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Effect of different levels of fly ash and NPK on growth and yield of Kidney Beans (*Phaseolus vulgaris*) in Dehradun

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Abstract

A field experiment was conducted during summer season of 2022 at research farm, Department of Agronomy Shri Guru Ram Rai University, Dehradun, Uttarakhand. In order to investigate the Effect of Different Levels of Fly Ash and NPK on Growth and Yield of Kidney Bean (*Phaseolus vulgaris*) at Dehradun. The layout of experimental field was laid randomized block design (RBD) with 10 treatments and 3 replications. Consisting of T₁ Control, T₂ Fly ash @ 15 t/ha + NPK @ 5%, T₃ Fly ash @ 40 t/ha + NPK @ 30%, T₄ Fly ash @ 30 t/ha + NPK @ 20%, T₅ Fly ash @ 10 t/ha, T₆ Fly ash @ 20 t/ha + NPK @ 10%, T₇ Fly ash @ 35 t/ha + NPK @ 25%, T₈ Fly ash @ 5 t/ha + NPK @ 5%, T₉ Fly ash @ 25 t/ha + NPK @ 15%, T₁₀ Fly ash @ 5 t/ha.

The results indicated that among all the treatments, T₃ (Fly ash @ 40 t/ha + NPK @ 30%) overall was found best for farmer point of view with respect to branches/plant (11.00), seed yield (19.08 q/ha), straw yield (38.19 q/ha). Based on present investigation, it can be concluded that the Fly ash @ 40 t/ha + NPK @ 30% is applied that improved growth and yield of Kidney Bean crop under present agro-climatic conditions.

Keywords: Nitrogen, fly ash, NPK, kidney bean

Introduction

India is ranked as the largest producer, importer and consumer of pulses in the world accounting for nearly 25% of global production, 15% of international trade and 27% of world consumption. We all know that pulses play a vital role in our lives. Pulses are the cheapest source of dietary proteins. The high content of protein in pulses makes the diet more nutritive for vegetarian when taken with other cooked food items. The pulses are also known for increasing productivity of soil through fixation of nitrogen from atmosphere, addition of biomass to soil and secretion of growth promoting substances. Pulses are well suited rain fed conditions and require less farm resources; herice, farmers prefer to grow them from economic point of view throughout the country. About a dozen pulse crops pi, chickpea, pigeon pea, mungbean, unbean, lentil, rajma, field pea, lathyrus, cowpea, common bean, moth bean, horse gram and rice bean are cultivated under varied agro-ecological conditions. Pulses are second most important group of crops after cereals. During the year 2009, the global pulse production was 61.5 million tonnes from an area of 70.6 million ha, with an average yield of 871 kg ha. In India, pulses account for about one fifth of the total area under food grains and contribute to about one twelfth of the total food grains production with the total area under pulses being 23.85 m ha and production of 14.60 m tones. (Anon., 2012) ^[11]. Pulses are grown over an area of 26.28 million ha with an annual production of 18.09 million tonnes and productivity of 689 kg ha. Rajma (*Phaseolus vulgaris* L.) is also known as French bean, snap bean, hairy coat bean, navy bean, common bean. Rajma has evolved in high lands of Middle America over periods of 700-800 years. Rajma being native to South and Central America probably Mexico, is being widely cultivated in tropical, sub-tropical and temperate regions. It is a traditional temperate region crop. It is cultivated even during Rabi season, where winters are mild and frost free.

Globally, rajma is cultivated in 28 m ha area with production of 19 million tones Brazil is the leading producer and then Columbia, USA. Canada, India & Turkey. In India, it is grown in 1 lakh ha mainly in the states of Maharashtra, Jammu& Kashmir, Himachal Pradesh, Uttar Pradesh, Tamilnadu, Kerala, West Bengal and Karnataka. Among the pulses rajma is one of the high potential pulse crops with yielding potential of 18 to 20 q ha⁻¹.

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Rajma belongs to the Family leguminosae and sub family fabaceae. The genus *Phaseolus* has over 50 species and Rajma is one of them accounting for 90% of cultivated species worldwide. In India both bushy and trailing type's rajma are found. Major Rajma producing areas are located in tropical and temperate regions with a temperature around 21 °C.

Material and Methods

The present investigation entitled “Effect of Different Levels of Fly Ash and NPK on Growth and Yield of Kidney Bean (*Phaseolus vulgaris*) at Dehradun”. Was carried out in the research farm, Department of Agronomy, Shri Guru Ram Rai University. It is located in the north western region of Uttarakhand at an altitude of 450 m above mean sea level (MSL) and 3088 square kilometers in size. Geographically, the location of Dehradun is in between 29 58’ and 31 2’30” North latitude and 77 34’45” and 78 18’30” east longitudes.

