soil fertility. India is the largest producer and consumer of pulses in the world accounting for about 29 percent of the world area and 19 percent of the world's production. At present, total pulse production in India is 17.28 million tones, with an area of 23 million hectares and the productivity is 600 to 800 kg ha^{-1} (Anon, 2012). The production of pulses however, does not commensurate with the demand in the country. It is estimated that the country's population will reach nearly 1350 million by 2020 A.D. The country would then need a minimum of 33.3 million tones of pulses to meet the requirement. In fact, there has been stagnation in the production and productivity of pulses over the past two decades. There has been a diversion of acreage from pulses to cereals as a result of "Green Revolution" brought by the high yielding varieties of cereals (Swaminathan and Jain, 1975). This is mainly due to the low yield potential of legumes under irrigation and instability of yield. During the post green revolution period, the production of pulses recorded a negative growth rate. This disturbing trend in the production of pulses had adversely affected the per capita availability of pulses. The daily per capita availability of pulses had decreased from 69 to 40 grams as against the World Health Organization's recommendation of 80 grams per day. Green gram is the third most important pulse crop in India covering an area of 3.53 m ha with a total production of 1.49 mt and the average productivity is 532 kg per ha (Anon, 2008).

Important green gram growing states in India are Orissa, Andhra Pradesh, Maharashtra, Karnataka and Bihar. By indicating the scope to improve its productivity, the release of high yielding varieties has contributed a great deal towards the improvement of green gram yields. Hence, combination of genotype and environmental factor can bring about increase in production. Differences in yield of genotypes are attributed to the complex process occurring in various parts of the plant involving many physiological changes. These physiological changes are influenced by environmental factors prevailing at

*Corresponding author Email: ajaiabhay30@gmail.com

different stages of crop growth. To understand yield variation among the green gram varieties in different environment, agronomic manipulation and yield analysis are required. Phosphorus (P) is one of the most needed elements for pulse production. Phosphorus, although not required in large quantities, is critical to green gram yield because of its multiple effects on nutrition.

Materials and Methods

The experiment was carried out under partially reclaimed sodic soil. The experimental site is located at Agronomy Research Farm of Narendra Deva University of Agriculture & Technology, Narendra Nagar, Kumarganj, Ayodhya (UP). The farm is situated at south-east of Ayodhya-Raibareilly road in a main campus of the university which is 42 Km away from Ayodhya city. The experimental site falls under subtropical region Indo-Gangatic Plains and situated at 26.49^0N latitude and 82.29^0E longitude at an altitude of 113 meters from mean sea level. The region receives a mean annual rainfall of about 1200mm. The climate is sub-tropical with remarkable humidity. It is extremely hot and dry in summer (March to May), having maximum temperature ranging between 32.7-40.8^0C. The experimental field was well leveled having good irrigation and drainage facilities. All agronomic cultural practices were followed during course of study. Data different attributes *viz*; initial plant population, plant height, number of leaves plant^{-1}, number of branches per plant, number of pod per plant and grain yield kg per hectare were recorded and subjected to statistical analysis with the help of method suggested by Cocharan and Cox (1961) for randomized block design.

