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# Performance of Pigeonpea (*Cajanus cajan* L.) sown on different land configuration techniques

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**Abstract**
The field experiment carried out during *Kharif season* of 2018 and 2019 at College of Agriculture, Gwalior to evaluate the performance of pigeonpea under different land configurations. The trials involved three land configurations i.e., Flat bed ($C_1$), Ridge and furrow ($C_2$) and Opening of furrow after two row ($C_3$) with 3 replications. The study revealed that among different land configurations, ridge and furrow method gave significantly higher values of all growth attributes viz., plant height (cm) and number of branches plant$^{-1}$ ; yield attributes viz., , number of pods plant$^{-1}$, number of seed pod$^{-1}$ and test weight and yield viz., seed and straw yield (kg/ha), Harvest index (%) over rest of the other treatments, respectively. Hence, it was conducted that treatment Ridge and furrow ($C_2$) was economically feasible as compared to other methods of sowing of pigeonpea.

**Keywords:** Pigeonpea, land configuration, ridge and furrow, yield

## Introduction
India is the world's largest producer and consumer of a wide variety of pulses which is dominated by tropical and sub-tropical crops such as chickpea, red gram (pigeon pea), black gram, green gram (mung bean) and lentil and so on, high in protein, fiber, vitamins and also supplies of high quality carbohydrate, minerals and vitamins. The carbohydrates provided by pulses are released slowly as compared to cereals and so a high value for maintaining optimal blood sugar levels and restoring energy over a long period of time after the meals. Pulses in general are one of most sustainable crop utilizing just 359 liter of water to produce one kg of pulses, as compared with 1,802 for soybeans and 3,071 for groundnut. They also contribute to soil quality by fixing nitrogen in the soil. In India, the area under total pulses during 2017-18 was 29.36 million hectares with production of 24.51 million tones and average productivity of 835 kg ha$^{-1}$ (Anonymous, 2017-18) [3]. Pulses are the rich source of protein and energy but largely cultivated under energy starved conditions, mostly on marginal and sub marginal land and more than three- fourth of the area under pulses is still rainfed resulting in poor crop productivity.
Among pulses, Pigeonpea (*Cajanus cajan* (L.) Millsp.) is cultivated in the semi-arid areas of topics and subtropics. It is commonly known as red gram or tur or arhar predominantly grown during *Kharif*. It provides protein rich food, firewood and income for resource poor small farmers. The crop owes its popularity to the fact that being a leguminous plant; it is capable of fixing atmospheric nitrogen and thereby restores nitrogen content in the soil .Its deep root system helps in extracting nutrients and moisture from deeper soil layers thus making it suitable for rainfed condition . Pigeon pea is a long duration pulse crop mainly being cultivated in poor soils under rainfed condition and the crop has capacity to thrive well under low input and adverse condition (Kumar and Paslawar 2017) [10]. Among the pulses it is extensively used as an important source of protein in human diet. Pigeonpea grain contains 23.3 per cent protein, 3.5 per cent minerals, and 57.6 per cent carbohydrates and provides 335 cal energy per 100g (Anonymous, 1981) [1]. Pigeonpea has multiple uses, besides its consumption in the form of dry split dhal the tender green seeds are used as vegetables and the stem and roots as fuel wood. In addition, it is also used for forage purpose and improves soil health through its deep strong rooting system, leaf drop at maturity and addition of nitrogen by symbiotic activities during the crop growth. Pigeaonpea being an important nitrogen fixing crop can fix atmospheric N upto 200 kg N ha$^{-1}$ (Anonymous, 2010) [2]. Hence, pigeonpea is often called as "Biological plough". Extensive ground cover by pigeonpea prevents soil erosion by wind and water, encourages infiltration of rain water and smothers the weeds.
Pigeonpea is the fifth prominent legume crop in the world and ranked second after chickpea in India in terms of area and production. The major pigeonpea growing states in India are Maharashtra, Madhya Pradesh, Karnataka, Gujrat and Andhra Pradesh.