The climate of Dehradun is humid subtropical. Summer temperatures can reach up to 44 °C for a few days and a hot wind called Loo blows over North India. Winter temperatures are usually between 1 and 20 °C and fog is quite common in winters like plains. Although the temperature in Dehradun can reach below freezing during severe cold snaps, this is not common. During the monsoon season, there is often heavy and protracted rainfall.

The soil of experimental site is classified as ‘sandy loam’ with characteristics as deep, well drained, coarse loamy cover over fragmental soils and of medium fertility. Total five soil samples were taken from upper (0-15 cm) layer of the soil and mixed properly from different sites of the field. After proper mixing of the soil, a representative sample was taken for its physiochemical process. A composite soil sample was prepared and analyzed separately for different physiochemical characteristics of the soil. The analysis revealed that the soil of the experimental site was Sandy loam in texture poor in organic matter, low in available nitrogen, medium in available phosphorus and Potassium contents with neutral in reaction and normal in electrical conductivity.

The experimental site having neutral pH and experiment was laid out in the layout of experimental field was laid randomized block design (RBD) with 10 treatments and 3 replications. Consisting of T₁ Control, T₂ Fly ash @ 15 t/ha + NPK @ 5%, T₃ Fly ash @ 40 t/ha + NPK @ 30%, T₄ Fly ash @ 30 t/ha + NPK @ 20%, T₅ Fly ash @ 10 t/ha, T₆ Fly ash @ 20 t/ha + NPK @ 10%, T₇ Fly ash @ 35 t/ha + NPK @ 25%,

T₈ Fly ash @ 5 t/ha + NPK @ 5%, T₉ Fly ash @ 25 t/ha + NPK @ 15%, T₁₀ Fly ash @ 5 t/ha and net plot size was 6 m (3 mx 2 m). Total number of plots were 30.

Result and Discussion

Branches/plant

Observations on branches /plant were recorded at harvest and the data were statistically analyzed. The mean values have been presented in Table 1. At harvest stage, maximum number of branches /plant recorded under T₃ (11.00) i.e., Fly Ash @ 40 t/ha + NPK @ 30%, followed by T₇ (10.66), T₄ (10.00), and least height recorded on control plots i.e. T₁ (6.00). Further, it was also observed that all the other treatments were significantly better in branches/plant than the control treatment.

Pods/plant

Observations on the pods/plant were recorded at harvest and the data were statistically analyzed. The mean values have been presented in Table 1. At harvest stage, maximum pods/plant were recorded under T₃ (9.66) i.e., Fly Ash @ 40 t/ha + NPK @ 30% followed by T₇ (9.33), T₉ (8.33), and least pods/plant recorded on control plots i.e. T₁ (5.33). Further, it was also observed that all the other treatments were significantly better in pods/plants than the control treatment.

Length of pods (cm)

Observations on the Length of pods were recorded at harvest and the data were statistically analyzed. The mean values have been presented in Table 1. At harvest stage, maximum length of pods was recorded under T₃ (11.66) i.e., Fly Ash @ 40 t/ha + NPK @ 30% followed by T₇ (11.33), T₉ (9.33), and least pods/plant recorded on control plots i.e. T₁ (6.66). Further, it was also observed that all the other treatments were significantly better in length of pods than the control treatment.

Seeds/pods

Observations on seeds/pods were recorded at harvest and the data were statistically analyzed. The mean values have been presented in Table 1. At harvest stage, maximum seeds/pods recorded under T₃ (5.66) i.e., Fly Ash @ 40 t/ha + NPK @ 30%, followed by T₇ (5.33), T₉ (4.33), and least seeds/pods recorded on T₁ (2.66). Further, it was also observed that all the other treatments were significantly better in seeds/pods than T₈.

Table 1: Effect of different treatments on growth & yield of Kidney Bean

	Treatments	Branches/plant	Pods/Plants	Length of Pods (cm)	Seeds/Pods
T1	Control	6.00	5.33	6.66	2.66
T2	Fly ash @ 15 t/ha + NPK @ 5%	8.33	7.00	8.00	3.33
T3	Fly ash @ 40 t/ha + NPK @ 30%	11.00	9.66	11.66	5.66
T4	Fly ash @ 30 t/ha + NPK @ 20%	10.00	9.00	10.33	5.00
T5	Fly ash @ 10 t/ha	8.00	6.66	9.00	4.00
T6	Fly ash @ 20 t/ha + NPK @ 10%	9.00	7.66	8.66	4.00
T7	Fly ash @ 35 t/ha + NPK @ 25%	10.66	9.33	11.33	5.33
T8	Fly ash @ 5 t/ha + NPK @ 5%	6.33	7.00	7.00	4.00
T9	Fly ash @ 25 t/ha + NPK @ 15%	8.66	8.33	9.33	4.33
T10	Fly ash @ 5 t/ha	7.66	6.33	7.00	4.33
	SEm ±	0.66	0.53	0.51	0.51
	CD (P = 0.05)	1.90	1.52	1.46	1.46