Results and Discussion

Effect of varieties

The initial plant stand per meter^2 recorded at 15 days after sowing was not significant among the varieties, indicating thereby the uniform viability of the varieties. In general, the growth parameters like plant height, number of leaves per plant and number of branches per plant, differed among the varieties (Table 1). It might be due to their own genetic capacity. The similar findings were also supported by Sharma *et al*. (1993) and Mishra (2003). Variation in plant height and number of branches per plant among varieties might also be probably due to their genetic characters. The maximum number of leaves per plant (20.93 and 21.26) in NDM^{-1} and minimum (17.17 and 17.75) in KM^{-1} at 60 days after sowing was credited during first and second year, respectively. It might be probably due to their genetic characters of varieties. Number of leaves per plant was decreased after harvest due to decreasing growth rate and senescence stage which showed drying and shattering of leaves. The similar findings were also supported by Sharma *et al*. (1993) and Mishra (2003). Variation in plant height and number of branches per plant among varieties might also be probably due to their genetic characters. The maximum number of leaves per plant (20.93 and 21.26) in NDM^{-1} and minimum (17.17 and 17.75) in KM^{-1} at 60 days after sowing was credited during first and second year, respectively. It might be probably due to their genetic characters of varieties. Number of leaves per plant was decreased after harvest due to decreasing growth rate and senescence stage which showed drying and shattering of leaves. The similar findings were also supported by Sharma *et al*. (1993) and Mishra (2003). The maximum and minimum number of branches per plant (5.40, 5.45 and 4.50, 4.55 during both the years) at harvest was credited to NDM^{-1} and KM^{-1} respectively. It might be probably due to their genetic characters of varieties. The similar findings were also supported by Singh and Pareek (2003).

Yield was resultant coordinated interplay of yield attributes. Vigorously growing plants are able to absorb larger quantity of mineral nutrients through well-developed nutrient system. The variety NDM^{-1} gave higher number of pods per plant, and number of seeds per pod than other varieties. It might be probably due to their genetic characters of variety like more number of pods per plant length of pods (cm) and number of seeds per pod, etc., minimum yield contributing characters was credited to KM^{-1}. It was due to less number of pods per plant length of pod (cm) as well as less number of seeds per pod. The similar finding was also supported by Singh and Pareek (2003).

The grain yield was credited to NDM^{-1} which was significantly superior over variety rest varieties. This was because good plant stands more number of pods per plant length of pod (cm and number of seeds per pod with more test weight. grain yield recorded with variety KM^{-1} might be due to less number pods per plant, length of pod (cm), number of seeds per pod and poor grain development. These findings in close conformity with the findings of Panwar and Singh (1975); Sharma *et al*. (1993); Mandal *et al*. (2005); Singh and Tripathi (2005).

Effect of Phosphorus

The initial plant population was not affected significantly due to application of phosphorus mainly due to the fact that phosphorus not influences the germination vis-à-vis initial plant population (Table 2). Application of phosphorus resulted significant increase in plant height and number of branches plant^{-1} at different stages of growth up to 60 kg P_2O_5 ha^{-1}. However, differences between values of 40 kg P_2O_5 and 60 kg P_2O_5 were not significant. This might be due to the fact that better availability of phosphorus enabled plant to grow faster and increased the root growth as well as nodules number and size which enhanced the growth of plant Prakash *et al*. (2002); Kumar *et al*. (2003); Singh *et al*. (2006); Mir *et al.* (2009) also reported increase in growth characters with increase in phosphorus application.

The number of leaves increased significantly with increasing levels of phosphorus up to 60 kg P_2O_5 ha^{-1}. This might be due to the fact that phosphorus application increases the plant height and number of branches $plant^{-1}$, *viz.,* number of leaf $plant^{-1}$ resulting increase leaf area as well as leaf area index. Results are in line with those of Rao *et al*. (1993) and Prakash *et al.* (2002).

Application of phosphorus resulted significant increase in yield attributing characters, *viz.*, number of pod $plant^{-1}$ and Grain pod^{-1} and Grain pod^{-1} with increasing levels of phosphorus (Table 3). Phosphorus application accelerated the production of photosynthates and its translocation from source to sink, which ultimately reflected for higher values of yield attributing characters. Increase in yield attributing characters has also been reported by Ram and Dixit (2000) and Prakash *et al*. (2002).

Application of phosphorus increased grain yield significantly with every increase in dose of phosphorous up to 40 kg P_2O_5 ha^{-1} Maximum grain yield (11.02 q ha^{-1} in 2014-15 and 11.31q ha^{-1} 2015-16) were obtained with 60 kg P_2O_5 ha^{-1} but is was on par with 40 kg P_2O_5. The increase in grain yield with phosphorous application was due to (i) increase in sources capacity *viz*., plant height, branches per plant and number of leaves per plant as well as sink capacity *viz*., pods per plant grains per pods and test weight (ii) better utilization of photosynthatase towards sink due to increase in translocation from source to sink may be attributed to increase in potassium uptake which is responsible for quick and easy translocation of the photosynthates from source to sink. The results findings of earlier research workers, *viz*., Singh *et al*. (2003) and Bhat *et al*. (2005) are in accordance with this finding.

