The Pharma Innovation Journal 2022; 11(9): 1631-1633

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(9): 1631-1633

www.thepharmajournal.com
Received: 08-06-2022
Accepted: 20-08-2022

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# Effect of integrated nutrient management on growth and yield of pigeonpea (*Cajanus cajan* (L.) Millsp.) In Chhattisgarh plain

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## Abstract
The present experiment was conducted at Barrister Thakur Chhedilal College of Agriculture and Research Station Bilaspur C.G. during *Kharif season* 2021-22 find out the Effect of integrated nutrient management on growth and yield of pigeonpea (*Cajanus cajan* (L.) Millsp.) In Chhattisgarh plain. The experiment was laid out in Randomized Block Design (RBD) with three replications. There were 8 treatments combinations. Application of 150% RDF + FYM @ 5 t ha$^{-1}$ significantly increased the yields of pigeonpea crops over control plot and other lower doses of fertilizers and FYM. The highest pigeonpea equivalent yield (16.75 q ha$^{-1}$), stalk yield (55.68 q ha$^{-1}$), Harvest index (23.12%), were recorded when 150% RDF + 5 t ha$^{-1}$ FYM was applied to pigeonpea crop in treatment ($T_6$) and which was at par with treatment 125% RDF + 5 t ha$^{-1}$ FYM ($T_5$) and treatment 100% RDF + 5 t ha$^{-1}$ FYM ($T_4$).

**Keywords:** Production, productivity, nutrient, pigeonpea

## Introduction
Pigeonpea (*Cajanus cajan* (L.) Millsp) is India's second-most important pulse crop after chickpea, also known as red grams, archer, or turn. It is most frequently consumed as 'dal,' a split pulse. It is commonly used as a pulse, green vegetable, and fodder for a number of other things. It occupies an area of about 4.92 m ha with a total production of 3.65 MT with an average productivity of 398 kg ha$^{-1}$ during 2020-21 (Anonymous, 2021) [1]. Pigeonpea occupies 119.30 ha in Chhattisgarh, with productivity 601 kg ha$^{-1}$ with positive growth rates. (Directorate of CG Government, 2021-22). The productivity of pigeonpea is controlled by many factors, i.e. varieties, time of sowing, nutrient management etc. out of which mineral nutrition plays an important role, but heavy and imbalance use of chemical fertilizers has led to think about the use of organic manures in intensively growing areas for sustainable production. Integrated nutrient management is the supply of the required plant nutrients for sustaining the desired crop productivity with minimum/no deleterious effect on soil health and environment through use of judicious combination of organic, inorganic and bio fertilizers. Thus, integrated management of the nutrients is needed for proper plant growth, together with effective crop, water, soil, and land management.

## Material and Method
The experiment was performed at Barrister Thakur Chhedilal College of Agriculture and Research Station, Sarkanda, Bilaspur. It is situated in the middle region of the state of Chhattisgarh. The soil of experimental field was clayey. During the crop period the maximum temperature ranges from 33.4 ºC to 33 ºC at 40$^{th}$ standard meteorological week while, minimum temperature ranges from 4.4 ºC to 6.4 ºC at 4$^{th}$ standard meteorological week. The relative humidity varied from 96.3 to 45 percent at its highest and lowest point on 41st standard meteorological week and 6th standard meteorological week. The maximum rainfall recorded on 9th August to 15th August which is 841.6 mm on 32$^{th}$ standard meteorological week. The pigeonpea variety was selected for the study purpose. It is developed from Indira Gandhi Krishi VIshwavidyalaya Raipur in 2011. Duration is about 180-190 days. This variety is resistant to wilt and sterility mosaic disease. The average yield is 18-19 q ha$^{-1}$. The experiment was laid out in randomized block design (RBD) with 3 replications and 8 integrated nutrient management treatments. $T_1$: 100% RDF, $T_2$: 125% RDF, $T_3$: 150% RDF, $T_4$: 100% RDF + FYM @ 5 t ha$^{-1}$, $T_5$ 125% RDF + FYM @ 5 t ha$^{-1}$, $T_6$: 150% RDF + FYM @ 5 t ha$^{-1}$, $T_7$: 100% RDF + *Rhizobium culture*, $T_8$: Control plot.

Pigeonpea was sown on 12th July 2021 and Harvested on 05th February 2022.