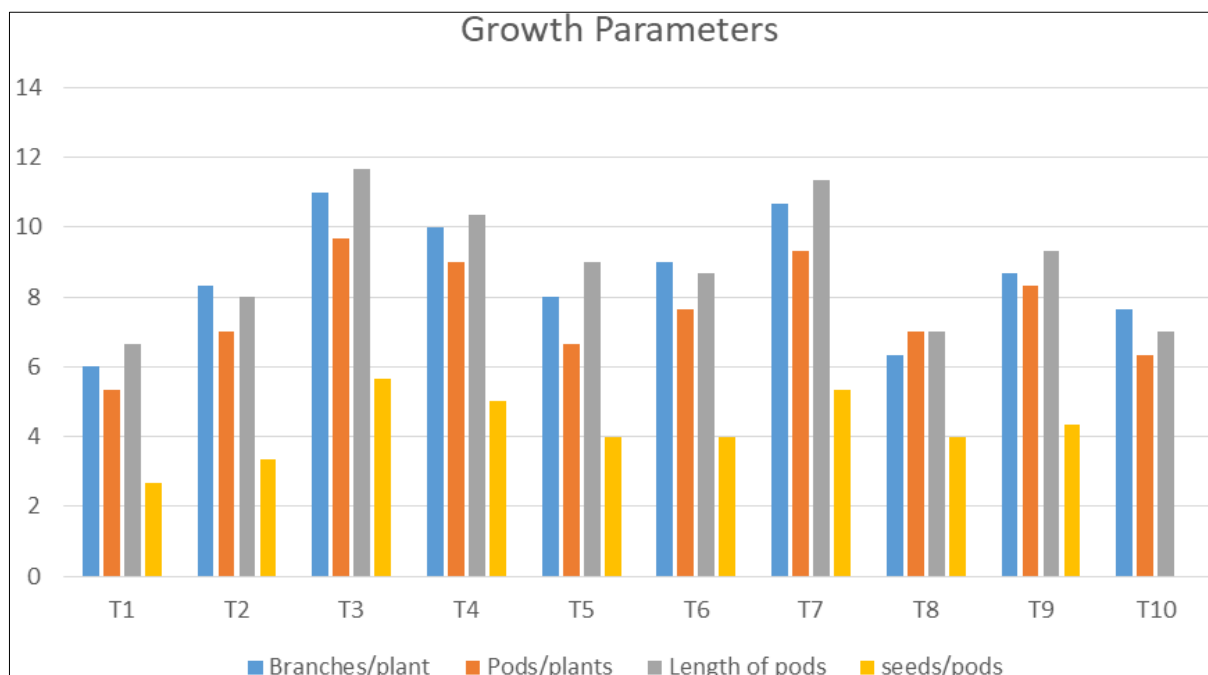


Fig 1: Graphical presentation of effect of different treatments on growth

Seed yield (q/ha)

Observations on seed yield were recorded at harvest and the data were statistically analyzed. The mean values have been presented in Table 2. At harvest stage, maximum seed yield recorded under T3 (19.08 q/ha) i.e. Fly Ash @ 40 t/ha + NPK @ 30%, followed by T7 (18.73 q/ha), T9 (17.76 q/ha), and least seed yield recorded on control plots i.e. T1 (11.92 q/ha). Further, it was also observed that all the other treatments were significantly better in seed yield than the control treatment.

Straw yield (q/ha)

Observations on straw yield were recorded at harvest and the data were statistically analyzed. The mean values have been presented in Table 2. At harvest stage, maximum straw yield recorded under T3 (38.19 q/ha) i.e. Fly Ash @ 40 t/ha + NPK @ 30%, followed by T7 (32.74 q/ha), T4 (26.78 q/ha), and least straw yield recorded on control plots i.e. T1 (19.74 q/ha). Further, it was also observed that all the other treatments were

significantly better in straw yield than the control treatment.

Biological yield (q/ha)

Observations on biological yield were recorded at harvest and the data were statistically analyzed. The mean values have been presented in Table 2. At harvest stage, maximum biological yield recorded under T3 (57.27 q/ha) i.e. Fly Ash @ 40 t/ha + NPK @ 30%, followed by T7 (51.47 q/ha), T6 (46.20 q/ha), and least biological yield recorded on control plots i.e. T1 (31.66 q/ha). Further, it was also observed that all the other treatments were significantly better in biological yield than the control treatment.