References

Anonymous (2008). Area, production and average yield. Department of agriculture and cooperation report, New Delhi, pp. 8-7.

Anonymous (2012). FAO *Bulletin of Statistics*. Statistics Division of Economics and Social Department, **2:** 54.

Bhat SA, Thenua OVS, Shivkumar BG and Malik JK (2005). Performance of summer green gram as influenced by bio-fertilizers and phosphorous nutrition. *Haryana, J. Agron*, **21(2):** 203-205.

Brar TS, Thalkar MG, Singh S, Singh K and Singh R (2019). Effect of different phosphorus level and arbuscular mycorrihiza fungi on yield of green gram (*Vigna radiata*) crop. *Plant Archives,* **19(2)**: 3165-3168.

Mandal S, Biswal KC and Jana PK (2005). Yield economics nutrient uptake and consumptive use of water by summer green gram as influenced by irrigation and phosphorous application. *Legume Research*, **28(2):** 131-133.

Mehta CPS and Dadheech (1999). Effect of plant growth regulator on growth and yield of black gram at varying level of phosphorous. *Crop Res. (Hissar)*, **18(1):** 163-165.

Mir AH, Bhat JA and Lal SV (2009). Effect of phosphorous, Sulphur and PSV on black gram (*Phaseolus mungo*) and its residual effects on mustard (*Brassica juncea*) and soil properties. *Environ. and Eco.*, **27(3A):** 1365-1368.

Mishra SK (2003). Effect of rhizobium inoculation, nitrogen and phosphorous on root nodulation, protein production and nutrient uptake in cowpea (*Vigna sinensis* Savi). *Annals of Agril. Res.*, **24(1):** 139-144.

Panwar RS and Kanwar Singh (1975). Effect of different spacing and phosphorous level on growth yield and chemical composition of mung (*Phascolus aureus* Robx) variety pusa baisakhi under early summer condition. *Haryana Agri. Uni. J. of Res.*, **5(1):** 91-93.

Prakash O, Sharma R and Singh BP (2002). "Effect of Phosphorous and row spacing on yield attributes and yields of mung bean cultivars under rainfed condition". *J. Pulse Res.*, **15(2):** 142-144.

Ram SN and Dixit RS (2000). Effect of dates of sowing and phosphorous on nodulation, uptake of nutrients and yield of summer green gram (*Vigna radiate* L. Wilczek). *Crop Res. Hissar*, **19(3):** 414-417.

Rao AS (1993). Response of green gram cultivars to levels of phosphorous. *Indian J. Agron.*, **38(2):** 317-318.

Sharma YM, Dikshit PR, Turkar OR and Sharma AM (1993). Effect of rhizobium culture with different levels of starts dose of nitrogen and phosphorous on yield, nutrition and nodulation of summer mung (*Vigna radiata*). *Bhartiya krishi Anusandhan Patrika*, **8(2):** 106-114.

Singh B, Singh CP and Parihar SS (2006). Growth and yield enhancement of mung bean (*Vigna radiata* L.) by sourses and levels of phosphorous and phosphate solublizing microbes. *Annals of Agri. Res.*, **27(3):** 210-212.

Singh B and Pareek RG (2003). Effect of phosphorous and bio-fertilizers on growth and yield of mung bean. *Indian J. of Pulse Res*., **16(1):** 31-33.

Singh P, Yadav KK, Meena FS, Singh B and Singh R (2017). Effect of phosphorus and sulphur on yield attributes yield and nutrient uptake of mungbean (*Vigna radiate* L.) in central plain zone of Punjab, India. *Plant Archives* **17(2):** 1756-1760.