In India, the area under pigeonpea during 2017-18 was 4.46 million hectares with production of 4.18 million tones and average productivity of 937 kg $ha^{-1}$. In Madhya Pradesh the area was 6.47 lakh hectares with production of 8.39 lakh tones (Anonymous, 2017-18) [3].

In recent years, uncertainties in rain water availability, the swings in the onset, continunity and withdrawal pattern of monsoon has made crop production more risky in rainfed areas (Singh, 2000) [14]. Under these circumstances efficient rain water management practices acts as insurance for crops during abnormal rainfall situation. For getting a sustainable crop production system under rainfed condition, the conservation of rain water and its efficient recycling are imperative. The rain water can be conserved either in-situ or ex-situ in natural or manmade structures for supplemental irrigation. In-situ rain water conservation can be carried out either through tillage or land surface management (Singh and Singh,2015). Among the various land surface management practices ridges and furrow, broad bed furrow, tied ridges and furrow are very promising in controlling surface runoff, reducing the soil loss through erosion and increasing infiltration. On this backdrop there is need to evolve an appropriate agro-technology for successful cultivation of pigeonpea that result in efficient rain water conservation through various land configuration techniques. Keeping the above fact in view the present investigation on the effect of different land configuration techniques on growth, yield and yield attributes on pigeonpea crop.

## Materials and Methods

The field experiment was conducted during *Kharif* 2018 and 2019 at the College of Agriculture, Gwalior (M.P.). The soil of the experimental field was sandy clay loam. Soil of the experimental field was rich in potash content but low in organic carbon, available nitrogen and medium in available phosphorus contents. It is slightly alkaline in reaction and had moderate cation exchange capacity. The experiment was conducted in Split plot design with three number of replications. Treatment consisting of Flat bed, Ridge and Furrow, Opening of furrow after two row. Pigeonpea variety "ICPL 88039" was sown on 1st August 2018 and 1st August 2019 at spacing of 45cm x 15cm using seed rate of 20kg/ha and fertilized with 20:50:20 NPK kg/ha, respectively as basal dose. The harvesting was done manually with the help of sickle, when the crop attained full maturity. The produce of a square meter from five randomly selected place of each plot was tied into bundle and allowed to sun drying in respective plots. The harvested bundles were weighed with the help of balance and transported to threshing floor. Threshing of produce of each plot was done separately by beating with wooden sticks; the seeds were then cleaned manually and weighed.

The plant height was measured from ground level upto growing tip of plant at harvest from five randomly selected one square meter place and then average worked out. The number of branches $plant^{-1}$, number of pods $plant^{-1}$, number of seeds $pod^{-1}$ were counted at harvest from one square meter randomly selected spot and the mean number were computed. A random sample of 1000 seeds was taken from the seed produce, counted and its weight was recorded. Seed yield of a square meter of each plot was noted down, after threshing, winnowing and drying and calculated in kg $ha^{-1}$. Straw yield was obtained by deducting the seed yield from the weight of total dry produce (biological yield) of respective plot and calculated in kg $ha^{-1}$. The figure of biological yield was calculated by summing seed yield and straw yield. Finally it was converted on hectare basis.

Harvest Index is the ratio of economic yield to the total biological yield. Harvest index reflects the proportion of assimilate distribution between economical and total biomass. It is computed by the following formula.

Harvest index (HI)% = Economic yield/ Biological yield *100

Biological yield = Seed yield + Straw yield

## Result and Discussion

Different land configuration practices for pigeonpea cultivation had significant effect on plant height, number of branches $plant^{-1}$, number of pods $plant^{-1}$, number of seeds $pod^{-1}$, test weight(g), seed yield, straw yield and harvest index during the year of experimentation (Table 1 & 2).