Harvesting index

The maximum harvesting index was found under T10 (43.41%) followed by T2 (41.72%), T9 (40.53%), and least harvesting index was on T3 (33.53%).

Table 2: Effect of different treatments on yield of Kidney Bean

Treatments	Seed Yield (q/ha)	Straw Yield (q/ha)	Biological Yield (q/ha)	H.I (%)
T1 Control	11.92	19.74	31.66	37.63
T2 Fly ash @ 15 t/ha + NPK @ 5%	15.54	23.73	39.27	41.72
T3 Fly ash @ 40 t/ha + NPK @ 30%	19.08	38.19	57.27	33.53
T4 Fly ash @ 30 t/ha + NPK @ 20%	17.73	26.78	44.51	40.22
T5 Fly ash @ 10 t/ha	14.70	25.03	39.73	37.76
T6 Fly ash @ 20 t/ha + NPK @ 10%	16.82	29.37	46.20	36.41
T7 Fly ash @ 35 t/ha + NPK @ 25%	18.73	32.74	51.47	36.44
T8 Fly ash @ 5 t/ha + NPK @ 5%	13.54	22.52	36.06	37.56
T9 Fly ash @ 25 t/ha + NPK @ 15%	17.76	26.76	44.52	40.53
T10 Fly ash @ 5 t/ha	14.16	18.75	32.91	43.41
SEm ±	0.51	4.45	4.50	4.43
CD (P = 0.05)	1.46	12.81	12.96	12.75

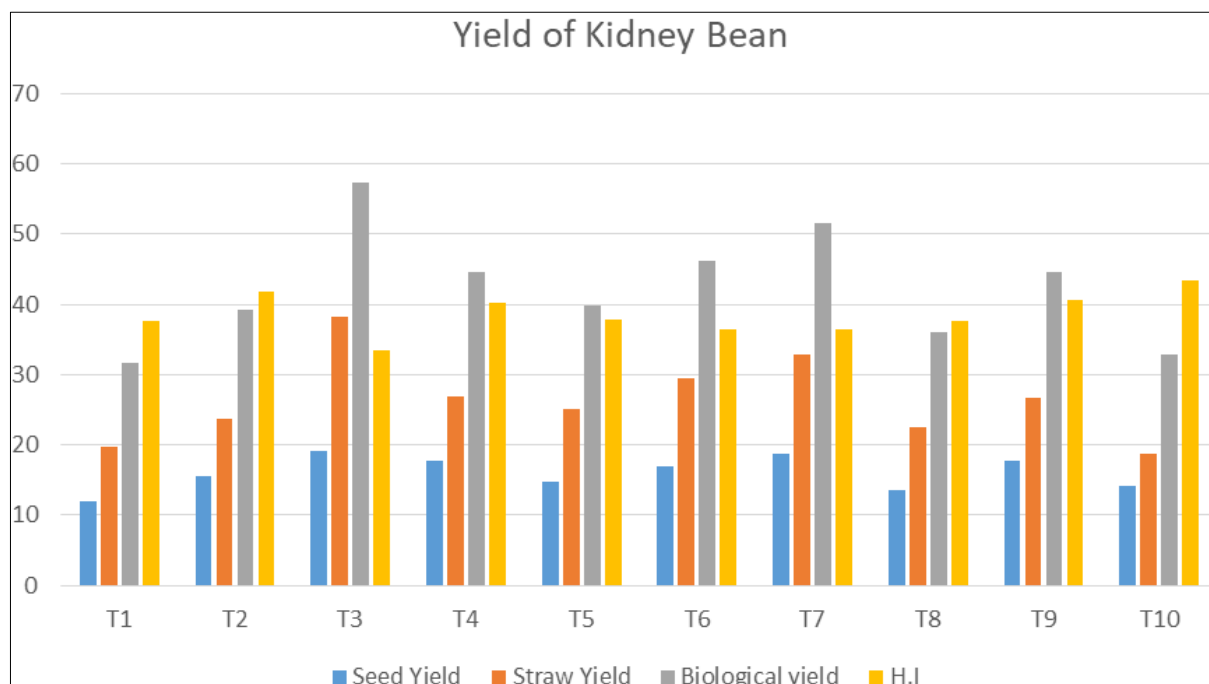


Fig 2: Graphical presentation of effect of different treatments on Yield

Conclusion

On the basis of field experiment conducted on “Effect of Different Levels of Fly Ash and NPK on Growth and Yield of Kidney Bean (*Phaseolus vulgaris*) at Dehradun” concluded that treatment T3 i.e., Fly Ash @ 40 t/ha + NPK @ 30% was found superior among the other treatments on growth and yield of Kidney Bean. Treatment 3 is the most recommended to the farmers.

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