Swaminathan MS and Jain HK (1975). Food legumes in Indian agriculture. In: Milner, M. (Eds.) Nutritional improvement of food legumes by Breeding, pp.69-82.

Table 1: Effect of varieties and phosphorus levels on initial plant population and plant height at different stages of growth

Treatments	Initial plant population		Height at 30 DAS		Height at 45 DAS		Height at 60 DAS		Height at Harvest	
	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16
Varieties										
NDM-1	37.31	37.97	14.10	14.58	30.10	30.69	36.51	37.21	36.68	37.37
Meha	36.15	36.74	12.77	13.20	27.26	27.79	33.06	33.70	33.22	33.84
Samarat	35.96	36.56	12.64	13.06	26.98	27.50	32.72	33.35	32.87	33.49
Amrit	35.64	36.22	12.75	13.19	27.24	27.76	33.03	33.66	33.18	33.80
KM1	35.38	35.96	12.97	13.41	27.69	28.23	33.58	34.22	33.74	34.37
Mohini	35.49	36.08	13.57	14.03	28.97	29.53	35.13	35.80	35.29	35.96
Pant Mung-1	35.82	36.41	13.43	13.89	28.68	29.24	34.78	35.45	34.95	35.60
Pant Mung-2	36.07	36.67	13.77	14.23	29.39	29.96	35.65	36.33	35.81	36.48
PDM-11	36.84	37.44	13.03	13.48	27.83	28.37	33.75	34.40	33.91	34.55
Pusa-105	36.07	36.67	12.64	13.06	26.98	27.50	32.72	33.35	32.87	33.49
Pusa Vaisakhi	36.15	36.74	13.30	13.75	28.40	28.95	34.44	35.10	34.60	35.25
Sabarmati	36.95	37.56	13.63	14.09	29.11	29.67	35.30	35.98	35.47	36.13
Sunaina	36.18	36.78	13.37	13.82	28.54	29.09	34.61	35.28	34.77	35.43
Varsha	36.00	36.59	12.24	12.65	26.13	26.63	31.68	32.29	31.83	32.43
Type-1	36.15	36.74	13.93	14.40	29.73	30.31	36.06	36.75	36.23	36.91
Type-44	35.93	36.52	13.74	14.20	29.34	29.91	35.58	36.26	35.74	36.41
Type-51	36.25	36.85	13.65	14.11	29.14	29.70	35.34	36.01	35.50	36.17
ML- 1	36.84	37.44	13.65	14.11	29.14	29.70	35.34	36.01	35.50	36.17
ML- 5	36.91	37.52	13.49	13.94	28.80	29.36	34.92	35.59	35.08	35.74
ML-131	36.98	37.59	13.66	14.12	29.17	29.73	35.37	36.05	35.53	36.20
CO-4	36.95	37.56	12.90	13.34	27.55	28.08	33.41	34.05	33.56	34.19
Jawahar-45	37.06	37.67	13.83	14.30	29.54	30.11	35.82	36.50	35.98	36.66
K-851	37.02	37.63	13.79	14.26	29.45	30.02	35.71	36.40	35.88	36.55
Gujrat-1	36.84	37.44	12.78	13.21	27.29	27.82	33.10	33.73	33.25	33.88
Gujrat-2	37.09	37.70	12.90	13.34	27.55	28.08	33.41	34.05	33.56	34.19
_	1.028	1.139	0.337	0.345	0.750	0.767	0.880	0.907	0.887	0.883
CD(P=0.05)	NS	NS	0.939	0.961	2.087	2.136	2.449	2.525	2.470	2.456
Phosphorus levels (kg ha^{-1})										
0	35.85	36.45	12.64	13.06	26.13	26.63	31.68	32.29	32.83	32.43
20	36.22	36.82	13.03	13.48	27.26	27.79	33.06	33.70	33.22	33.84
40	36.58	37.19	13.70	14.16	29.82	30.40	36.16	36.86	36.33	37.01
60	36.95	37.56	13.86	14.30	30.39	30.98	36.85	37.56	37.02	37.72
SEm±	0.291	0.322	0.095	0.098	0.212	0.217	0.249	0.257	0.251	0.250
CD(P=0.05)	NS	NS	0.266	0.272	0.590	0.604	0.693	0.714	0.698	0.695