### Effect on plant height (cm)

Among different land configuration practices for pigeonpea cultivation have significant effect on length of plants and were presented in Table(1).Cultivation of pigeonpea with ridge and furrow treatment method produced tallest plants (169.76 &165.46 cm) which was at par with the treatment opening of furrow after two rows (166.50 &164.65 cm) was found significantly superior over flat bed (156.35 & 154.96 cm) respectively, during both the years. This might be due to favorable seed bed, aeration, more conservation of water in ridge and furrow and initial vigorous growth resulted in more plant height of the crop. These results are confirm the findings of Indapuganti *et al.*, (2007) [4], Kalokhe (2010) [7], Sathe (2015) [13] and Kumar *et al.*, (2012) [8].

### Effect of number of branches $plant^{-1}$

The data on number of branches $plant^{-1}$ under various land configuration treatments was presented in Table (1). Results revealed that all the treatments differ statistically significant from each other. However, the highest number of branches $plant^{-1}$ (15.33 &15.16) was found with crop sown with ridge and furrow method which was statiscally at par with the treatment opening of furrow after two rows (14.96 &14.41) and was found significantly superior over flat bed (12.70 &12.82) respectively, during both the years. This might be due to the more plant height and vegetative growth of the plants grown on ridge and furrow. Moreover, the space available for side rows on ridge and furrow was more than that of flat bed system. Similar results were obtained by Kalokhe (2010) [7], Kumar *et al.*, (2012) [8], Pandey *et al.*, (2014) [11]. Sathe (2015) [13] also reported that significantly higher plant height, more number of branches and dry matter production in ridge and furrow as compared to Flat bed planting.

### Effect on number of pods $plant^{-1}$

As far as data on number of pods $plant^{-1}$ is concerned, all the treatments regarding land configuration practices of pigeonpea cultivation differ significantly with each other and was presented in Table(1). Results revealed that highest number of pods $plant^{-1}$ (94.39 & 89.33) was recorded in crop sown with ridge and furrow method which were at par with the treatment opening of furrow after two rows (89.67 & 85.33) and was found superior over flat bed method (84.94 & 73.17) respectively, during both the years. Increase in number of pods $plant^{-1}$ due to proper growth of crop, which might have resulted in greater translocation of food material to the reproductive part, which also reflected towards superiority in yield attributing characters. Pandey *et al.*,(2014) [11] also

reported similar results in which they stated that significantly higher yield attributes like number of pods plant$^{-1}$ and seed yield of pigeon pea was found superior with raised bed as compare to flat bed.
The results are in confirmation with kantwa *et al.*, (2005) [9], in which they conducted the experiment on effect of land configuration on performance of pigeonpea and reported that Broad bed furrow improved the yield attributes (pods$^{-1}$ and seed$^{-1}$) of pigeonpea over flat planting.

**Effect on number of seeds pod$^{-1}$**
Various land configuration practices has a significant effect on number of seeds pod$^{-1}$ of pigeonpea was presented in Table (1). Highest number of filled seed pod$^{-1}$ (3.92 &3.87) was recorded with crop sown in ridge and furrow method which was at par with the treatment opening of furrow after two rows (3.70 &3.78) and was found statistically superior over flat bed (3.37 &3.33). The higher growth attributes followed by more synthesis and translocation of food material to the source might have resulted in more number of seed per pods. The effect of land configurations on yield attributes are in line with the reports of Kantwa *et al*., (2005) [9] reported that Broad bed furrow improved the yield attributes (pods/plant and seed/pod) of pigeon pea over flat planting.