**Results and Discussion**

In this experiment different crop growth period number of plant population observed non- significant. Treatment ($T_6$) shows significantly highest growth parameters and yield attributes i.e., plant height, number of primary and secondary branches plant$^{-1}$, number of functional leaves plant-1, number of root nodules and dry weight of root nodules plant$^{-1}$, dry matter accumulation (g), crop growth rate, relative growth rate and number of pods plant-1, pod length in cm, number of seed pod-1, seed weight plant-1 and it was at par with ($T_5$). Significantly maximum seed yield and stalk yield recorded in this treatment. While lowest was found under ($T_8$) control plot. Highest cost of cultivation (44206.30 ₹ ha$^{-1}$), gross return (105504 ₹ ha$^{-1}$) and net return (61297.70 ₹ ha$^{-1}$) observed in ($T_6$) followed by ($T_5$) and ($T_4$).While lowest was recorded under ($T_8$) control plot. Maximum benefit: cost ratio 1.82 found in treatment 100% RDF+ *Rhizobium culture* ($T_7$) followed by ($T_2$) and ($T_3$).

**Plant height**

A significantly effect of integrated nutrient management was observed on plant height at all growth stages till harvest stage (180 DAS). Among the applied treatment 150% RDF+ 5 t ha$^{-1}$ FYM ($T_6$) recorded the highest plant height (186.09 cm) as compared to other treatments at the time of harvest. However it was at par with treatment 125% RDF + FYM @ 5 t ha$^{-1}$ ($T_5$). Significantly the lowest plant height (165.73 cm) observed in control plot ($T_8$). The similar trend was observed in each duration.

**Number of primary branches plant$^{-1}$**

Among the applied treatment, 150% RDF+ 5 t ha$^{-1}$ FYM ($T_6$) recorded the highest number of primary branches plant-1 (15.24) as compared to other treatments at the time of harvest. However it was at par with treatment 125% RDF+FYM @ 5 t ha$^{-1}$ ($T_5$). Significantly the lowest number of primary branches plant$^{-1}$ (10.68) observed in control plot ($T_8$). The similar trend was observed in each duration.

**Dry matter accumulation (gm) plant$^{-1}$ of pigeonpea**

Among the applied treatment, 150% RDF+ 5 t ha$^{-1}$ FYM ($T_6$) recorded the highest number of dry matter accumulation plant$^{-1}$ (150.74 gm) as compared to other treatments at the time of harvest. However it was at par with treatment 125% RDF + FYM @ 5 t ha$^{-1}$ ($T_5$). Significantly the lowest dry matter accumulation (gm) plant$^{-1}$ (115.63 gm) observed in control plot ($T_8$). The similar trend was observed in each duration.

**Seed yield (q ha$^{-1}$)**

The application of integrated nutrient management had significantly effect on seed yield (q ha$^{-1}$). Data pertaining of yield recorded and presented in Table 3. Among the applied treatment, 150% RDF + 5 t ha$^{-1}$ FYM ($T_6$) recorded the highest seed yield (16.75 q ha$^{-1}$) as compared to other treatments. However it was at par with treatment 125% RDF + FYM @ 5 t ha$^{-1}$ ($T_5$). Significantly the lowest seed yield (10.79 q ha$^{-1}$) observed in control plot ($T_8$).

**Stalk yield (q ha$^{-1}$)**

The application of integrated nutrient management had significantly effect on seed yield (q ha$^{-1}$). Data pertaining of yield recorded and presented in Table 3. Among the applied treatment, 150% RDF+ 5 t ha$^{-1}$ FYM ($T_6$) recorded the highest stalk yield (55.68 q ha$^{-1}$) as compared to other treatments. However it was at par with treatment 125% RDF + FYM @ 5 t ha$^{-1}$ ($T_5$). Significantly the lowest stalk yield (43.52 q ha$^{-1}$) observed in control plot ($T_8$).

**Table 1:** Effect of integrated nutrient management on plant height (cm), number of primary branches plant$^{-1}$ and dry matter accumulation (gm) plant$^{-1}$ of pigeonpea at harvest stages

| | Treatment details | Plant height (cm) at harvest | Number of primary branches plant$^{-1}$ at harvest | Dry matter accumulation (gm) plant$^{-1}$ at harvest |
|---|---|---|---|---|
| $T_1$ | RDF 100% (20:50:20) kg ha$^{-1}$ N:P2O5:K2O | 168.28 | 12.72 | 132.40 |
| $T_2$ | RDF 125% (25:62.5:25) kg ha$^{-1}$ N:P2O5:K2O | 171.22 | 12.86 | 136.62 |
| $T_3$ | RDF 150% (30:75:30) kg ha$^{-1}$ N:P2O5:K2O | 173.18 | 13.33 | 141.48 |
| $T_4$ | RDF 100% + FYM @ 5t ha$^{-1}$ | 179.57 | 14.45 | 142.76 |
| $T_5$ | RDF 125% + FYM@ 5t ha$^{-1}$ | 184.56 | 15.16 | 146.52 |
| $T_6$ | RDF 150% + FYM@ 5t ha$^{-1}$ | 186.09 | 15.24 | 150.74 |
| $T_7$ | RDF 100% + *Rhizobium culture* | 178.30 | 14.05 | 141.85 |
| $T_8$ | Control plot | 165.73 | 10.68 | 115.63 |
| | SEM± | 0.44 | 0.68 | 0.96 |
| | CD (5%) | 1.32 | 2.08 | 2.90 |