Table 2: Effect of varieties and phosphorus levels on number of leaves plant^{-1} at different stages of growth

Treatments	No. of leaves 30 DAS		No. of leaves 45 DAS		No. of leaves 60 DAS		No. of leaves at har.	
	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16
Varieties								
NDM-1	7.58	7.80	17.71	17.99	20.93	21.26	18.97	19.18
Meha	6.67	6.87	15.60	15.84	18.43	18.72	16.70	16.90
Samarat	6.53	6.73	15.28	15.51	18.05	18.33	16.36	16.54
Amrit	6.88	7.09	16.09	16.34	19.01	19.31	17.23	17.42
KM1	6.32	6.52	14.79	15.02	17.47	17.75	15.83	16.02
Mohini	7.02	7.23	16.41	16.67	19.39	19.70	17.57	17.78
PantMung-1	7.16	7.37	16.74	17.00	19.78	20.09	17.92	18.13
PantMung-2	7.30	7.52	17.06	17.33	20.16	20.48	18.27	18.48
PDM-11	6.74	6.95	15.76	16.01	18.62	18.92	16.88	17.07
Pusa-105	6.46	6.66	15.11	15.35	17.86	18.14	16.18	16.37
Pusa Vaisakhi	7.09	7.30	16.58	16.83	19.58	19.89	17.75	17.95
Sabarmati	7.23	7.45	16.90	17.16	19.97	20.28	18.10	18.30
Sunaina	7.09	7.30	16.58	16.83	19.58	19.89	17.75	17.95
Varsha	6.43	6.62	15.03	15.26	17.76	18.04	16.10	16.28
Type-1	7.26	7.48	16.98	17.24	20.06	20.38	18.18	18.39
Type-44	7.12	7.34	16.66	16.91	19.68	19.99	17.84	18.04

Type-51	7.06	7.27	16.51	16.76	19.51	19.81	17.68	17.88
ML- 1	7.12	7.33	16.64	16.90	19.66	19.97	17.82	18.02
ML- 5	7.05	7.27	16.49	16.75	19.49	19.79	17.66	17.86
ML-131	7.26	7.48	16.98	17.24	20.06	20.38	18.18	18.39
CO-4	6.57	6.77	15.36	15.59	18.14	18.43	16.44	16.63
Jawahar-45	7.21	7.42	16.85	17.11	19.91	20.22	18.04	18.25
K-851	7.17	7.39	16.77	17.03	19.81	20.12	17.96	18.16
Gujrat-1	6.74	6.95	15.76	16.01	18.62	18.92	16.88	17.07
Gujrat-2	6.68	6.88	15.62	15.86	18.45	18.74	16.72	16.91
SEm±	0.183	0.515	0.434	0.420	0.514	0.509	0.437	0.467
CD(P=0.05)	0.509	0.515	1.208	1.168	1.430	1.418	1.217	1.299
Phosphorus levels (kg ha^{-1})								
0	5.49	5.66	12.84	13.04	15.17	15.41	13.75	13.90
20	6.32	6.52	14.79	15.02	17.47	17.75	15.83	16.02
40	7.92	8.16	18.53	18.81	21.89	22.23	19.84	20.06
60	8.06	8.31	18.85	19.14	22.27	22.62	20.18	20.42
SEm±	0.052	0.052	0.123	0.119	0.145	0.144	0.124	0.132
CD(P=0.05)	0.144	0.146	0.342	0.330	0.404	0.401	0.344	0.367

Table 3: Effect of varieties and phosphorus levels on number of branch plant^{-1} number of pod per plant and grain yield kg per hectare