**Effect on test weight (g)**
In regard with effect of different land configuration techniques for pigeonpea cultivation on test weight, heavier seeds (102.89 & 100.83 g) was recorded with crop sown in ridge and furrow method which was at par with the treatment opening of furrow after two rows (102.83 & 97.78 g) and was found significantly superior over flat bed (97.44 & 92.17 g ) and was presented in Table (1). The overall better growth, development with the support of conserved soil moisture might have reflected in higher test weight plant$^{-1}$.
Kumar *et al*., (2012) [8] from Indian Agricultural Research Institute, New Delhi also found that, there is a significant improvement in yield attributes and yield component under BBF and paired row planting over uniform row planting. Pandey *et al*., (2014) [11] also find similar results and reported that significantly higher values of yield attributes and seed yield of pigeonpea was

**Effect on Seed yield and straw yield (kg ha$^{-1}$)**
Effect of different land configuration techniques for pigeonpea cultivation on seed and straw yield was presented in Table (2). The results showed that all treatments differ significantly from each other. Ridge and furrow method recorded statistically significant highest seed yield (1774.07 & 1661.42 kg ha$^{-1}$) and straw yield (5473.15 &5304.63 kg ha$^{-1}$) which was at par with the treatment opening of furrow after two rows and was found superior over flat bed method. This might be due to more favoured overall growth and yield attributing characters due to favourable seed bed, better aeration, scope for more space benefit of more conserved moisture in furrows and its support at critical growth stages like pod initiation and development. This result correlate with the work of Jaypaul (1996) [5], Jain *et al.*, (2000) [6] and Raut *el al.*, (2000) [12].
The capacity of plants to produce seed yield depends not only on the size of photosynthetic systems, it's efficiently and length of time for which it is active but also on translocation of dry matter into economic sink. Higher seed yield under these treatments was due to the highest branches plant$^{-1}$, pods plant$^{-1}$, seed pod$^{-1}$, and test weight resulted in higher dry matter production, high growth in terms of LAI, which resulted in higher production of photosynthesis, which acts as a source and greater translocation of food materials to the reproductive parts resulted in superiority of yield attributing characters and ultimately highest yield.

**Effect on Harvest Index (%)**
Harvest index reflects the proportion of assimilate distribution between economical and biological. Under different land configurations technique for cultivation of pigeonpea, maximum harvest index (24.42 & 23.83%) was recorded with crop sown with ridge and furrow method which was at par with the treatment opening of furrow after two rows (23.87 & 23.45%) over treatment of flat bed (23.15 &23.23%).
Based on two year study it could be concluded that sowing of pigeonpea in ridge and furrow found to be effective and achieve higher seed yield, straw yield and yield attributing characterstics like plant height, number of branches plant$^{-1}$, number of pods plant$^{-1}$, number of seeds pod$^{-1}$, test weight and harvest index than any other techniques.

**Table 1:** Effect of different land configuration techniques on pigeonpea growth and yield attributes

| Treatments | Plant height (cm) | | Number of branches plant$^{-1}$ | | Number of pods plant-$^{1}$ | | Number of grains pod$^{-1}$ | | Test weight (g) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2018 | 2019 | 2018 | 2019 | 2018 | 2019 | 2018 | 2019 | 2018 | 2019 |
| C1- Flat bed | 156.35 | 154.96 | 12.70 | 12.82 | 84.94 | 73.17 | 3.37 | 3.33 | 97.44 | 92.17 |
| C2- Ridge and furrow | 169.76 | 165.46 | 15.33 | 15.16 | 94.39 | 89.33 | 3.92 | 3.87 | 102.89 | 100.83 |
| C3- Opening of furrow after two rows | 166.50 | 164.65 | 14.96 | 14.41 | 89.67 | 85.33 | 3.70 | 3.78 | 102.83 | 97.78 |
| S.E.(m)± | 2.065 | 1.906 | 0.345 | 0.275 | 1.714 | 1.767 | 0.088 | 0.085 | 1.157 | 1.418 |
| C.D.(P=0.05) | 8.108 | 7.483 | 1.353 | 1.079 | 6.729 | 6.938 | 0.344 | 0.333 | 4.544 | 5.566 |