**Table 2:** Effect of integrated nutrient management on pod length in cm, number of pods plant$^{-1}$, number of seeds pod$^{-1}$, seed weight plant$^{-1}$ and test weight (gm) of pigeonpea

| | Treatment details | Pod Length (cm) | No of pod plant$^{-1}$ | No. of seed pod$^{-1}$ | Seed weight plant$^{-1}$ | Test weight (gm) |
|---|---|---|---|---|---|---|
| $T_1$ | RDF 100% (20:50:20) kg ha$^{-1}$ N:P2O5:K2O | 4.91 | 129.10 | 3.52 | 53.33 | 90.51 |
| $T_2$ | RDF 125% (25:62.5:25) kg ha$^{-1}$ N:P2O5:K2O | 5.01 | 130.13 | 3.68 | 54.56 | 90.88 |
| $T_3$ | RDF 150% (30:75:30) kg ha$^{-1}$ N:P2O5:K2O | 5.32 | 133.72 | 3.77 | 54.67 | 91.39 |
| $T_4$ | RDF 100% + FYM @ 5t ha$^{-1}$ | 5.96 | 135.66 | 3.86 | 58.08 | 92.33 |
| $T_5$ | RDF 125% + FYM@ 5t ha$^{-1}$ | 6.08 | 137.33 | 4.37 | 58.19 | 92.87 |
| $T_6$ | RDF 150% + FYM@ 5t ha$^{-1}$ | 6.31 | 138.38 | 4.49 | 59.54 | 93.17 |
| $T_7$ | RDF 100% + *Rhizobium culture* | 5.42 | 135.48 | 4.23 | 57.25 | 92.08 |
| $T_8$ | Control plot | 4.48 | 126.93 | 2.99 | 48.13 | 88.31 |
| | SEM ± | 0.26 | 1.11 | 0.24 | 0.42 | 2.33 |
| | CD (5%) | 0.80 | 3.35 | 0.72 | 1.29 | 7.05 |

**Table 3:** Effect of integrated nutrient management on seed yield, stalk yield, biological yield and harvest index of pigeonpea

| | Treatment details | Seed yield (q ha$^{-1}$) | Stalk yield (q ha$^{-1}$) | Biological yield (q ha$^{-1}$) | Harvest index (%) |
|---|---|---|---|---|---|
| $T_1$ | RDF 100% (20:50:20) kg ha$^{-1}$ N:P2O5:K2O | 13.83 | 51.13 | 64.97 | 21.29 |
| $T_2$ | RDF 125% (25:62.5:25) kg ha$^{-1}$ N:P2O5:K2O | 14.50 | 52.33 | 66.82 | 21.69 |
| $T_3$ | RDF 150% (30:75:30) kg ha$^{-1}$ N:P2O5:K2O | 15.12 | 53.56 | 68.68 | 22.01 |
| $T_4$ | RDF 100% + FYM @ 5t ha$^{-1}$ | 15.50 | 53.03 | 68.53 | 22.61 |
| $T_5$ | RDF 125% + FYM@ 5t ha$^{-1}$ | 16.21 | 54.33 | 70.54 | 22.97 |
| $T_6$ | RDF 150% + FYM@ 5t ha$^{-1}$ | 16.75 | 55.68 | 72.53 | 23.12 |
| $T_7$ | RDF 100% + *Rhizobium culture* | 14.11 | 53.15 | 66.36 | 21.29 |
| $T_8$ | Control plot | 10.79 | 43.52 | 54.31 | 19.87 |
| | S.Em ± | 0.45 | 2.19 | 1.99 | 0.99 |
| | CD (5%) | 1.36 | 6.66 | 6.04 | 3.00 |

## Conclusion

It is concluded that on the basis of growth parameter were significantly higher under treatment ($T_6$) 150% RDF + FYM @ 5 t ha$^{-1}$ in pigeonpea. It was at par with treatment ($T_5$) 125% RDF + FYM @ 5 t ha$^{-1}$. On the basis of yield attributes, seed yield ($T_6$) 150% RDF + FYM @ 5 t ha$^{-1}$ recorded highest (16.75 q ha$^{-1}$) however, it was significantly at par ($T_5$) 135% RDF + FYM @ 5 t ha$^{-1}$ and ($T_4$). Treatment ($T_8$) Control plot recorded lowest yield compare to all other treatments.

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