Treatments	No. of Branch at 45 DAS		No. of Branch at 60 DAS		No. of Branch at har		No. of pod plant $^{-1}$		Yield kg ha^{-1}	
	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16	2014-15	2015-16
NDM-1	4.58	4.67	5.23	5.30	5.40	5.45	34.98	37.74	10.36	10.63
Meha	4.03	4.11	4.61	4.67	4.75	4.80	31.68	34.18	9.12	9.36
Samarat	3.95	4.02	4.51	4.57	4.65	4.70	31.35	33.82	8.93	9.17
Amrit	4.16	4.24	4.75	4.81	4.90	4.95	31.65	34.14	9.41	9.65
KM I	3.82	3.89	4.37	4.42	4.50	4.55	32.18	34.71	8.65	8.87
Mohini	4.24	4.32	4.85	4.91	5.00	5.05	33.66	36.31	9.60	9.85
Pant Mung-1	4.33	4.41	4.94	5.01	5.10	5.15	33.33	35.96	9.79	10.04
Pant Mung-2	4.41	4.49	5.04	5.10	5.20	5.25	34.16	36.85	9.98	10.24
PDM-11	4.07	4.15	4.66	4.71	4.80	4.85	32.34	34.89	9.22	9.46
Pusa-105	3.91	3.98	4.46	4.52	4.60	4.65	31.35	33.82	8.84	9.07
Pusa Vaisakhi	4.28	4.37	4.90	4.96	5.05	5.10	33.00	35.60	9.69	9.95
Sabarmati	4.37	4.45	4.09	5.05	5.15	5.20	33.83	36.49	9.88	10.14
Sunaina	4.28	4.37	4.90	4.96	5.05	5.10	33.17	35.78	9.69	9.95
Varsha	3.89	3.96	4.44	4.50	4.58	4.63	30.36	32.75	8.79	9.02
Type-1	4.39	4.47	5.02	5.08	5.17	5.23	34.55	37.27	9.93	10.19
Type-44	4.31	4.39	4.92	4.98	5.07	5.13	34.09	36.77	9.74	9.99
Type-51	4.27	4.35	4.88	4.94	5.03	5.08	33.86	36.53	9.65	9.91
ML-1	4.30	4.38	4.92	4.98	5.07	5.12	33.86	36.53	9.73	9.98
ML-5	4.26	4.34	4.87	4.93	5.02	5.08	33.46	36.10	9.64	9.90
ML-131	4.39	4.47	5.02	5.16	5.16	5.16	33.89	36.56	9.93	10.19
CO-4	3.97	4.04	4.54	4.67	4.67	4.67	32.01	34.53	8.98	9.21
Jawahar-45	4.36	4.44	4.98	5.12	5.12	5.12	34.32	37.02	9.85	10.11
K-851	4.33	4.42	4.95	5.10	5.10	5.10	34.22	36.92	9.80	10.06
Gujrat-1	4.07	4.15	4.66	4.79	4.79	4.79	31.71	34.21	9.22	9.46
Gujrat-2	4.04	4.11	4.61	4.75	4.75	4.75	32.01	34.53	9.13	9.37
SEm-+	0.111	0.110	0.122	0.127	0.127	0.128	0.858	0.899	0.243	0.257
CD(P=0.05)	0.309	0.307	0.340	0.354	0.354	0.355	2.387	2.501	0.675	0.716
Phosphorus levels (kg ha^{-1})										
0	3.32	3.38	3.79	3.85	3.91	3.94	31.35	33.82	7.51	7.70
20	3.82	3.89	4.37	4.44	4.50	4.54	32.34	34.89	8.65	8.87
40	4.79	4.88	5.47	5.56	5.64	5.68	33.99	36.67	10.83	11.12
60	4.87	4.96	5.57	5.66	5.74	5.78	34.32	37.02	11.02	11.31
SEm-+	0.031	0.031	0.035	0.036	0.036	0.036	0.243	0.254	0.069	0.073
CD(P=0.087)	0.087	0.087	0.096	0.100	0.100	0.100	0.675	0.707	0.191	0.203