**Table 2:** Effect of land configuration techniques on pigeonpea seed yield, straw yield and harvest index

| Treatments | Seed yield (kg ha$^{-1}$) | | Straw yield (kg ha$^{-1}$) | | Biological yield (kg ha$^{-1}$) | | Harvest index (%) | |
|---|---|---|---|---|---|---|---|---|
| | 2018 | 2019 | 2018 | 2019 | 2018 | 2019 | 2018 | 2019 |
| C1- Flat bed | 1436.42 | 1328.40 | 4679.01 | 4332.41 | 6115.43 | 5660.80 | 23.15 | 23.23 |
| C2- Ridge and furrow | 1774.07 | 1661.42 | 5473.15 | 5304.63 | 7247.22 | 6966.05 | 24.42 | 23.83 |
| C3- Opening of furrow after two rows | 1635.19 | 1558.02 | 5199.38 | 5068.83 | 6834.57 | 6626.85 | 23.87 | 23.45 |
| S.E.(m)± | 55.856 | 60.653 | 141.791 | 153.976 | 197.428 | 214.438 | 0.224 | 0.198 |
| C.D.(P=0.05) | 219.282 | 238.116 | 556.650 | 604.487 | 775.074 | 841.855 | 0.879 | NS |

## Conclusion
It was concluded from the study that crop planted on ridge and furrow method with proper production technology gives good yield as well as economically feasible as compared to other methods of sowing of pigeon pea.

## References


1. Anonymous. Food composition of pulses. Indian Farming. 1981; 31(5):41.
2. Anonymous. A profile, AICRP on Pigeonpea Indian Institute of pulse research, Kanpur, 2010.
3. Anonymous. DES, Ministry of Agri. & FW (DAC & FW), Govt. of India, 2018.
4. Idapuganti KG, Mankar PS, Khawale VS, Date CP, Gaindhane SN. Effect of land configuration and weed biomass addition on growth and yield of semi - rabi pigeonpea. Journal of soils and crops. 2007; 17(1):114-116
5. Jayapaul P, Uthayankumar B, Markendevasagayami M, Balakrishna A. Effect of land configuration methods, irrigation regimes and soil moisture conservation amendmentson soybean yield and quality characters. Crop Res. 1996; 11(3):253.257
6. Jain HC, Deshmukh MR, Goswami V, Hedge DM. Studies on land configuration and seed hardening on productivity of sesame in different soil types. J. Maharashtra Agric, univ. 2000; 25(1):1-24
7. Kalokhe KT. Effect of biofertilizers on pigeonpea under different land configuration. M.Sc. (Agri.) Thesis VNMKV, Parbhani (M.S.) India, 2010.
8. Kumar P, Rana KS, Rana DS. Effect of planting systems and phosphorus with bio-fertilizers on the performance of sole and intercropped pigeonpea (*Cajanus cajan*) under rainfed conditions. Indian Journal of Agronomy. 2012; 57(2):127-132.
9. Kantwa SR, Ahlawat IPS, Gangaiah B. Effect of land configuration, post-monsoon irrigation and phosphorus on performance of sole and intercropped pigeon pea (*Cajanus cajan* L.). Indian Journal of Agronomy 2005; 50(4):278-280.
10. Kumar R, Paslawar AN. Effect of conservation tillage on biomass partitioning and quality of pigeonpea based intercropping system under Vidarbha region. The Bioscan. 2017; 12(1):571-574.
11. Pandey IB, Tiwari S, Pandey RK, Rakesh Kumar. Effect of bed configuration, fertilizer levels and placement method on the productivity of long duration pigeonpea under rainfed condition. Journal of Food Legume. 2014; 27(3):206-209
12. Raut VM, Taware SP. Comparison of different sowing methods in soybean. J Maharashtra Agric. Univ. 2000; 25(2):218-219
13. Sathe RK. Response of transplanted pigeonpea to different panting geometry and land configuration. M.Sc. (Agri.) Thesis, VNMKV, Parbhani (M.S.) India, 2015.
14. Singh DP. Drought management in field crops. Recent Advans. Agron. 2000, 253-277.